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ANALYSIS OF THE CAUSATIVE FACTORS BEHIND CHANGES TO FOREST COVER IN THE STATE OF MEXICO FROM 1993 TO 2000

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I. INTRODUCTION

Any analysis of changes to land use and occupation in a given region implies an attempt to understand the interaction between diverse socioeconomic and biophysical factors. In the case of forest cover, whether tropical or temperate, changes may be due to a variety of causes and factors (Lambin, 1997; Bocco *et al.* 2001). The strongest and most frequent effects of such changes in a region concern climate, hydrology, soil quality, food shortages, risk of illness and loss of biodiversity (Chhabra *et al.* 2006).

Numerous empirical techniques currently exist for exploring, explaining and predicting changes to land use and occupation, such as exploratory data analysis, regression analysis, Bayesian statistics and artificial neural networks (Lesschen *et al.* 2005). In the case of deforestation processes, these techniques are generally used to model and quantify the magnitude of relationships between causative factors and loss of forest cover.

In recent years, deforestation and changes to forest ecosystems have been a source of concern in numerous regions of Mexico, and consequently, various sectors in the country have become involved in assessment and analysis of the phenomenon. Some of these have recognised the enormous complexity involved in studying the causes and origins of these processes (Merino and Segura, 2002). The State of Mexico is not exempt from this problem, and thus the primary aim of this study was to understand and relate the causes and factors leading to loss of forest cover in the study area between 1993 and 2000. To this end, the following specific objectives were set: (1) to estimate and fit a multiple linear regression model (MLR) for each type of forest cover, (2) to estimate and fit a logistic regression model (LR) for each type of forest cover, and (3) to analyse the results obtained with these regression models, in order to compare two different spatial observation units.

II. METHODOLOGY

1. Material

Two digital forest cover maps at a scale of 1:250 000 and provided by the Mexican National Institute of Ecology (INE) were used as the reference baseline for this study. The cartographic basis comprised a 1993 map, designated series II, produced by the Mexican National Institute of Statistics and Geography (INEGI), and another map from 2000 corresponding to the Mexican National Forest Inventory of 2000 (IFN2000) produced by the INE in conjunction with the Institute of Geography (IG) at the National Autonomous University of Mexico (UNAM).

The advantages of these maps compared with the cartography used by Pineda *et al.* (2009) included better geometric and thematic quality, both as regards the series II map and IFN2000 coverage, and the compatibility strategy employed when compiling each data base so that they were statistically and cartographically comparable (Velázquez *et al.* 2002). However, one disadvantage was that the period studied in the present research was shorter.

2. Methods

Two of the analytical methods most commonly used for this type of study were applied. Firstly, taking the municipality as the spatial observation unit, multiple linear regression was employed using municipal socioeconomic and biophysical information as independent variables. Secondly, taking the pixel as the spatial observation unit, the influence of certain factors which lead to loss of forest cover was analysed. Logistic regression models were estimated according to a series of socioeconomic and biophysical factors.

In order to identify the main factors which had most impact on the process of forest and jungle loss in the study area, municipal statistical data were compiled, separating the information into two spatial units: municipal level and pixel level. On the basis of the information obtained, various potential variables were selected corresponding to factors related to loss of forest cover. A Pearson's correlation analysis was conducted in order to measure the intensity of the association between the explanatory variables. Those variables which did not correlate with each other and which presented greatest explanatory power were selected. Lastly, in order to validate the goodness-of-fit of the models, ROC statistics were used.

IV. RESULTS

Considering the first three most influential coefficients in all the MLR models, it was concluded that the biophysical variables exercised most influence on deforestation processes, followed by land tenure and availability of credit and subsidies. This demonstrates that some of the variables were associated with factors related to agricultural expansion and with political and institutional factors. The first case was considered a direct and immediate cause

of deforestation, whilst the second represented an indirect, or secondary, cause. Biophysical variables were considered factors which exercised a mixed influence on the process, sometimes directly and sometimes indirectly.

As they corresponded to pixel level measurements, the results obtained from the LR model were more consistent as regards the proximity variables and once again, this group was associated with factors related to agricultural expansion and political and institutional factors, together with variables related to expansion of infrastructures.

If the results obtained from both the methods employed in this study are analysed from the perspective of type or group of variables, it can be seen that no clear pattern of variables which influence the deforestation process emerged which was significant in both models. However, if the results are analysed from the perspective of causative factors of change, it can be observed that agricultural expansion and political and institutional factors emerged as significant variables in both of the regression models employed. As regards the type of causes which have an impact in both models, it would appear that direct causes have greater impact according to the LR model, possibly due to the type of unit analysed, whilst according to the MLR model, mixed causes have greater impact.

V. DISCUSSION AND CONCLUSIONS

1. Discussion

Two spatial observation units and two different statistical techniques were employed, yielding quantitative results which measured the positive and/or negative impact of the variables used on four types of forest cover. Multiple linear regression was used for a municipal level analysis of the variables which had most influence on deforestation processes, whilst pixel level logistic regression contributed to improved understanding of the probable impact of explanatory variables on loss of forest cover.

Nevertheless, the goodness of both the statistical methods applied presented disadvantages which should be considered. It will be necessary to explore mechanisms for overcoming problems such as loss of information due to data aggregation, spatial autocorrelation, re-expression of statistical variables, or the non-normal distribution of data in some models, for example. In addition, it should be borne in mind that the assumptions of MLR and LR methods do not include a consideration of spatial behaviour in geographical data. Lastly, one of the disadvantages of using LR is the high spatial autocorrelation presented by data aggregated at municipal level.

2. Conclusions

This study presents elements which help to explain the extent to which the factors employed are related to or responsible for deforestation processes in the State of Mexico. The results show that the joint application of statistical methods and GIS technology constitutes a powerful tool for geographical analysis. These methods could serve as the methodological basis for future forestry planning procedures within the municipality and in other regions of the country. The statistical analysis proposed in the present study has provided quantitative

results which will help to improve understanding of the causes and mechanisms of change to forest cover.

The results of this research show that in some regions of the state of Mexico, social organisation has certain implications for loss of forest and jungle cover, although further research will be necessary in order to confirm this finding.

DERELICTED SPACES AND FORMS OF SOCIAL EXCLUSION IN THE CANARIAN PORTS

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INTRODUCTION

Throughout its evolution the restructuring of port areas, and by extension of urban waterfronts, has prompted the expansion of cities at the same time that in port areas. But the transformation of these areas has also involved the appearance of devalorised spaces, lacking function and environmentally degraded; together with certain parts of the urban surrounding characterized by traits of marginalization and social exclusion.

At present, urban revitalization oftentimes has brought about devalorization and social exclusion generated within or nearby the ports. Changes in world maritime trade, associated to economic liberalization, have led to the proliferation of ships sailing under flags of convenience; these ships cause new forms and locations of social exclusion linked to abandonment of ships and their crews in ports.

II. GENERAL TRENDS AND LOCAL EXPRESSIONS OF CITY-PORT RELATIONSHIPS: FROM ITS ORIGINS TO THE LATE TWENTIETH CENTURY.

Through history, a large number of coastal and river cities have had their origin in port trade. The term 'city-port' has been coined as an expression of the symbiotic linkages between the city and the port. Hoyle (1998) identified five stages in the city-port relation for Western Europe, which correspond to different spatial and functional restructuring.

During the first stage, in between the High Middle Ages and the nineteenth century, it takes place a close functional and spatial association between city and port. Then, there is a port expansion, driven by a fast industrial and commercial growth that requires, from the nineteenth century to early twentieth, a spatial development beyond the urban boundaries by linear quays and industries. The third stage is characterized by the separation and spatial expansion of the port from the city that reaches until mid-twentieth century, a separation

due to industrial growth (especially the coastal location of oil refineries), the introduction of the roll on-roll off ships, and container services for its requirement in larger areas. During the period 1960-1980 there is a split between city and port driven by changes in shipping technology that induces the growth of separate maritime areas dedicated to industrial use. The fifth phase, which began in the eighties of last century, is identified with the urban redevelopment of the fluvial and waterfronts. In it, at the same time that the port consumes large areas of land and water space, it begins renovation of the historical centre. The successive restructuring of port areas have been linked to the several rounds of capital accumulation and investment, at the same time that brings in the appearance of devaloured or obsolete parts, with specific effects on nearby urban areas.

With the support provided by the different general phases mentioned before, although adapted in their traits and chronology to local specificity, we explore the historical effects of the two main Canarian ports in the shaping of devalued and socially excluded urban spaces.

1. Functional and spatial association between the city and the harbour: military uses and devalued spaces in Canarian ports

The initial phase of association runs from the origin of the city until mid-nineteenth century when the port is precisely the fundamental economic activity of the city, establishing then, a dialectic between the urban rise or decline and the ups and downs of port traffic.

The search for safety in the two major Canarian ports marked, during the first centuries, the principal coastal uses, therefore, one of the first occupations on the coast was the military which from the beginning, builds a system of castles, batteries and defensive walls along the coast. Once the unsafe phase is over, much of the military construction becomes obsolete and is abandoned causing a progressive ruin and, later, its demolition and replacement by new urban uses. Infirmaries were also located on the coast to isolate goods as well as passengers from infected ships. Other activities such as lime kilns, shipyards, and grounds for salted fish characterized the coastal areas.

These activities were gradually replaced by others and finally disappeared. However, their spatial traces in many cases remained whole for a long time. The proximity of port activities gave rise to land use segregation, thus some coastal neighbourhoods became devalued areas inhabited by workers and marginal population.

2. Growth and distance between the city and the harbour: coal docks, industries and new neighbourhoods in the canary port areas

The consequences of industrialization were felt from the second half of the nineteenth century to the mid-twentieth in the expansion of urban areas and ports. Ports had a cosmopolitan ambience, especially in the nineteenth century, because of the exchange of goods and ideas. But the manufacturing development of cities also transformed the port areas into industrial ones with cheap housing neighbourhoods in their surroundings, where the most vulnerable social groups concentrated for a long time.

Since the second half of the nineteenth century the Canarian ports of Santa Cruz and Las Palmas became coal docks, related to the geographical location of the Archipelago in the main Atlantic maritime routes. This new role was prompted by the Free Trade Law of 1852.

At the beginnings of the twentieth century there were nine coal deposits in Canary Islands, the main part in Las Palmas port which became the main supplier of coal in the Islands. With the passage of time and the change that resulted in the appearance of liquid fuels, these installations which included the old coal docks, lost functionality and while some were reused for other activities, many of them became part of a degraded landscape ruined by the pass of time and lack of use. At the same time, in the coast of Santa Cruz is located a set of different industrial activities that made the port areas and its surrounding undervalued places, with the consequent displacement of residential areas inland: the municipal slaughterhouse, the ice factory, gas works and electricity, and later the oil refinery and some chemical industries. On the coast of the city of Las Palmas the main manufacturing activities were fishing and shipyard, located next to the historical centre; however, since 1890, industries moved to the new port in La Luz which became the economic core of the city and of the whole island.

Later on some of these activities changed or were converted. The transition was slow and the port landscape degraded by the presence of large abandoned areas, ruined and empty buildings. During this period some port-linked neighbourhoods kept growing such as El Cabo and Los Llanos in Santa Cruz while new ones appeared as La Isleta in Las Palmas.

3. Expansion and separation of the port in respect to the city: modernization of port facilities and degradation of the urban landscape

During the second half of the twentieth century, port structures grew autonomously from the urban structure. Therefore, port areas emerged as an isolated compound from the city, materialized in many cases by fences and hedges, which also made its spatial and functional separation.

Since the late seventies, the industrial decline affected most of the big cities of the developed world. These transformations generated new undervalued spaces caused by the industrial and ports decline which brought about the appearance of extensive degraded areas where you could previously find productive activities.

However, the port areas of the two Canarian harbours continued to grow, incorporating new docks and facilities. In Santa Cruz of Tenerife, port line of vision' separation from the city happened since the 1960s; port growth absorbed obsolete spaces, it made disappeared some traditional activities and wiped out the main urban beach. At the same time the closure of the island garbage, upon eighteenth century infirmary site, generated a very large environmentally contaminated area. Port expansion had also differential impacts on the cities; Santa Cruz was kept away from the shore, a different situation from Las Palmas where some districts were built next to the sea.

III. URBAN REVITALIZATION AND NEW FORMS OF SOCIAL EXCLUSION WITHIN PORT BOUNDS

In the last decades of the twentieth century, we assist to a profound geographical reorganization of the economic system that has led to the dispersion and fragmentation of production; a global economy characterized among other by processes of generalized trade liberalization, deregulation and privatization of economic activities, and a weaker position of the national state against the multinationals that control the global networks of production-distribution. The industrial relocation in the advanced countries has altered the role of ports in global supply chains of production-distribution, and consequently has caused a radical redefinition of economic relations between the city and port, encouraging the approach and integration of both. The extensive areas liberated by the old factories, warehouses and port areas have become a priority for revitalization policy. But globalization trends have also driven to a dramatic increase in competition among countries and regions and also between carriers in world maritime trade (Lee et al., 2008: 373). Effects of this competitiveness are the proliferation of vessels under flags of convenience or the existence of 'second record' of vessels, instruments that coupled with the deregulation of labour, are leading to the emergence of spaces of social exclusion within the port areas.

1. Ports in globalization: new port functions and urban change

Since the last decade of the twentieth century, the ports start a process of transformation and regeneration which aims to revitalize the port area. These actions are part of a revitalization strategy oriented to introduce, besides new commercial, tourism, sports, leisure or cultural uses, a great potential for real estate development and shaping, ultimately, new core areas that substitute the old factories, warehouses, depots and, in general, waste economic activity. But this intense renewal takes place in a context of economic globalization where liberalization, deregulation and privatization determine the relations of both production and distribution, so that improvement projects of the waterfronts, are accompanied by changes in traffic conditions, responsible for the emergence of new spaces of social exclusion that affect the major ports.

2. Flags of convenience and abandonment of ships in ports

The process of globalization and economic liberalization has sheltered since three decades ago, the emergence of unorthodox practices in the shipping industry with very negative consequences on the fulfillment of safety regulations, which affect both navigation and the labour and social conditions of sailors.

The search for higher profits by reducing costs in wages and maintenance of ships, has caused the increase of ships sailing under flags of convenience (BDC) located in developing countries, and 'second registers' in the developed world which permit to enforce more 'relaxed' practices of existing legislation.

The flag of convenience and the arbitrariness, with which shipping companies operate, have resulted in increasing numbers of abandoned ships in ports; especially those ports who, relying

on competitiveness, are more permissive to existing regulations. One of the most bleeding consequences of abandonment of ships is the state of helplessness in the remaining sailors. The main ports of all countries (Table 1) and especially those found in the main maritime trade routes have experienced a greater or lesser extent, the abandonment of ships and the serious consequences that this entails, both for the port itself and for seafarers concerned. In all cases the same pattern is repeated, vessels are being held in port because of its many shortcomings or debts that are abandoned by their owners and by the flag state.

3. The dark side of the port areas: helplessness and exclusion of crew

As in the rest of the world, the main Spanish ports have also been affected by this phenomenon (Table 2). Of all the Spanish ports, the Las Palmas is the one who is in a worst situation; between 2000 and 2007, about eighteen ships were abandoned on their sites, representing an average of more than two per year, thirteen of whom also did so with their crews. The Port Authority admitted that in November 2008 there were a total of 40 boats abandoned at Queen Sofia Pier who were occupying 4,000 meters of the berthing line, unfit for its use and therefore under used. However, it did not recognize the existence of abandoned crews. Anyway, some inspections of the ITF and the Apostleship of the Sea assured that an unspecified number of sailors were badly living on these boats.

While the long administrative and judicial process that determined the final destination of the ship was culminating, the crew, which is often owed with the wages of several months, or by all the campaign on the fishing boats case, were the most affected. During the holding time, the ship becomes for many of these sailors their residence, resulting in a real «dock shanty,» composed of vessels that get deteriorated with the passage of time and lack of the minimum services as they are water and electricity. In short, the proliferation of boats with BDC in the port of La Luz and Las Palmas and the helplessness of sailors once they are abandoned, have resulted in the emergence of marginal spaces in their docks, where the crew barely survive in unhealthy conditions and with a great risk of social exclusion. The local administration of the city in which the port is located lacks authority about the problem.

The attempts to alleviate this problem through the reform of maritime law and the appearance in February 2006 of the Revised Convention of the Sea, which includes among other things, the creation of the Welfare Commission, do not seem to be effective, as long as the factors responsible for this problematic situation, namely the records of flags of convenience and ineffective legislation for its breach, keep on existing.

IV. CONCLUSIONS

The relationship between the city and the port has evolved over time in parallel with the transformation of productive activities and transport requirements. The urban waterfronts and port areas have suffered successive conversions through change processes, on some occasions, or devaluation, in others. Thus, in addition to new core areas, marginal and devalued places have existed side by side; the latter often have been associated with low income groups marked by poverty and social exclusion.

Canarian ports show also this dynamic. Segregation trends of various types, generated in the own port territory and the city-port interface, have been happening over time.

Today, despite the intensive interventions, especially in devalorised or neglected areas, which have converted the waterfronts in new revalorized core areas, the marginal spaces remain under new forms. The liberalization of maritime transport and the appearance of vessels with flags of convenience have brought about in the Canarian ports, as well as in many port of the world, new forms of spatial devaluation and social exclusion related to the abandonment of ships and their crews.

THE INFORMATIVE VALUE OF TOPONYMS. THE CASE OF THE WORD *BERROCAL* AND ITS VARIANTS

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I. INTRODUCTION

It has been customary in geographical analysis to resort to toponyms as elements that can provide important, albeit preliminary, information about an area of study; at the least they afford clues that can later be corroborated by means of tasks that demand another kind of approach. Toponyms often used to be considered as having practically undisputed value as indicators, something which does not seem consistent with the nature of place names, which for different reasons do not always have the precision they have often been imbued with.

This work therefore makes an attempt to verify to what extent the names used to designate villages, districts, mountains, plains, streams and farms possess this value as effective indicators of certain characteristics of the environment or of other circumstances. To do so we have chosen a family of toponyms: those related to the noun *berrocal*, an appellative that refers to a lithological and morphological combination that in principle is not very equivocal and which is used to designate a landscape of variable size characterized by the presence of spherically weathered granite boulders in more or less chaotic formations.

In short, the starting hypothesis is to consider whether this family of toponyms faithfully reflects, within reason, the lithological, morphological or landscape situation just described.

II. DATA EMPLOYED AND PROCEDURE FOLLOWED

Perhaps the most problematic task that arises when approaching a project such as this consists of choosing the list of toponyms that can be used, above all if we are considering the entire territory of Spain. It was a matter of obtaining a set based on some kind of standardized procedure in order to avoid the possible biases inherent in a collection of data carried out without criteria, which furthermore would constitute an impossible amount of work in terms

of time available. We thus decided to use the Database of Geo-referenced Toponyms from the Spanish National Centre for Geographic Information (*Base de datos de topónimos geo-referenciados* del Centro Nacional de Información Geográfica [CNIG]).

The second issue that had to be resolved was choosing the search criteria for the database. This choice had to take into account the toponyms that included a word from the same family or linguistic root (including allomorphs) as the words *berrocal* or *berrueco*.

In this way we obtained 275 entries from the database. All of them are geo-referenced with three types of coordinates: on the one hand with the UTM ED-50 projection, in each of the three possible zones of the Iberian Peninsula, and on the other hand in latitude and longitude in both decimal and sexagesimal degrees. Each toponym (or better said, each record) corresponds to a pair of coordinates, that is, it is represented by a point, which obviously involves a noteworthy simplification in the cases of those toponyms that refer to linear entities or entities that can occupy a more or less large area.

Of these 275 entries, we rejected those that had an exact duplicate in the geo-reference coordinates, maintaining in all cases the most significant or highest ranking toponym. After this refining, the number of entries was reduced to 212.

Examination of the typology of toponyms yielded that practically half of them refer to an orographic elevation, such that as we already mentioned, this family of place names has frequently been used to designate topographical unevenness; however, the number of towns or places in which these denominations are used is also considerable.

The next step was to convert this database with 212 entries into a point map. The result is shown in Figure 1. This first map is already quite significant, if only for the most common distribution of the toponyms, with a nucleus clearly located along the Central Mountain Range and a less dense western strip. We have tried to determine whether this pattern is due to chance or, as it seems to be visually, whether the location of the toponyms is not random. Different analyses of specific patterns, spatial structure and density were also carried out.

To do so, we ran the *nearest neighbour test*, using as the area of reference the whole of peninsular Spain (493.716 km²). Calculations were made on the first, second and third nearest neighbours. To support the results of this test, which measures whether a distribution is random, well-spaced, or shows a trend towards concentration, we also ran the Kolmogórov-Smirnov test, dividing the peninsular territory into 516 hexagonal cells measuring 1.000 km², and we obtained the index based on these cells (see Figure 2).

We also determined the basic spatial statistics of centrality and dispersion, that is, the mean centre, the geometric mean centre, the harmonic mean centre, the median centre, the minimum distance centre, the standard distance, the ellipse of the standard deviation and the standard deviation of the *x* and *y* coordinates. All of these values were calculated using CrimeStat III.

To strengthen this type of analysis linked to the spatial distribution, we also calculated focal densities, which in short is a matter of establishing the areas in which theoretically we would be more likely to find a toponym of the *berrocal* family, based on the different groups of entries identified. To draw up this map of focal density we also used the CrimeStat III programme.

To approach what is probably the fundamental aspect analysed in these pages, that is, the degree of correspondence between the location of the toponyms of the *berrocal* family and the lithology of these places, we used the Geological Map of Spain with a scale of 1/1.000.000 in digital format made by the Geological and Mining Institute of Spain (IGME) in 1994.

In order to find out on which formations the 212 points established lie, we carried out what is known as a spatial link or point-in-polygon analysis. Using this link we transferred to each of the toponyms the attributes of the database of the polygons that contain those points and that represent geological cartographic units.

In some cases, the points that represent the toponyms are located on water (reservoirs); in other cases, the toponyms are located on unexpected geological units. In both cases we first established whether the toponym could be dubious, and in all cases we estimated the shortest distance from that point to the border of the closest polygon containing a geological unit plausible for the effects considered in our study. If it was a dubious toponym and the distance to the closest admissible lithological formation was greater than a league (5572.7 metres), we assumed that it was an erroneous case and eliminated that entry from our final analyses. We typified the rest of the situations as toponyms that are not good indicators. The reason we established a league as the distance was because it clearly surpasses the positional error that we can attribute to the maps used.

Once the spatial link was made, the point map then included in its table of attributes the complete lithological description of the polygons containing these points. There were 32 units (including surfaces covered by water) on the 96 formations described on the geological map of the Iberian Peninsula and the Balearic Islands. Of these 32 units we concluded that only 6 would be admissible in principle as lithologies on which the type of morphology in question could appear, and these are as follows: a) *migmatitic-anatectonic complexes*, b) *alkaline granitoids (extensional frame)*, c) *biotite granitoids*, d) *two-mica granitoids*, e) *peraluminous granitoids (collisional frame)* and f) *undifferentiated s.l. granitoids*.

This decision enabled us to create a new point map from which we excluded all the toponyms that were located on any of these six formations, that is, 90 of the 212 original entries. Thus, 122 toponyms (57.5%) are located on potentially suitable lithologies. The following step consisted of calculating the distance in a straight line between each one of these 90 points and the closest border of a lithological unit able to give rise to a morphology of *berrucos* (see Figure 3); the following morphologies had to be added to the six classes mentioned above: a) *calc-alkaline granitoids*, b) *granitoids with a postcinematic alkaline tendency* c) *metagranites*, d) *ultrabasic rocks (serpentinites, Active margin)*, e) *intermediate and basic rocks*, f) *basic and ultrabasic rocks*, g) *undifferentiated acid and basic complexes* and h) *acid-basic alkaline complexes*. To do this we used the *Nearest features* extension which generates a table in which in this case each point is assigned the closest lithological unit from among those selected and also the distance is established between the points and these formations.

Of the 90 entries that were rejected in principle, 36 are found at less than a league from the 14 lithological sets. There would thus be 158 entries for which we can assume that there exists a reasonable connection between the meaning of the toponym and the lithological characteristics of the surrounding environment. We then had to inquire as to whether the

toponyms of the remaining 54 entries have some kind of ambiguity that would mean ruling them out.

The idea was that a false attribution of these toponyms to the *berrocal/berrueco* family should not contribute to increasing the number of entries that act as false predictors of a granite boulder landscape. To resolve this we calculated that 10 of the 26 entries should be ruled out, the proportion of entries ruled out being greater within the subset of toponyms that are not found on granite terrains than otherwise. Figure 4 shows the final distribution of the two sets of data considered, in the one case composed of 154 entries and in the other of 48.

Finally, the last step consisted of verifying whether in the proximity of the 154 entries that we finally selected there existed a landscape of *berrocales*. To test this we carried out a photo interpretation of the surrounding area where each toponym was located using the images offered by the SigPac viewer.

III. THE TOPONYM *BERROCAL* AS AN INDICATOR OF GRANITE BOULDERS

The visual impression that the toponyms in question have a concentrated distribution pattern was confirmed with the different statistical analyses that were run. Indeed, according to the nearest neighbour technique the likelihood that this concentrated structure is random is less than 1%, with neighbour R values of 0.33, 0.38 and 0.45, respectively, for the first, second and third nearest neighbour, and that was taking into consideration the 212 original entries and the entire peninsular territory. We arrived at the same conclusion with the Kolmogórov-Smirnov test: the **D** index takes a value of 0.19, likewise allowing us to affirm that the distribution of the toponyms is not random.

This conclusion may seem obvious, in the sense that it is normal for a place name that refers to lithologies that make up 8.8% of the peninsular surface to appear mainly in relation to these surfaces. It is more important to verify that if we only consider the 158 entries for which in principle we assumed there was a reasonable connection between the toponym and the lithology of the surrounding area and also the area of distribution of the different units of granitoids (43475.62 Km²), we again find by means of the nearest neighbour test a result of concentrated structure, and the probability that this pattern is due to chance is likewise less than 1%. That is, the toponym *berrocal/berrueco* is not used with the same regularity in the different granitic areas and thus it seems to have a local component.

The distribution measures reinforce this impression. The different statistics of centrality (with the exception of the harmonic mean centre) are located in the province of Avila, around the mountains in Piedrahita and Villafranca, and the typical distance is 136.15 Km, with a poorly marked standard deviation ellipse and thus one very similar to the circle defined by the radius of the standard distance. Seventy-four percent of the 158 toponyms enter this circle and the standard deviation ellipse and 91.8% enter the second standard deviation ellipse. It is therefore a considerably compact distribution, or at least one with a very dense nucleus along the Central Mountain Range between the provinces of Madrid and Ávila.

This can be observed very clearly with density maps. We generated two maps: one for the 212 original entries and another for the subset of 158 toponyms dealt with subsequently. The two focal points with the highest densities can be clearly observed on both maps (Figures 5 and 6), and then others of less density that furthermore are not continuous with the Avila-

Madrid sector, especially in Figure 7, where the elimination of 54 toponyms makes the locations we could consider furthest from the centre disappear.

It is also quite evident that it is a clearly occidental phenomenon corresponding exactly to the main location of rock of igneous origin. Once again we observe the spatial concentration of this denomination of the granite outlayer along the Central Mountain Range and the bordering areas and at the same time, its relative absence from Galicia, where we find very large cultivated land sectors over appropriate lithologies, but where the word *penedo* is much more frequent as the toponym referring to these granite or other types of rocky places.

As we mentioned earlier, of the 212 original entries, 202 are unequivocal from the linguistic point of view and of these 202, there are 48 that are not on a granite geological formation or located at less than 6.6 Km from the border of one of these formations. In other words, 23.76% of the toponyms of the *berrocal* family incorrectly predict the type of geological substrate to be expected. In Table 3 we present a summary of the lithological formations to which we can ascribe 48 toponyms. Although they are units that occasionally comprise rocks that can give rise to contrasted morphologies, it is striking how frequently we find lithological types that are considerably distant from what one would expect of a granite *berrocal*, such as limestone or alluvial deposits.

The photo-interpretation of the SIGPAC images of the 154 entries that show no ambiguities in their names and furthermore are found on granite terrains did not allow us to locate even a granite outlay in all cases; it must also be said that on some occasions the toponym appeared in zones with granite rocks on the surface but in rather ordinary forms.

According to this, 134 of the 154 entries have a *berrocal*-like landscape in the broad sense in their surroundings, whereas in 20 cases we were not able to observe this correspondence between the toponym and the landscape. It is, however, important to stress that of these 20 toponyms, the majority (13 to be exact) are entries that originally were not located on granitic terrains, which means that only 7 toponyms located strictly on this type of lithology do not have a *berrocal*-like landscape.

On the other hand, the entries considered positive are not located proportionally to the surface occupied by different types of granite rocks on the Iberian Peninsula (see Table 4), and thus the biotitic granitoids are clearly over-represented, the peraluminous granitoids show a reasonable equilibrium and the rest of the formations have a percentage of toponyms lower than what should correspond to them according to their area size. The chi test indicates that this circumstance has a less than 1% chance of being random. But the concentration of toponyms from this family on biotitic granites does not seem to have so much to do with the type of rock as with the fact that it is these granitoids that dominate the focal or central distribution zone of this kind of toponym, that is, the Avila-Madrid sector mentioned earlier.

In short, the toponyms of the *berrocal/berrueco* family that are not ambiguous from the linguistic point of view are only good indicators of the granite boulder landscape in 2/3 of cases (66.34%), always taking into account that the sample of toponyms used came from the Geo-referenced Toponym Database of the CNIG (Spanish National Centre for Geographic Information).

IV. CONCLUSIONS

The toponyms of the *berrueco/berrocal* family show a quite concentrated distribution, such that it can be considered a local denomination that has a western variant (*barrueco*). The fundamental nucleus is found in the mountain ranges of Avila and Madrid, with extensions towards Salamanca and Cáceres, and to a lesser extent towards Toledo and Segovia.

There is undoubtedly a very close relation between this kind of toponym and landscapes characterized by the presence of granite boulders on the surface. However, around a third of these toponyms turn out to be a deficient indicator of this type of landscape.

Although we cannot know whether the predictive capability of other toponyms is similar to this case, it seems reasonable to assume that the value of place names as indicators is not absolute, and it is therefore necessary to act with prudence when attempting to infer something based on the toponym.

TERRITORY, CONSTRUCTION AND DEVELOPMENT ACTIVITY: SINCE «TSUNAMI» TO CRISIS. EXPLANATORY FACTORS AND A PROPOSAL OF INDICATORS AT MUNICIPAL SCALE IN ANDALUSIA

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I. INTRODUCTION

Since the expression urbanistic or development «Tsunami» was made popular by Javier García-Bellido in 2005 it has become popular when referring to an increase in the construction and development activity in Spain during the first half of the present decade; followed by the near paralysation of the sector in the wake of the beginning of the global economic crisis. This article aims to cover the territorial aspect of this phenomenon, covering various objectives that correspond to the epigraphs upon which it is structured. These objectives are:

- To briefly expose, by means of selected statistical data, the magnitude of the process in the case of Spain, differentiating it in the context of Europe as a whole.
- To explore the process diagnostic in depth, presenting a detailed revision of the factors that triggered it.
- To present, by means of a statistical synthesis, the traits that characterize and differentiate the Andalusian case in the context of Spain.
- And lastly, to propose a series of indicators to quantify the different manifestations of the process in the Andalusian case, applying these indicators at a municipal scale, mapping the results and obtaining conclusions.

In what the characterization of the Spanish case is concerned within the context of Europe as a whole, it must be mentioned that since the second half of the nineties and until the year 2007, the Spanish economy underwent an accentuated expansive cycle, with annual G.D.P. growths of over 3%. In this way, Spain presented the most pronounced G.D.P. upward trend when compared to the rest of the countries in the UE12 up until the generalized trend

inversion in the year 2008. The level of influence the progressive basculation of the Spanish Economic model towards the construction sector has exerted on this growth is a widely debated theme, but it seems irrefutable that its undeniable accelerated proportional increment can't be alien to the global result.

To summarize statistically speaking, the construction sector in Spain has a series of characteristics which differentiate it from most of the countries in the European Union. One of the most notable relates to the fact that most of the building works undertaken have been new constructions, both for housing and public purposes; to this effect, the highest volume of new housing built was reached in 2006, with 18,000 new homes per million inhabitants, whereas the EU Member State average was at 5,000 per million inhabitants. Another differentiating factor of the Spanish as opposed to the European model makes reference to property usage, ownership being more frequent than renting. With respects to home rental, 2005 registered the lowest values in the entire European Union: only 10.4% of Spanish homes were based on the rented accommodation model. In what temporary housing is concerned, the presence of a second residence must be outlined, as 13.4% of Spanish households declared owning secondary residences in 2001.

II. PROCESS DIAGNOSTIC: TRIGGERING FACTORS OF THE CONSTRUCTION AND DEVELOPMENT BOOM

The article analyses in detail the explanatory factors whose actions, both coupled and interrelated resulted in the development boom. These factors were:

- Economic and demographic growth.
- A favourable financial scene.
- The considering of home-ownership as a means of investment.
- The real-estate market orientation towards ownership and second residence.
- The acquisition of properties by older or «climatic immigrants».
- The impact of floor legislation amendments.
- The week social response to this model.

III. STATISTICAL ANALYSIS OF THE REGIONAL CONTEXT: THE CONSTRUCTION SECTOR IN ANDALUSIA

This section aims at showing, by means of selected statistical data, the main traits of the construction sector in the Andalusian Autonomous Community and its evolution over the last few years, illustrating the relevance of the Andalusian case in the context of Spain as a whole, given the magnitude reached by the phenomena here showcased.

Thereby, the noteworthy increase in the sector is proven, both in absolute and relative terms by means of indicators such as: proportional weight of the Gross Added Value of the different productive sectors in the regional economy; number of municipal licenses granted for the building of housing; number of homes started and finished; or variations in home prices.

IV. THE ESTABLISHMENT OF INDICATORS AND THEIR APPLICATION TO THE ANDALUSIAN CASE

This section suggests a series of indicators to quantify the different aspects of the issue at stake, applying them at a municipal scale to fit Andalusia's specific case (there are 770 municipalities in the Autonomous Community, all of which have obtained the data here referred to), and this scale permits the differentiation of the different behaviours and dynamics which have been observed regionally within the context characterized; finally, we go on to map the results obtained as a preamble to their interpretation and summarization.

The variables selected are brought together in three groups:

- Municipal orientation towards real estate activity. Aimed overall towards showing the proportional weight reached by said activity at a municipal level, economic, social and territorially speaking. The indicators used were:
 - Urban Real Estate Taxing. Tax Base: This tax is calculated based on objective characteristics, both quantitative and qualitative, of the municipal real estate state stock; to which a series of quotes or multiplier factors are applied, decided upon by the corresponding town hall.
 - Proportion of Urban Real Estate Tax (Base Quota) of the total municipal budget.
 - Non-Permanent Residential Function Index (it is the result of the quotient of residential use cadastral units of a municipality amongst its lawful inhabitants).
 - Construction work employment versus total employment in the municipality.
 - The evolution of number of construction workers in the period 2000 - 2006.

- Real-estate market dynamics. Oriented towards illustrating the situation and evolution of the real-estate market at a municipal level given its importance as the main driving force behind the construction sector. Also because of the importance of the effect of its fluctuations as a way of explaining the socio-economic evolution in a large number of municipalities. The indicators used were:
 - Real-estate transaction per municipality in 2006.
 - Transaction variations between 2006 and 2008.
 - Proportion of transactions based on the total residential usage cadastral units in 2008.

- Repercussions of the intensity of construction activities: They illustrate the variety of consequences the different territories have experimented based on their higher or lower general real-estate and building activity orientation. The indicators selected were:
 - Momentary planning modifications between 2000 and 2009.
 - The relation between labour impact in the construction sector (2006) and the subsequent evolution of unemployment (2006-2008). It relates the percentage of jobs in construction and the total number of jobs in the municipality with the

subsequent increase or decrease of the total unemployment within it. It aims to illustrate the level of socio-economic structure vulnerability experimented in the areas that have displayed a higher dependence upon construction activities.

V. CONCLUSIONS

Firstly, the singularity of the Spanish case in the European context due to the proportional dimension reached by the construction sector and its rapid growth since the end of the nineties and up until the second half of the current decade. In fact, this spectacular growth is thought of as one of the main factors for the remarkable growth rates of the Spanish G.D.P. during that period, higher than the European averages (albeit setting off from a statistically lower starting point). As is well known, all of this resulted in an unprecedented development boom that drastically transformed the territorial structures of wide expanses, especially coastal areas and urban agglomerations.

This singularity is explained by means of a complex group of interrelated factors, amongst which a favourable financial climate, marked by historically low interest rates and also the orientation towards the concept of home-ownership as a means of investment as opposed to actual usage stand out. Without leaving aside others such as an economic and demographic growth, the Spanish market's preference for ownership when compared to renting, the mass acquisition of real estate by foreigners, the effects of legislative changes, the generalized support of this process by all political forces, or the mindless social acceptance (except by an environmental-minded minority) of the economic and territorial model which was the driving force behind this phenomenon.

Within this country-wide framework, and in agreement with it, the Andalusian Autonomous Community presents some differentiating traits, amongst which the sheer magnitude of this phenomenon stands out, as well as its distinct influence over the regional growth (in this case the statistical starting point was also notably lower than the Spanish average); especially if the proportional implications reached by the construction sector in the Andalusian economy as a whole, in contrast with the comparative weakness of other sectors, such as the industrial area, when compared to other autonomous communities or the national average.

Along the same lines, as shown by the selected indicators, it may be said that Andalusia has borne witness to an unprecedented constructive and development boom, for its intensity and territorial span; a boom that has marked the course of events economic, social and territorially like none other phenomenon in recent years. As a consequence, the construction sector has played a key role in territorial development in Andalusia during the present decade, both by its transcendental incidence in the improvement of employment during the first half of the decade and by the intensity of the negative drag effect it has exerted on the local economies since the near paralysation of the sector in 2007-2008, and that continued retaining its fundamental characteristics until the end of the decade.

In this regard, the implementation of indicators at a municipal scale in the Andalusian case shows the various intensities that this phenomenon has experimented in the different areas of the regional territory, as predicted, more accentuated in coastal areas and urban agglomerations; but appearing also at very important levels in rural areas of high

environmental value and near-coastal spaces neighbouring consolidated tourist spots. This represents a clear demonstration of the extension of this economic and territorial model, based on construction and development, to large areas of the Andalusian territory, in some cases, towards areas that had remained distant from the process up until about just over a decade ago. This reality becomes apparent in significant variables such as the high level of dependence the local treasuries present with respects to their taxation derived from their real-estate stock, the proportion of employment in the construction sector over the total, or the number of real-estate transactions in relation to the number of homes, amongst other indicators analyzed in the preceding text. Lastly, the most relevant conclusion extracted from the municipality-level analysis undertaken is the ascertainment that there exists a notable coincidence between areas in which there existed a higher intensity of the construction and development process, and those that currently suffer the most from the impact of the crisis (measured based on the number of unemployed), therefore it is proven that an excessive tilting towards the construction sector entails a notable vulnerability of the local socio-economic structures (apart from the territorial and environmental cost this inclination implies). This lesson should not be forgotten in the face of a possible reactivation of the construction and development boom when the macroeconomic circumstances go back to being favourable.

BEYOND TOURISM: EUROPEAN RESIDENTIAL MOBILITY AND NEW POPULATION CENTRES

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The process of modernisation that began on Spain's Mediterranean coast in the 1960s is a paradigmatic example of urban planning and tourism development focused on the production of urban land demanded by both the national and international real estate markets. The evolution from farming and fishing societies to societies whose economic development is based on the activities related to the property market, has concurred with new social processes, such as the growth of international residential tourism, and intra-European retirement migration from central and northern Europe towards the Mediterranean region.

Such movements of people are linked to the appearance of lifestyles and residential strategies associated with leisure functions, and life projects more closely related to the search for self-realisation, and a better (and intangible) quality of life, than to the typical activities of the work context. The different types of residential mobility we are referring to are not easily categorised. As well as the traditional tourists that spend their holidays in some town in the Mediterranean area, and make use of a private dwelling, the presence of other groups of tourists has become more frequent in the last few decades. They are more heterogeneous, have very diverse mobility patterns, and create different bonds with the host society.

In Spain's Mediterranean region, this framework of new mobility forms and multi-residential lifestyles has been incorporated into an urbanisation process based on the construction of second homes on a massive scale in environments with potential tourist appeal. The geographical manifestation of these dynamics has produced new urban enclaves detached from the traditional urban centres. The distance between such settings alludes to both the irregular distribution of social groups on the territory, and the lack of relationship between these groups. We are referring specifically to the growth in the number of housing states (*urbanizaciones*, in Spanish) separate from the traditional town centres where an unusual number of northern European citizens reside.

Our first goal is to approach the matter from a quantitative perspective that may allow us to identify the extent of these trends towards the concentration of people with distinct socio-demographic characteristics, in housing estates socially and spatially away from the

traditional urban centres on Spain's Mediterranean coast. Second, we aim to understand, from a qualitative perspective, the circumstances of the European citizens living in those *urbanizaciones*. Especially, we try to comprehend the social problems that the residents face due to their distance from the Spanish society.

The study was designed using a methodological approach able to integrate geographical and social aspects. The provinces located on the Mediterranean coast have 44.75% of the second homes registered in Spain. The figure helps us to understand the link between these properties and the urban activity associated with the traditional 'sun and sand' tourist destinations. Consequently, we decided to analyse the towns within these 11 provinces. After identifying the most evident processes of concentration of foreign population in the Alicante province, we analysed again the demographical data. Our aim was to identify those towns where the processes of socio-spatial separation between the traditional urban centre and the new housing estates with a high concentration of foreign residents have become more intense. Once we identified 17 towns in the Alicante province, we decided to focus on the town where such dynamics are most powerful: San Fulgencio. In doing so, we wanted to work with an «extreme case». San Fulgencio's case has a remarkable analytical value in that it reflects in a most intense and evident way the trends towards the concentration of northern European residents in new urban enclaves, spatially separated from the traditional urban centres. Then we began to collect qualitative data. We conducted fieldwork between April and June 2008. We came into contact with the town's residents, and held informal conversations with them. Furthermore, we carried out 20 in-depth interviews that lasted between 60 and 90 minutes, and were conducted with a guided that included questions about the interviewees' opinion on economic, socio-cultural, and political issues.

Through the analysis of quantitative data from Spain's Office for National Statistics we can appreciate how the convergence of the tourism function of the second homes with the migration of northern European retirees to coastal areas in southern Spain has generated configurations of the territory, in which new forms of geographical and social distance can be identified. The protagonists of these new configurations are northern European citizens that tend to become 'encapsulated' in housing estates located on the towns' periphery. The empirical identification of this phenomenon, and the study of its basic characteristics are explained in the Analysis section of the article. We have identified trends towards the development of apparent parallel societies with their own cultural features as a result of the concentration of people of the same nationality in a space away from other areas where most of the residents are Spaniards. We have also identified the appearance of lifestyles guided by leisure rather than by the attempt to enter the labour market. These results are coherent with the findings of other studies that have researched the lifestyles of residential (non-labour) migrants in the Mediterranean regions.

The qualitative research explains how British nationals that decide to purchase a property in these areas seek to go back to the local human scale in a sunny location. In a way, they are trying to recreate a pleasant rural community life on the Mediterranean.

Their common culture and similar socio-demographic profile facilitate the development of a framework of shared expectations about the relationships in the neighbourhood. The fact that the housing estate is geographically 'isolated' reinforces the tendency towards homogeneity. Our analysis shows the discontent of foreign residents arising from the

problems of the housing estates. The intensification of such state of affairs may lead to conflicts of interests because the residents of these housing estates demand services that often differ from those demanded by the residents of the traditional urban centre. In other words, they are pleased with the social composition of their new environment but they admit their disappointment about the infrastructures and facilities available in the housing estate. Thus, the social conglomerate that shapes the housing estate tends to uniformity: a national minority whose common denominator is a shared cultural tradition establishes ties that become increasingly stronger, and later realises that they share the same economic and political interests.

The wishes of young families encounter more difficulties: the troubles associated with the low quality of the urban infrastructures are aggravated by the problems linked to the lack of adaptation to the Spanish social life. Retirees can to a certain extent avoid such problems, but that is not the case of the active population and the teenagers. Withdrawing into one's own community to the point of creating something resembling a closed social system is an acceptable option for retirees, as long as their ties with Spanish institutions are not cut, particularly those with health care centres. However, that does not seem to be a satisfactory alternative for younger residents.

The irregular residential logic of the protagonists of these flows of population, between tourism and residential migrations, leads to confusion. The residents of the housing estates follow mobility patterns that make public management more difficult. This situation gives rise to dissatisfaction among northern European residents, who perceive contradictions between their requirements, and the means that the local council provides to meet them.

To avoid the situation becoming unsustainable, we suggest reinforcing the policies of information about the rights and duties of European citizens that decide to live in Spain. Although it is rather naïve to think that future urban planning will be rationally developed, and will try to join the housing estates and the traditional urban centre, we believe it is necessary to organise public transport services at a local level, and also between towns, to improve the connection between both spaces. It is also advisable to support those associations that include Spanish and foreign citizens, as well as to encourage inclusive cultural initiatives, that is, initiatives not exclusively aimed at one of these groups.

HYDRIC EROSION RATES IN THE REGION OF MURCIA

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I. INTRODUCCIÓN

The attempt to obtain soil loss rates has been a constant in erosion studies. In Spain, early work on erosion assessment using experimental techniques started last century at the beginning of the eighties. Much of this pioneering work took place in the Murcia Region, where numerous studies have been carried out since in order to assess soil loss in different lithologies, uses and surface areas (Francis et al., 1986; Romero Díaz et al., 1988; Albaladejo & Stocking, 1989). This work aims at showing and comparing the results of most of these studies.

In the Murcia Region there are several factors which favour erosion processes: rainfall, soil erosion and anthropic action.

II. METHODS

Erosion rates have been obtained using different scales and methodologies:

1. On a millimetric scale: (i) erosion pins (Francis, 1985; Romero Díaz et al., 2007b) and (ii) microtopographic profilers.

2. On a hillslope scale: (i) open erosion plots (Francis, 1986; Romero Díaz et al., 1988; Cammeraat (2004), (ii) closed erosion plots (Francis, 1986; López Bermúdez, et al., 1996; Romero Díaz et al., 1998, 1999; Belmonte et al., 2002; Castillo et al., 1997; Albaladejo et al., 2000; Martínez Mena et al., 1999; Boix Fayos et al., 2007; Romero Díaz y Belmonte Serrato, 2008), (iii) rainfall simulations (Francis, 1986; Francis y Thornes, 1990; Calvo et al., 1991; Bergkamp et al., 1996; Cerdá, 1997; Martínez Mena et al., 2001, 2002; Fernández Gambín et al., 1996; Albaladejo et al., 2006), (iv) topographic profiles and geomorphological transects

(Chaparro y Esteve, 1995; Romero Díaz y Belmonte Serrato, 2008; Poesen et al., 1997; Vas Wesemael et al., 2006).

3. On a basin scale: (i) experimental catchments (Romero Díaz et al., 1988; Martínez Mena et al., 2001; Boix Fayos et al., 2006; Oostwoud Wijdenes et al., (2000); Cammeraat, 2002, 2004), (ii) bathymetry of dams (López Bermúdez y Gutiérrez Escudero, 1982; Romero Díaz et al., 1992; Almorox et al., 1994; Avendaño et al., 1997), (iii) check dams of hydrological correction (Romero Díaz et al., 2007a, 2007b; Romero Díaz, 2008; Castillo et al., 2007; Boix Fayos et al. 2007, 2008; Conesa y García 2007) and (iv) geometric and topographical parameters (Poesen et al., 2002; Vandekerckhove et al., 2003; Romero Díaz et al., 2007c, 2009).

Experiments quantifying soil erosion have also been carried out on different lithologies (marls, marls and gypsums, limestones, sandstones, conglomerates, schists and phyllites) and different soil uses (fields with crops, semi-natural vegetation, forests and abandoned fields).

III. RESULTS AND DISCUSSION

1. Erosion rates on a millimetric scale

On a millimetric scale erosion has been mainly measured by using erosion pins with different purposes: calculating the volumes of eroded material in the headcut of gullies (Francis, 1985), measuring the dynamics of piping processes (Romero Díaz et al., 2009), estimating the sheet erosion in reservoirs of mining sediments (Moreno Brotons, 2007), assessing the sediments retained in check dams of hydrological correction after each period of rainfall (Romero et al., 2007c), and even checking the role of different vegetation species in retaining sediments on hillslopes. Some of the most relevant data were obtained from 51 check dams selected from the the Quípar river basin during a period of three years of sediment follow-up research (Romero Díaz et al., 2007b). Although the use of erosion pins generally provides high erosion rates, in this particular case the estimated rate was only 1.37 ($\text{t ha}^{-1} \text{yr}^{-1}$).

2. Erosion rates on a hillslope scale

On a hillslope scale, erosion rates have been obtained by using open and closed plots.

2.1. Open plots

In open plots, collectors similar to those devised by Gerlach (1967) were installed to know the transfer of sediments along a hillside. The first collectors were installed in the experimental area of the *Rambla de Gracia* in 1984 on a hillside with low density scrubland (López Bermúdez et al., 1986). The erosion rates obtained during a two-year period (1985-1986) ranged from 1.8 to 3.2 $\text{t ha}^{-1} \text{yr}^{-1}$ (Francis, 1986 y Romero Díaz et al., 1988). These values coincide with those reported by other authors who have used the same method in other parts of Spain. More recently, Cammeraat (2002, 2004) carried out studies with open plots in *Cañada Hermosa* (at the headwaters of the Guadalentín basin), obtaining very low erosion

values in scrublands and areas reforested with pine on limestones (0.08 t ha^{-1} on average per event). On the contrary, in marl and valley bottom areas the rates exceeded 30 t ha^{-1} .

2.2. Closed plots

From 1989 to 1999, the experiments carried out in *El Ardal* (López Bermúdez et al., 1996) on a limestone substrate with good vegetation cover, and under different weather conditions, obtained low erosion rates. From 1899 to 1997 the average erosion rate was lower than $1 \text{ t ha}^{-1} \text{ yr}^{-1}$ (Romero Díaz et al., 1998). Plots covered by scrubland provided the lowest erosion rates ($0.06\text{-}0.22 \text{ t ha}^{-1} \text{ yr}^{-1}$), followed by those where bush vegetation had been cut, but still kept some vegetation ($0.43\text{-}0.94 \text{ t ha}^{-1} \text{ yr}^{-1}$), and those which were abandoned ($0.01\text{-}0.50 \text{ t ha}^{-1} \text{ yr}^{-1}$). On the contrary, cultivated and ploughed plots provided the highest rates ($0.78\text{-}1.20 \text{ t ha}^{-1} \text{ yr}^{-1}$). But the highest rates were found in plots ploughed up and down, which registered a very high rate compared to the rest ($5.92 \text{ t ha}^{-1} \text{ yr}^{-1}$).

The erosion rates obtained in *El Minglanillo* on marls were much higher. For the 1997-1999 period, the rates were $7.47 \text{ t ha}^{-1} \text{ yr}^{-1}$ on crops, compared to $0.80 \text{ t ha}^{-1} \text{ yr}^{-1}$ on scrubland and $1.12 \text{ t ha}^{-1} \text{ yr}^{-1}$ on abandoned fields.

The results obtained in the experiments carried out by the CEBAS in the plots installed in *Santomera* showed the contrast between those areas covered by vegetation and those lacking it. On the other hand, from October 1988 to September 1993 experiments carried out with urban solid refuse (USR) in the Abanilla basin, using different soil addition rates (6.5 , 13.0 , 19.5 and 26.0 kg m^{-2}), confirmed a noteworthy decrease in runoff and soil losses.

Research carried out for 4 years on closed plots of 30 m^2 in the *Sierra del Picarcho* (*Venta del Olivo*) in areas of burned scrubland and unburned scrubland and pine forests, showed higher rates of sediment production in the burned scrubland ($0.54 \text{ t ha}^{-1} \text{ yr}^{-1}$) when compared to the unburned one ($0.03 \text{ t ha}^{-1} \text{ yr}^{-1}$).

In different lithologies (marls, conglomerates and schists) of the Guadalentín basin Romero Díaz and Belmonte Serrato (2008) installed closed plots of $10 \times 2 \text{ m}$ in places with dispersed natural scrubland and near reforested areas from 2005 to 2006. The aim was to compare erosion rates between forested and non-forested areas. The rates obtained were very low in all the plots, being higher in marls ($1.86 \text{ t ha}^{-1} \text{ yr}^{-1}$), followed by schists ($0.11 \text{ t ha}^{-1} \text{ yr}^{-1}$) and lastly by conglomerates ($0.06 \text{ t ha}^{-1} \text{ yr}^{-1}$).

To sum up, the high number of studies carried out on closed plots showed an average range from inappreciable erosion to maximum rates of $7.5 \text{ t ha}^{-1} \text{ yr}^{-1}$. The highest rates were found in lithologies of marls, with little vegetation, in the first years after abandonment, in burnt surface areas, in crops and especially in downslope tillages.

2.3. Rainfall simulations

There are different types and different sizes of simulators (Calvo et al., 1988; Cerdá, 1999). In the Murcia Region, the 0.25 , 2 and 20 m^2 simulators have been used.

With rainfall simulations, erosion rates ranged between 0 and $14.36 \text{ t ha}^{-1} \text{ yr}^{-1}$. The higher rates were obtained in marl lithologies and soils without vegetation and recently abandoned.

In general, simulations displayed low erosion rates, except for the cases where high rainfall intensities were applied.

2.4. Geomorphological transects and topographic profiles

The geomorphological transect method has been widely used in different studies. In the Murcia Region, this method has been applied to assess the effect of reforestation on soil erosion. The data obtained by using this method provide high erosion rates, with average rates of $105 \text{ t ha}^{-1} \text{ yr}^{-1}$ on marls and $63 \text{ t ha}^{-1} \text{ yr}^{-1}$ on conglomerated in terraced slopes for reforestation.

When assessing erosion with longitudinal profiles, rates were also high in the studied areas. In areas with metamorphic lithologies, the rates obtained in slopes with almond groves ($26.6 \text{ t ha}^{-1} \text{ yr}^{-1}$) were very similar to those obtained in terraced areas for reforestation ($29.4 \text{ t ha}^{-1} \text{ yr}^{-1}$). In sedimentary lithologies, values were very high on conglomerates ($103.6 \text{ t ha}^{-1} \text{ yr}^{-1}$) and lower on marls ($67.8 \text{ t ha}^{-1} \text{ yr}^{-1}$)

3. Erosion rates on a hillslope scale

3.1. Experimental catchments

Studies made on a catchment scale in the Murcia Region are not so numerous. The first studies were carried out in small microcatchments. Those carried out in the *Rambla de Gracia* (Mula basin) on an area of 3000 m^2 date from 1984 to 1986; and those carried out in the Chícamo river basin in two small microcatchments of 328 and 759 m^2 (*Color and Abanilla*) date from 1990 to 1993. In the *Rambla de Gracia*, the erosion rates ranged from 0.08 to $2.36 \text{ t ha}^{-1} \text{ yr}^{-1}$ (Romero Díaz et al., 1988) and in the second site the rates ranged from 0.85 to $2.99 \text{ t ha}^{-1} \text{ yr}^{-1}$ (Martínez Mena et al., 2001).

From 1997 to 2003 there were experiments in catchments of greater surface areas (6.4 , 7.9 and 24.3 ha) which took place in the Sierra del Picarcho. The erosion rates provided were very low compared to those in the microcatchments with mean values ranging between 0.034 , 0.011 and $0.015 \text{ t ha}^{-1} \text{ yr}^{-1}$ (Boix Fayos et al., 2006).

Microcatchments displayed higher rates than basins (0.08 - $2.99 \text{ t ha}^{-1} \text{ yr}^{-1}$ compared to 0.011 - $0.034 \text{ t ha}^{-1} \text{ yr}^{-1}$).

3.2. Bathymetry of reservoirs

The data published by different authors for the main reservoirs in the Segura basin sometimes showed different values. López Bermúdez and Gutiérrez Escudero (1982) obtained an average value of $8.3 \text{ t ha}^{-1} \text{ yr}^{-1}$ for 8 reservoirs and with bathymetries performed until 1976-1977; Soto (1990) and Romero Díaz et al. (1992) obtained lower average values of 4.3 and $4.7 \text{ t ha}^{-1} \text{ yr}^{-1}$ respectively for 11 reservoirs and with more recent bathymetries; Almorox et al., (1994) obtained a similar value of $4.4 \text{ t ha}^{-1} \text{ yr}^{-1}$ for 7 reservoirs; and finally Avendaño et al., (1997) who studied a longer period of bathymetries (until 1994), reduced the average to $3.3 \text{ t ha}^{-1} \text{ yr}^{-1}$.

3.3. Check dam of hydrological correction

Romero Díaz et al., (2007a) studied 425 check dams in the Quípar river basin (814 km²). They calculated the erosion rate in 195 of them, which were not silted. They took into account the quantity of accumulated sediment, the basin surface area and the date of construction of the check dams. This is a relatively simple and efficient method to estimate erosion rates in basins. However, this method requires registering data for a period of time long enough and the check dams must be distributed over the total surface area of the basin (Romero Díaz et al., 2007b). The average erosion rate obtained for the whole of the Quípar basin was 3.95 t ha⁻¹ yr⁻¹. However, the variability was very high (ranging between 0.03 and 72.47 t ha⁻¹ yr⁻¹). More than half of the check dams displayed a very low erosion rate (below 1 t ha⁻¹ yr⁻¹); 30% showed a rate between 1 and 5 t ha⁻¹ yr⁻¹; and in 8% of the check dams the value registered was higher than 10 t ha⁻¹ yr⁻¹.

Studies on the check dam function in smaller basins have been carried out by other authors (Cárcavo, Rogativa and Torrecilla). Thus, Castillo et al., (2007) studied the effectiveness and geomorphological impacts of check dams on erosion control in the Cárcavo basin (a small basin of 27.3 km² located near the Quípar basin), where 32 check dams were analyzed; Conesa et al., (2004) and Conesa & García Lorenzo (2008) focused on the role of check dams in the hydrological dynamics of the Rambla de la Torrecilla (Guadalentín basin) with a surface area of 14.7 km². In this gully 30 check dams have been built. Boix Fayos et al. (2007, 2008) and Castillo et al., (2009) studied the effectiveness of forestry hydrological restoration projects on erosion control in relation to soil use changes in the Rogativa basin (north face of the Sierra de Revolcadores). This basin has a surface area of 47 km² and 58 check dams. The average erosion rate calculated using sediments contained in check dams in the Rogativa basin is 5.39 t ha⁻¹ yr⁻¹ (Boix Fayos et al., 2008). As in the case of the Quípar river basin, the Rogativa basin also displayed a high variability (ranging between 0.25 and 107.33 t ha⁻¹ yr⁻¹).

3.4. Geometric and topographical parameters

Another way of carrying out erosion rate estimates, especially in gullies and piping areas, is by measuring directly the field, carrying out topographic liftings, vertical photographs and complementing the estimates with aerial photographs.

Poesen et al., (2002) reported data obtained in 2006 in the Guadalentín basin in rills and gullies and calculated rates of 36.6 and 37.6 t ha⁻¹ yr⁻¹. Oostwood Wijdenes et al., (2000) obtained rates of 1.2 t ha⁻¹ yr⁻¹ in another study carried out between 1997 and 1998 in 458 gully headcuts in the Rambla Salada (Guadalentín basin). Vandekerckhove et al., (2003) obtained a higher gully retreat rate (17.4 m³ yr⁻¹) in the Guadalentín basin by studying 12 gullies over a 40–43 year time period using aerial photographs.

Romero Díaz et al., (2009) estimated the volume of soil loss in an area affected by piping processes in Campos del Río (Mula basin). Piping processes were reported for 96 out of the 122 analyzed plots of land. When the average between the different analyzed areas was calculated, the average erosion rate per plot was 287 t ha⁻¹ yr⁻¹ and 120 t ha⁻¹ yr⁻¹. Erosion rates higher than 100 t ha⁻¹ yr⁻¹ were shown in 34% of plots. This value was higher than the

rates obtained in gullies, but lower than that reported by García Ruíz and López Bermúdez (2009), who obtained a value of $550 \text{ t ha}^{-1} \text{ yr}^{-1}$ in other piping areas in Spain.

IV. CONCLUSIONS

The various experiments performed in the Murcia Region in order to study erosion processes have to be highlighted. These experiments have been performed not only by the Area of Physical Geography at the University of Murcia or the Centre of Edafology and Applied Biology of the Segura (CSIC), but also by other Spanish and foreign researchers.

Different methods have been used in the assessment of erosion rates and at different scales, depending on the processes under study and quantification. For this reason, very different results have been obtained. None of the values obtained can be considered to be absolute. However, they provide orders of magnitude under different environmental conditions.

Variations in the erosion rates obtained depend on the assessment method. Lower rates have been obtained with rainfall simulations, open plots, some types of closed plots, microcatchments and catchments. Medium rates are the result of assessing different types of closed plots (crops, plots without vegetation cover and on very easily erodible lithologies), check dams and bathymetry of reservoirs. Higher rates are the result of quantifying erosion through geomorphological transects, longitudinal profiles and geometric and topographic parameters. The highest erosion rates are the ones obtained with methods which are normally used to quantify areas with higher erosion, especially those with concentrated erosion: rills, gullies or pipes.

In general terms, erosion rates in the Murcia Region are lower than $2 \text{ t ha}^{-1} \text{ yr}^{-1}$ except for the areas of badlands, piping, much altered sectors with inadequate uses and handling. However, sometimes the rates are high due to periods of heavy rainfall. In these cases, values can be higher than $50 \text{ t ha}^{-1} \text{ yr}^{-1}$ and even higher than $100 \text{ t ha}^{-1} \text{ yr}^{-1}$.

The highest erosion rates, regardless of the method used, have been obtained on marls, high slopes, soils not covered by vegetation and abandoned crops. In semi-arid environments, like the Murcia Region, scrubland may play a protective role as efficient as, or even more efficient, than that of forest.

However, it is impossible to extrapolate the results for erosion and sediment production from plots to basins due to the different ways in which connectivity of flows and sediments is produced. There are many different factors intervening in soil loss and the period of measurement must also be taken into account. Observation periods should be long, something that is not always possible. Therefore, the comparison of data is not always valid, even if the same method is used.

The erosion rates obtained using experimental methods on soil erosion assessment question erosion rates estimated through equations such as the USLE which, in the case of the Murcia Region, overestimate erosion rates mostly in sheet runoff areas. On the other hand, as they do not calculate concentrated erosion, they underestimate erosion in gully and piping areas.

RURAL TOURISM IN SPAIN. STRATEGIES GUIDELINES FOR A DEVELOPING TIPOLOGY

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Rural tourism has experienced in Spain, during the first decade of this century, a period of extraordinary growth. There are several factors which together have contributed to the development of this form of tourism: increased interest in the environment, new motivations of the tourist, and the administration's commitment to tourism as a tool to transform rural society, *inter alia*.

However, this growth process has not been characterized for following a set pattern, but rather, is configured as an anarchic process that have not previously set some basic criteria in the design process, not even by the administration, which has resulted in significant legal or environmental problems that still remain unresolved. Also during the phase of introduction and development of the product, the rural tourism has been perceived as a magic solution to the problems of rural society, which has lead to the development of projects without any prior planning and whose only *raison d'être* was the common belief that would help solve the problems of the population in these rural areas.

Experts believe passed the stage of introduction and development of rural tourism, characterized by an average occupancy reaching eighteen percent in 2010, high levels of seasonality in certain periods of the year (Easter, Summer and Christmas), a Unknown considerable and unregulated supply, mostly national demand, a peculiar and reduce cost structure and a very weak position in the traditional source markets of this demand. Currently, has started a new period in which all stakeholders perceive the need to respond with an adequate process for planning and coordinating the development of tourism.

In this context, this paper pretends on one hand to analyze the current situation of rural tourism in Spain, in quantitative and qualitative terms, on the other hand, to establish a proposal to guide action towards good governance of this type of tourism in Spain, in order to promote competitiveness and long-term sustainability.

In response to the first objective, despite the period of growth experienced by rural tourism in the last decade, it is a typology still emerging that has not consolidated its production structure, there are no land marks with sufficient strength in markets (especially international), does not have proper distribution channels to the particular characteristics of

this type of business, and is not able to maintain minimum volumes of tourist flows with specific motivations.

It also highlights the existence of an offer that is growing, although it is very fragmented, is medium small, poorly professionalized and that, with few exceptions, has still very generic products throughout the Spanish territory on the other hand. The demand for rural tourism is also growing, albeit at a slower pace, so have reduced the average stay and the occupancy rate during the last decade in Spain.

However, the development of rural tourism has not followed a uniform process throughout the Spanish territory, as there are important differences when analyzing rural tourism of each regions, which suggests that the actions of the different regional administrations has not followed a common pattern. That is why there is a different growth rate between different regions of Spanish territory.

Regarding the second objective proposed in this paper, apart from a thorough review of the literature, we have used a qualitative analysis technique, the Focus Group, which, thanks to its flexibility and versatility, has facilitated the interaction of a group of experts, allowing a holistic and strategic view about the main issues in this research.

Also, at the time of establishing guidelines or recommendations in the planning and development of the tourist activity, we have identified the strategic priorities of rural tourism in Spain, and the key elements of good governance of rural tourism in this country. The exploratory study, conducted under a structured and systematic approach, has led to capture a set of ideas put forward by different experts, which gives soundness to the final results.

Of all the strategic guidelines that are part of this agenda for action, it is worth noting the five identified by experts with a broader consensus. These are not necessarily the most important issues, but these are those for which implementation does not seem to debate, given the high agreement among all stakeholders. It is understood, therefore, they can be the pillars that support from the start moving towards a new model for the Spanish rural tourism management, based on good governance for tourism. These five key issues are the following:

- Diversifying the rural tourism product.
- Improving the skills of entrepreneurs and workers.
- Generating market intelligence.
- Adjust the supply growth of demand generation.
- Coordination of regional policy for the homogenization of the supply.

In this regard, this paper presents the strategic lines of a new governance in rural tourism for Spain, as understood by experts, based on three assumptions: i) the achievement of a sustainable development of the Spanish rural tourism which respects the signs area's identity and ensure the local use of tourism revenues, enhancing, simultaneously, the environmental values of these areas, ii) the coordination of sectorial policies that affect tourism development in rural areas, and iii) the rigorous knowledge of the various rural tourist areas, at least in regard to macroeconomic issues, the analysis of tourism supply and demand, the behavior of tourist flows and relevant figures, and relationships, synergies and differences that occur between the different actors involved in the process.

The rural tourism in European countries with the longest tradition is increasingly complex and diverse, it has gone past from a first stage starring by accommodation to a second which started giving importance to the food, and a third characterized by specialization supply in specific segments of demand, in which agriculture (especially in the territories in which it was hardly competitive) is a recreational resource (in many cases in terms of teaching) which promotes a holistic experience of tourists during their visit to rural areas. The proposals in this research will contribute to Spain follows this same process, as proposed at the beginning of this article, promoting competitiveness and long-term sustainability of this tourism typology.

THE TOURISTIC VALENCIAN COAST. INTERESTS AND CONTROVERSIES IN A TERRITORY TENSED BY THE RESIDENCIALISM

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The principal Valencian tourism product, colloquially known as «sun and beach», or more accurately «sun on the beach», has been spoiled due to its progressive deviation towards the building industry activities and speculative components related to purchase and sale of land and houses. This fact has led to a massive tourism, headed by land development companies, which are the real creators of «touristic urban planning». In such a context, prices are the main competitive point of reference for the visitors to the country, who will predictably choose another equal or cheaper alternatives, but with a more genuine environment and less damaged by the barbaric urbanization of the coast area.

As regards to its effects on the territory and socioeconomic impact, since 1960 the development of the tourism industry in this area represents one of the most remarkable geographical processes, due to its complex nature, its demonstration and clustering effect and its cross impacts. This maritime region has undergone a touristic metamorphosis, especially in its touristic coast axis, which has been functionally and radically changed and reshaped.

In 2010, there were 25 million hotels overnights in the Valencian Community, which accounts for 9,5% of the total in Spain. The Valencian Community moved then to the fifth place, behind the insular communities, Catalonia and Andalusia.

In the last years the evolution of the number of hotels and hotel beds is positive, particularly in the provinces of Alicante and Valencia. On the contrary, there has been a standstill in the number of beds offered in apartments, which had a very small increase in Alicante, despite the terrific building construction in the decade 1997-2007. Over the last years of economic welfare, there has been a growing trend towards the diversification of investments from the real estate firms to the hotel sector, most of all in the capitals of the provinces and because of that, both activities have strengthened their bonds. The strong wave of urbanization under touristic rhetoric has practically reached the whole country.

The Valencian Land Grab law (*Ley Reguladora de la Actividad Urbanística*) passed in 1994 and modified the relationship between land owners and developers, thus putting

and end to the exclusive vesting of the powers to urbanize in the land owner. In order to do it, the law introduced the role of the «property developer». The property developer, after presenting an Integrated Actuation Program (P.A.I.), had the power to develop the urbanization process, without being the land owner. The objective of the law was, theoretically, to release urban land, to lower land and house prices and to give leeway to civil services in the land management. In practice, however, the law favoured the opposite effect. Furthermore, the way in which the law has been carried out contributed to raise house and land prices in an endless speculative spiral and, at the same time, it placed the power of the land management in the hands of a more speculative figure than the original owner: the property developer.

All the same, the best consolidated and planned tourism occupancy rates are distributed among twelve great coast destinations: Peníscola, Orpesa, Benicàssim, Cullera, Gandia, Dénia, Xàbia, Calp, Altea, Benidorm, Santa Pola, Torrevieja, besides the three capitals of the provinces, Valencia, Castelló de la Plana and Alicante. The ongoing and significant increase of urban planning prospects has reached also the agricultural coast villages (Moncofa and Tavernes de la Vallidigna...), where they held out the first urban wave in the 1970s, and also the pre-coastal ones (such as Sant Jordi, San Fulgencio and Rojales). Most of the new urbanization projects follow the patterns of a tourist residential development based on golf courses, hotels and shopping centers. So, this housing bubble that has been blowing up until 2008, exploded and wreaked havoc on this coast, the coast which suffered the urban planning excesses as a result of unjustifiable expansionism and reclassifications. And all this devastation, in most of cases, won't be offset.

The touristic and metropolitan areas with more free rustic land have seen a great development in its urban planning activity. The Spanish Land Law (8/2007, 28th May) was intended to solve some of the problems related to the irritating urban planning of the country: lack of transparency in administration, the requirement of more state subsidised houses, more respect to the private property, etc. Nevertheless, the economic crisis has reduced their capacity to start new urbanisation projects and maybe now they have time to carefully think about the sustainability of their model.

Data from European project CORINE LAND COVER, for the period 1987-2000, inform that urban area in Spain grew up by 13,8%, with a 14,6% increase between 2000-2006, according to the Observatory of Sustainability in Spain (OSE). This strong increase is bigger in coast provinces, (besides Madrid), such as Málaga, Murcia and, of course, Alicante and Valencia.

In 2006, Spain had more than 20 homes every 1000 inhabitants. The Valencian Community had 25, with 65 homes every 1000 inhabitants in the province of Castellón, the highest rate in Spain. Housing development and construction has become the basis of a model of development that we could call «*constructur*». This feedback model rests upon both construction and tourism, which reach around 30% of the Gross Domestic Product in the Valencian Community and that is a heavy weight.

In the coast towns, more than a hundred million square meters changed their usage between 2000 and 2006. Data from remote sensing prove that more than 80% of them changed from agricultural land into some kind of urban use. It is remarkable that in the last date from which data are available, around 37% of the changes refers to land under construction, which doesn't mean a slowdown in construction, but quite the opposite.

The residential tourism model seems to be heading for a reorganization. New touristic trends show that profitable attractions are different now, such as a genuine and well maintained environment, a quality and diversified cultural offering, authenticity, originality, etc.

From a sectoral point of view, the tourism development has to do not only with an increase in the number of visitors, but also with their rhythm of haunt and expenditures. Then, profitability is not directly related to an increase in the number of visitors, but to the spending power, occupancy rate and leisure patterns of such visitors.

Occupancy rates in Valencian hotels changes according to their touristic location. Their average occupancy rate ranges from 85% in Benidorm to 35% in the interior of the province of Valencia. Seasonal fluctuation still is a structural problem with grave negative repercussions in business, labour and social profitability. According to the Spanish National Statistics Institute (2008), the hotel occupancy rate is just a 54%, although it reaches 60% in the province of Alicante. On the other hand, the apartment occupancy rate is 29%, but the province of Valencia shows here better results (32%), due to the existence of some specialized tourist places (Cullera, Gandia...). Furthermore, data from EXCELTUR (2005) show that every hotel generates 6.900 € per bed space, whereas a residential one provides just 1.400 € and also that both models generate 93 and 13 jobs, respectively, for each 1.000 bed spaces. If we take all this data into consideration, it seems clearly necessary to reinvent the «funnel destination» model (fairly full in August and quite empty the rest of the year). An overcoming is still one of the main challenges of tourism in Valencia.

On top of everything, the expense in non-hotel accommodation decreased more than in hotel accommodation. In view of this negative results, it is certain that to cut prices, services, quality and professionalism to increase competitiveness is not the best way to follow.

The level of tourism specialization achieved, the means of accommodation and the majority productive dynamics made it easier to distinguish between two kinds of destination: the hotel and the residential ones. However, the recent property boost cut down the distance between both destinations, which have also several characteristics in common. For instance, a recovery of beaches, environment and cultural heritage, an updating in the complementary accommodation and a provision of urban services where the tourism function prevails. With regard to the hotel destinations, in addition to their traditional weaknesses (tour-operators oligopoly, low prices determined by holiday packages, familiar hotels, individualism...), now we have the real threat led by a hotel oversupply and a decrease in the days of stay and expenditures. Hotel renovation and better quality in the provision of services have not turned into an increase of the profits, due to the price competition of the emerging destinations and the lost of customers, who gradually give in the temptation to buy a house in their holiday destination.

However, there are still opportunities: new marketing channels via internet, revival of «*all-in cost*», microsegmentation of the offer... But there are threatens as well. On the one hand, the everlasting seasonal fluctuation is still a chronic pathology in the hotel system, despite having more or less assumed a third vacation. On the other hand, positive discrimination towards hotel establishment (reserve of buildable area in the General Urban Plans, tax deductions...) is a constant theme here and in the residential destinations. This positive discrimination politics has also contributed to an oversupply in some touristic destinations and it doesn't exclude hotel deficits in many Valencian touristic places.

The sole challenge begins by redefining production, marketing and distribution patterns. Hotel managers must enhance, diversify and categorize their establishment, in order to achieve more and new markets and better business with brokers, and they also must increase profitability, by raising consumers spending with new offers. Otherwise, the destination must contribute to a better commercialization without giving up its touristic status.

The Valencian tourism model has several positive and negative elements. The combination of such elements provides a wide range of situations which, broadly speaking, reflect this massive «residential tourism» model, based on an unlimited housing growth in the coast. And this model is creating considerable functional, territorial and environmental imbalances and disorders.

Urbanization process, excessive and unstoppable until 2008, does not aim to achieve tourism assets. It just pursues the three classic economic types of the location theory (of scale, agglomeration and urban economics), without bringing with it new tourism potentials. Therefore, it is essential to maintain and categorize tourism activities starting from sustainability, competitiveness and integrated management principles. That is, from a forward-looking approach as a whole.

THE GROWTH OF THE DIFFUSE CITY IN THE CANARY ISLANDS: EFFECTS FOR THE TRANSPORT BY ROAD

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There are a number of factors that influence the increased mobility in the Canary Islands in recent years. Among them we highlight the evolution very high population dispersal in the territory and at least also the separation between place of residence and work.

As regards the population, moving from 1.3 to almost 2.1 million people between 1975 and 2009. The percentage increase between these years has exceeded 60%, although this growth has been uneven, with the islands more closely linked to tourism (Lanzarote, Fuerteventura, Gran Canaria and Tenerife), which have been in the forefront of growth. It is precisely in these islands which are located the greatest increases in daily average road traffic.

As we say in this population increase would be added the increasing involvement of the Canarian economy towards tourism. This has facilitated a further increase of the real population of the islands, further enhancing the mobility, not only by increasing the floating population, but because every tourist tends to move more in relation to a resident.

Thus, between 1991 and 2007, cars have increased more than 120%, rising to the roads on the islands about 900 thousand vehicles that require more space to park and move around the territory.

The latest figures indicate that between 1991 and 2001, average daily mobility attributable to a job or study of each resident of 16 years and over had increased by 46%, from 17 to 25 miles a day for each person performing Islands residents. This represented in 2001 carrying about 19 million miles a day made by all the inhabitants of the Canary Islands who moved for reasons of study or job.

But not only is important to increase mobility, but most of these trips were made in 2001 in transport with greater impact (cars, vans and motorcycles), accounting for just 66% of labor mobility school.

The new low-density residential model that has developed in the Canary Islands in recent decades has led to a significant pressure on oil-dependent transport. In fact, more environmentally friendly means of transport such as cycling and walking, haven't place in the territorial model where all functional areas are far (schools, workplaces and leisure facilities, shops, etc.). This model implies almost immediately, if no congestion in these areas of low density, other significant complications that traffic at the entrances to the cities that do have these functional areas. This results in the spaces between these points of low density and large cities, a large occupation of land for the road, resulting in substantial economic costs for expansion. At the same time, the impact on the landscape by the excessive consumption of land for the road, calls into question the model of the city that grows horizontally.

In addition, the low density residence implies a cost that implies in particular transport, it is very difficult to establish here a profitable public transport. Similarly, the costs of the diffuse city are not only here, as they also involve a considerable price increases attributable to bring services up there certain common features, such as sewage, electricity, waste collection, cleaning and road maintenance, etc.

One of the indicators that best reflects the huge development of the sprawling city on the islands are the times of transport, in addition to distances greater than 40% each cash daily performed in 2001 relative to 1991. While it is true that we can not compare travel times between 1991 and 2001, it is true that in some islands as small size, almost 40% employ between 20 and 45 minutes each way to travel, while 10% exceeded 46 minutes travel time.

In turn, low occupancy rates of vehicles and that result from car use to connect the low density areas of the workplace, we indicate the great waste of energy in the horizontal growth of cities in the islands. Indeed, it is well known that on this issue has particularly affected the technology in recent years in an attempt to mitigate such consumption, although the result, while praising, is minimized. Indeed, the rate of adoption of new vehicles on the roads, has undermined those technological advances, although they currently consume less fuel cars, as many of them in circulation, has led to increased global input fuel, generating more air pollution, just as greater reliance on foreign energy.

But while much progress the technology until we get closer to zero pollution, the problem then shifts to the unstoppable need for land to accommodate more vehicles each day on the road, coming mainly from the city that grows horizontally, it is a problem difficult to resolve. Indeed, like the energy problem, the need to travel territory is directly related to the occupancy rates of vehicles, as a lower occupancy, there will be more cars on the road to transport the same number of people. So much so, it is estimated that a conventional freeway lane at rush hour, one is able to handle 1,700 vehicles per hour, ie, about 2,025 people if we apply the load factor of 1.19 passengers per vehicle, this fact that corresponds to the actual occupancy of cars in the Canary Islands whose passengers were traveling in 2001 for work or study.

In short, one of the main objectives of this study was to demonstrate how mobility has increased in the Canary Islands in recent years, suggesting that much of this phenomenon is

due to increased territorial model of horizontal city where it is not possible the implementation of public transport with a minimum return. In this sense, improving accessibility, induced by the constant pressure of the separation of land uses, has been favoring the dramatic increase in land mobility in the Canaries. Thus, in just one decade, ie between 1991 and 2001, 50% from the global perspective and mobility by 40 per capita. This fact has contributed to improving the road network, with the refurbishment and introduction of new roads, but also other major factors such as the significant increase in population, vehicle fleet under tourism development, improvement of income, etc.

In this context, it is logical that in 2001 two thirds of the total mobility of the Islands was represented by oil-dependent transport: cars, vans and motorcycles. Even more serious is that the occupancy rates of private vehicles when traveling population in 2001 for work or school, was of only 1.19 spaces, a fact that reflects the energy-intensive model requires horizontal city, while high occupation of territory.

In short, the political management of the territory that comes from the various planning tools in the Canary Islands and by extension in at least the rest of Spain, several criteria should address sustainable in terms of transportation, as, for example The condition of the territory by road infrastructure and is significantly higher compared with predominantly residential land. With this we mean that the ground mobility planning should be in absolute accordance with the planning of the territory, trying to minimize the mobility through certain instruments such as the approximation of the workplace, business, etc. the residence.

THE MANAGEMENT OF THE LANDSCAPE ECOLOGICAL CONNECTIVITY IN SPAIN: INITIATIVES AND CHALLENGES

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I. INTRODUCTION

For the last decades it has widely been agreed that nature conservation policies focused on the designation of protected natural spaces do not efficiently work by themselves. Habitat defragmentation processes fundamentally caused by infrastructure networks, housing development and the intensification of agriculture are regarded as the main causes of the global biodiversity crisis. Therefore, to prevent and, in turn, restore the loss of the ecological connectivity of the landscape understood as the capability of this to allow the displacements of organisms among the resourceful tesseras are one of the main challenges to be tackled in order to stop the loss of biodiversity.

To tackle the challenge to integrate the ecological connectivity into the decision-making process impacting on the landscape which necessarily implies to create a series of positive synergies among the nature conservation policies and the ones regarding landscape and sectorial land use planning. The desirable scenario in which the integration of biodiversity would be accommodated in the sectorial policies and the ecological connectivity criteria into the spatial planning has been conceptualized at international level by means of ecological networks. These ecological networks may, in board lines, be regarded as any coherent system of natural, rural or periurban spaces which are built and managed in order to maintain or restore the ecological functions as a means to preserve biodiversity. The ecological networks are identified, from a structural view-point, by the inclusion in the landscape pattern, at different spatial levels, of connecting-interest areas located out of the protected natural spaces.

Within the European Union framework 92/43/EEC Directive or Habitats Directive regulating the development of the network for the protected Natura 2000 spaces urges to improve the ecological coherence thereof by means of the management of those elements of the landscape resulting fundamental to guarantee the geographical migration and distribution and the genetic exchange among species.

II. ADVANCES REGARDING THE ECOLOGICAL CONNECTIVITY IN SPAIN

1. Integration of elements of connecting interest within the regional planning

The autonomous administrations having competences both for the conservation of nature and for the Land Use Planning of landscape are the ones responsible for developing coherent ecological networks in Spain.

As for Catalonia, in 2006, the Generalitat Department for the Environment passed the binding rules for the ecological connectivity guidelines within such a Department and as a guidance for the rest of the public administrations in Catalonia. Recently the Generalitat has commissioned the drafting of the Ecological Connectivity Sectorial Plan in Catalonia. Catalonia is the Autonomous Community where decidedly most of the progress regarding planning has been achieved in terms of ecological connectivity.

In the Basque Country since 2005 – the Autonomous Government of the Basque Country commissioned the delimitation of a series of ecological corridors among Natura 2000 spaces– these ones are used as a non-binding reference information regarding the environmental-assessing processes for plans and projects. This is showing an unevenly effectiveness when taking decisions confirming that the prevention of impacts on the corridors are mostly materialized when they coincide within the space with other planning instruments aimed at preserving the rural character of the land. Currently the Guidelines laid down for the Land Use Planning of Landscape in force since 1997 are being reviewed. Within this review such a network of ecological corridors will be included under the concept of the superimposed determining factor within the autonomous landscape pattern.

In Navarre, in 1998, some ecological corridors were defined to complete the conservation regional network. The importance of the ecological connectivity was expressed in 1999 within the autonomous strategy for the conservation and sustainable use of the biological diversity, and such corridors are borne in mind in a non-binding way for the planning processes. This precedent has facilitated the inclusion of several requirements regarding the ecological connectivity within the regional planning in such a way that the on-going sub-regional plans for the Land Use Planning of the landscape define various connecting-interest areas.

The Government of Murcia, at regional level, also commissioned the delimitation of a network of ecological corridors among Natura 2000 spaces with the intention to include such network in the environmental-assessing processes of plans and projects. As for Asturias, a network of ecological corridors has been defined at regional level, from the academic context, with the intention to complete the autonomous conservation network. Also Communities of Valencia and Madrid are working in the development of their green infrastructure and ecological corridors.

2. Integration of connecting-interest elements within the sub-regional and local planning

The sub-regional plans for the integrated landscape planning, derived from the autonomous laws set forth for the Land Use Planning of the landscape at intermediate level,

constitute a relevant instrument for the integration of connecting-interest elements in such a way that there are an increasing number of plans which incorporate them.

Especially in Catalonia important advances are being achieved in this sense in such a way that the sub-regional landscape plans add a special protection, non-developing land network, aiming at the ecological & landscape connectivity among the protected natural spaces. Besides, both Barcelona County Hall and Girona County Hall are taking into consideration their competences regarding connectivity criteria when taking decisions. In Castilla y León ecological connectivity is beginning to integrate in provincial and local planning.

Nevertheless, among the Autonomous Communities a global integration of the connecting-interest areas within the sub-regional plans is not specified, but a wide diversity of methodologies, approaches and editor teams. Moreover, a wide part of the national territory does not enjoy passed sub-regional plans yet. Besides, these plans work as a reference more than regulating or binding plans, for which this generation of plans in force have often been passed.

The integration of connectivity criteria within the urban and metropolitan landscape planning implies the acknowledgement of ecological, social and landscape functions of unbuilt free spaces. These represent an important potential both for the harmonic integration of the urban fabric within the surrounding vicinity and for the conservation of the biodiversity. In the past years an increasing attention is being paid to such kind of planning, albeit they are still initiatives applied in certain cases in Spain.

3. Integration of the prevention criteria within the environmental-assessing processes

Those plans and projects that may negatively affect the coherence of the Natura 200 network is subjected to the 92/43/EEC or Habitats Directive.

The application of the environmental-assessing devices has required the adoption of new methodologies including integrated criteria for the assessment of the affection of the plan upon connectivity. The incorporation of such criteria regarding connectivity within the environmental-assessing processes has meant in some cases the withdrawal of projects of great impact upon the coherence of the Natura 2000 network i.e. Toledo-Cordoba highway and Cuenca-Teruel freeway, whose completion date was included in the Strategic Plan for Transportation Infrastructures by the Ministry of Public Works and Development (PEIT 2005-2020). In this sense the non-consideration of the coherence of the Natura 2000 network with PEIT's initial design caused the service of a letter of citation by the European Commission to the Spanish Government in 2006 within a process of infringement which is still open.

As for the prevention of the barrier-effect upon the biota (wild fauna & flora) within the construction projects of several infrastructures the demand of establishing fauna passages exists in Spain since 2001. At methodological level, in the last years, we have obtained several detailed technical prescriptions related to the adoption of measures to favor the transverse permeability of infrastructures for the various affected groups of fauna. However, the strict application of these prescriptions for the projects and for their environmental assessment have not been deployed yet, albeit it is more and more taken into consideration their observance nowadays.

4. Defragmentation of habitats affected by infrastructures

In the last years some permeability measures have been executed in Spain aimed at restoring as much as possible connectivity which has been deteriorated by linear barriers built in past decades. This kind of actions are still incipient in Spain though they had already been designed and executed in several countries i.e. The Netherlands, Switzerland and Germany years before. Prior to the execution of permeability measures the location of critical spans allow us to decide where to carry out such priority actions. The materialization of these actions requires the approval of the needed budgets by the competent administrations. In this sense, nowadays previous diagnose works are more numerous in Spain than the actions executed, such as new fauna passages within various problematic infrastructures.

5. Improving the connectivity of the habitat of endangered species

Under the approach of the Biology of Conservation connectivity among populations is a priority aspect included in the conservation plans of certain endangered species with fragmented populations. Within the Iberian fauna three emblematic endangered species are highlighted: the brown bear (*Ursus arctos*), the Iberian Lynx (*Lynx pardinus*) and the grouse (*Tetrao urogallus*).

Currently the LIFE + Communication Corridors project is being executed for the conservation of the brown bear (2009-2011) fundamentally aimed at improving connectivity among the western populations and the eastern populations along the Cantabrian mountain range suffering from serious kinship problems.

Regarding the feline the LIFE Conservation and reintroduction of the Iberian Lynx in Andalusia (2006-2011) is being executed. To communicate both population nuclei existing in the Andujar mountain range is among its goals, and to cut down the mortality of such a species as they are mainly run over by vehicles in Doñana.

The grouse is seriously affected by the loss of quality of its habitat and by the forest fragmentation — both for the Cantabrian sub-species and the Pyrenees one. The conservation of the grouse contained in the national strategy passed in 2004 urges to set up connection areas and corridors among the population nuclei by identifying the elements that may act as a barrier and envisage conservation or restoration plans for such corridors.

6. Other initiatives

The ecological restoration works of the fluvial and riversides of the Guadamar river, which started after the mining spillage of Aznalcollar in 1998, have set forth the groundwork for establishing a performance framework aimed at promoting the ecological connectivity through the corridor and by bearing in mind the natural spaces of the area, particularly Doñana and Sierra Morena. This is one of the accomplishments of the declaration of the Green Corridor of the Guadamar river of 2003 as a Protected Landscape in Andalusia.

On the other hand, an initiative promoted in 2005 by the Fundació Territori i Paisatge is aimed at favoring the ecological connectivity among the Cantabrian Mountain range, the Pyrenees, the French Central Mountains and the Western Alps. Due to the width of

the concerned territory the materialization of such goals of such an initiative requires the coordination of several administrations, which means an important challenge.

III. OTHER OPPORTUNITIES TO TEAM UP WITH CONNECTIVITY

Firstly, the application of a socio-environmental vision of the landscape based on sustainability principles and a «new culture of the landscape» within planning has a high potentiality to foster the maintenance of the ecological connectivity. One of the principles supporting this vision consists of the positive planning and management of landscape by appreciating the matrix of free spaces as the drive of the landscape pattern capable of guaranteeing the continuity of the ecological processes and hold back the urban development. Another of the principles consists of adopting concentrated urban patterns avoiding the urban development, dispersion and fragmentation, processes which soared in Spain in the past decades.

Secondly, spaces included in the Hydraulic Public Dominion, Maritime-Land Dominion and in the Livestock Routes comprise a vast surface as a whole. Their inclusion in the landscape patterns and appropriate management has a great potentiality in promoting the continuity of natural interest spaces in Spain.

Thirdly, funds for the Common Agricultural Policy aimed at developing agro-environmental measures and regional programs for the rural development have a remarkable potential to team up with connectivity. The PAC reform of 2013 constitutes a chance to face growing efforts thereof.

Fourthly, the overcoming of the traditional vision of the Land Use Planning of forests by stands through planning at landscape level, which means an important opportunity to contribute to the ecological connectivity. The Plans for the Land Use Planning of Forest Resources (PORF) at regional level may play a relevant role in this way.

Finally, but not less important, territory custodial programs may play a leading role in the management of the ecological connectivity. The custody of the territory may be especially interesting regarding the initiatives aimed at fostering the continuity of the ecological processes owing to the capability of the custodial entities in establishing agreements with the owners of such lands both out of and within the protected spaces.

IV. DISCUSSION & CONCLUSIONS

Currently it has been stated that the ecological networks including the criteria regarding the ecological connectivity within planning is not as relevant in Spain as it is in other European countries. A series of possible specific reasons have been pointed out thereof i.e. the lack of a framework coordinated by the state regarding connectivity, the low priority of this subject-matter in the autonomous environmental administrations' agenda, which have to manage a surface area included in Natura 2000, certainly extensive at European level, the still incipient scope and development of planning instruments derived from the autonomous Land Use Planning laws, the existence of several low densely populated regions with lower rates of territorial fragmentation in relation to other European regions.

The performed review reveals that the initiatives regarding the ecological connectivity set in motion in Spain show a growing trend fundamentally during the last lustrum. It is stated that there is still a long way to go to widely integrate such criteria related to the ecological connectivity in the spatial planning in Spain. It is also stated that there are instruments and chances to properly implement the ecological connectivity within the landscape planning in Spain, therefore the materialization of such an integration is feasible.

The planning instruments listed in the autonomous Plan Use Planning laws are to play a fundamental role. It is essential the development of regulating instruments for the comprehensive Land Use Planning and its prevalence over sectorial plans.

FLOWS OF CAPITAL AND FLOWS OF WATER: THE TEXTILE INDUSTRY AND THE PRIVATISATION OF THE WATER SUPPLY IN SABADELL IN THE SECOND HALF OF THE 20TH CENTURY

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Historical accounts of the evolution of urban water supply may shed light on the processes that shape the nature and development of urban growth and also on the interests that lie behind the expansion of urbanisation. To use Erik Swyngedouw's words: «flows of water are also flows of power». Both flows represent vital elements for the continuous expansion of the urban fabric, and water commodification and privatisation strategies are usually entrenched within a scarcity discourse in an attempt by private interests of overcoming new frontiers of capital accumulation, in what David Harvey calls 'accumulation by dispossession'. How water privatisation processes arise and operate is geographically and historically contingent but may have certain elements that cross through political and environmental boundaries. Therefore, case studies on municipal water privatisation are needed in order to identify the general as well as the specific trends by which the resource is taken away from the public sphere and incorporated in the circuits of urban/regional/global capital.

In this paper we want to present the case of Sabadell (population 204,000 in 2008), the fifth most populated city of Catalonia (North-east Spain) and, historically the most important Spanish centre for the production of textiles. Sabadell constitutes an early, interesting, and at the same time peculiar example of water privatisation directed and controlled by the political and economic elites of the city. Our main hypothesis in this paper is that the manufacturer's

interest in water went beyond the strict need of ensuring an adequate supply for the textile mills. It signalled a shift in investments strategies towards the water sector.

The debate that took place in the city of Barcelona between 1910 and 1923 regarding the municipalisation or the privatisation of the city water supply was reproduced in Sabadell a decade later again with the phantom of scarcity lurking in the back. At that time water consumption (domestic and urban plus industrial) in Sabadell was 100 liters per person and day (lpd) on average. This was a fairly large quantity that reflected the abundant domestic and industrial wells existing in the city. The supply coming from these wells will gradually vanish in the years after the civil war due mostly to overuse and pollution.

Sabadell's water supply in the first decades of the 20th century showed a large heterogeneity. First, the municipal company obtaining its waters from the Ripoll River¹ saw a growing inability to satisfy its customers with the existing resources. Sabadell was also served by the two private water companies (*Sociedad de Propietarios de la Mina de Aguas de Sabadell* and *Compañía de Aguas para el abastecimiento de Sabadell S.A.*) that reached their maximum capacity during the 1920s when a long period of drought restricted supply to customers.

From 1930 onwards, the strategy of industrialists belonging to the Manufacturers Guild, the Chamber of Urban Property and the Society of Owners of the Water Mine of Sabadell would shift from searching local resources in the Besòs river towards searching for more distant waters together with the city of Barcelona. Only the political change brought about by the Spanish Second Republic in 1931 and especially the democratization of local councils precluded the constitution of private local monopolies for water supply.

At the end of the Spanish Civil War (1936-1939), the two private water supply companies of Sabadell were returned to their original owners in perfect conditions so that in 1940, the three suppliers (one public, two private) existing before the Civil War reassumed their operations.

In the mid 1940s a pronounced drought pushed the existing water supply system to its limits (including supply cutbacks) and consequently threatened the economic growth of the hegemonic and water-dependent wool textile sector. This crisis led the City Council of Sabadell (then chaired by a representative of the Textile Guild and with a strong presence of the local Chamber of Commerce) together with the Manufacture Guild to create a Study Commission to search for a so-called 'definitive solution to the water needs'. The Committee agreed on two significant conclusions. First, local resources were insufficient to meet the growing demand of the city, and second, increases in consumption, new industrial uses and domestic expansions were to be increasingly taken by the city council.

Wool textiles during the period 1940-1950 represented close to 80 per cent of all industrial activity in Sabadell. Dyeing in particular necessitated vast quantities of water; hence the location of all factories near the Ripoll River. Despite political intervention and restrictions, wool lived in these years a golden age in which entrepreneurs became rapidly wealthy. In this context, the Committee for the water supply of Sabadell abandoned the option of bringing water from the Besòs River because the alleged high costs and lack of profitability despite the generally good quality of the water. Instead, the favored solution was to bring water from

1 The Ripoll river, flowing 40 km through the Vallès plains, is tributary of the Besòs river.

the Llobregat, more distant and of less quality but with a piping system to Terrassa already existing since 1934. However, this solution was also abandoned because of the dependency from Terrassa that this option would create. Terrassa had the same manufacturing base than Sabadell and competition was feared, despite the fact that only a nine kilometer long pipe was needed at a very reasonable cost. Finally, the Committee proposed the creation of a new company with participation of all industrial sectors in the city that «would solve forever the water problem, so important for our town».

The model adapted in Sabadell emulated that taken by the *Societat General d'Aigües de Barcelona* (currently the AGBAR group) in the city of Barcelona 50 years before: to consolidate a monopoly for the distribution of water in the city. The alliance between Sabadell's industrialists and the city council sealed a water supply system geared towards the logic of capital accumulation that rarely took into account a socially just distribution of the resource for the city. Besides, the authoritarian political regime would preclude any debate between the defenders of water as a public service and the defenders of water as a private venture.

The existing companies supplying water could have legally objected the constitution of the new company. And they complained to the city council opposing the «municipalisation» and the new monopolistic situation. However, these companies were financially unable to fund the new network to bring water to Sabadell to which they were entitled by order of preference². As much as the financial argument is critical it is also true that the main shareholders of this company were also part of the new company.

In 1949 CASSA [*Compañía de Aguas de Sabadell*] (Water Company of Sabadell) was finally created. The company held the water supply for Sabadell in monopolistic terms and was, as agreed, 80% private and 20% public. The extent to which the latter was totally controlled by manufacturers can be noted in that the city council relinquished his right to search for financial resources to make water supply entirely public despite the fact that the service was not in deficit. The president of the new company was also the President of the Manufacturers Guild while the vice-president was an industrialist and banker. The other members of the board were all significant members of the city's industrial elites. The ties with the existing elites were so tight that the first physical location of the company was the very same Manufacturers Guild.

CASSA was said to have a concession for 99 years; that is, in 2048 rights and all physical infrastructure will become property of the city council and the company will cease to exist. Initially, capital was set at 5 million pesetas but could be increased until 25 million, which was the estimated costs of bringing water from the Llobregat river. Meanwhile the company signed a contract with SGAB (Barcelona's water company) to supply 7,500 cubic meters per day, more than twice the amount served then to the city in 1949.

In 1952 finally waters from the Llobregat arrived in the city. This fact went unnoticed in the media because at the time Barcelona suffered severe restrictions and it would have been certainly bad press to publicize the diversion of water to another town. Once the Llobregat alternative was ensured, in 1953 CASSA asked the Spanish Ministry of Public Works a direct

2 Report, for 1948, núm. 63. Sociedad de Propietarios de la mina de aguas de Sabadell.

uptake from the river to be transported to Sabadell through an entirely new water piping system. In 1955, the permit was granted by the Spanish government.

The 1950s saw also the absorption by CASSA of the two private water companies existing in the city and therefore the consolidation of the monopoly in urban water supply service. At the end of the decade, the company extended the city's water supply network and captured from the Llobregat almost 15,000 daily cubic meters. This expansion coincided in time with a period of strong population and industrial growth. In 1960 Sabadell had already more than 100,000 people and the textile base had diversified towards metal works and housing construction. At that time, water consumption had increased to 140 lpd but, given the forecasts of strong demographic and economic growth for the following decade and beyond, CASSA asked for new supplies, this time from the Ter river (located some 100 kilometers north of the Barcelona Metropolitan Area). Eventually, this concession was denied but in 1967 water from the Ter reached Barcelona. It was matter of time that this new resource was tapped by Sabadell as well. In this sense, Sabadell's business leaders and politicians saw economic growth intimately bound to the availability of water and the best way to ensure future resources was to tight up Sabadell with Barcelona.

In 1966, water from the Llobregat attained 20,000 daily cubic metres and per capita consumption jumped to 167 lpd. This accelerating consumption could not be detained since the economic elite of the city foresaw a population of 500,000 for the year 2000. In 1969, the company applied again to increase the water intake from the Llobregat River, this time further upstream and for a quantity of 250 liters/second (21,600 cubic meters per day). Sabadell never reached 500,000 people. The 1970s came and with them the beginning of a number of periodic crises that would leave the textile sector seriously damaged. In 1980 textiles were already in a secondary position in front of other manufacturing activities, and in the 1990s and 2000s, manufacturing in general suffered several processes of restructuring and lost most of its former importance while Sabadell, as many other formerly industrial towns navigated a transition towards banking, finance and other white collar activities. During all this period, however, CASSA has never stopped to grow. Further it has followed the model of other private water utilities and diversified its business ventures to the point that water supply today merely contributes 48.8 per cent to the total turnover of the company, the rest being investments in other parts of the hydrological cycle such as wastewater and desalinization plants. In 2009 CASSA managed about seventy-five water supply and sanitation contracts in towns of Catalonia, Aragon and the Canary islands, and the complete water cycle of Cape Verde, Boavista and Sal islands (off the coast of Africa) as well as 29 wastewater treatment plants. Today the owners of CASSA do not have wool textiles as their main business activity. The most profitable activity sought by the successors of those manufacturers is precisely the selling of water.

To conclude, the case of Sabadell illustrates a process by which a city with few local flows of water and a chronic water deficit during the first third of the 20th century became a larger water supplier from the 1940s onwards after the service was mostly privatized with the consent of the town council under the influence of industrial interests. It is also interesting to note that while the business based on the textile industry declined from the 1970s onwards, the water sector remains one of the most reliable and profitable businesses of Sabadell. The case of this city, though geographically and historically contingent, is an early example

of how water could be opened to capital accumulation; all this with the complicity of the administration. Public Private Partnership agreements or partial/full privatizations of the water supply (such it was done in Chile and England in the 1980s, or as it is planned to be done with the whole supply of the Autonomous Community of Madrid), operating under the hegemonic neoliberal background, envisage nature and basic services as niches for business. In that sense, environmental urban history could provide us with valuable information about early and common trends on nature's neoliberalisation. By expanding continuously the scope of its business and overcoming physical frontiers, CASSA turned up water flows into flows of capital.

LANDSCAPE INTEGRATION AND ITS FOUNDATIONS. METHOD OF APPLICATION FOR REMOTE BUILDINGS IN RURAL AREAS

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I. INTRODUCTION AND OBJECTIVES

The insertion of remote rural buildings into the landscape is a challenge for the regional policy and landscape management. Their landscape integration constitutes a social and administrative demand which, however, lacks solid theoretical approaches and specific methodological developments which contribute to the standardization of the approaches.

This piece of work states the following main objectives. On the one hand, it offers theoretical contributions which help to establish the conceptual foundations of landscape integration and, on the other hand, it provides a methodology of analysis and evaluation for the landscape integration applied to remote rural buildings, in order to allow their use in other spatial and thematic fields.

Likewise, this piece of work has another objective: it shows the results obtained from applying the methodology in various research projects about the integration of remote rural buildings into the landscape which have been carried out in Andalusia. Its aim is to determine the criteria which the buildings aspiring to the «Natural Park Label» have to achieve on this subject. This is a quality eco-label acknowledged by the regional administration.

II. DEVELOPMENT AND APPLICATION SCOPE OF LANDSCAPE INTEGRATION

The problem of integrating buildings into the landscape has undergone an increasing interest in the Spanish society, as it already happened in more advanced societies. Its demand emerges as a result of social unrest caused by the spread of the housing development in rural areas and also due to the locations and typological modalities used.

In rural areas, landscape integration, being understood as a public intervention, has a still incipient stage of development, at least in our spatial context. On the contrary, it was in the urban areas where this model of territorial management emerged and where its path has been increasing, especially in the historic downtowns.

It has not been until the 20th century that integration of the remote rural architecture into the landscape has been a subject of reflection in itself, having as main referents Lloyd Wright's Fallingwater and Villa Malaparte in Capri. Similarly, different tendencies linked to Land Art have experimented with the search for the fusion between architecture and landscape.

The integration of rural buildings into the landscape, as a territorial policy instrument, constitutes a more recent subject matter, undoubtedly due to the lower incidence that constructive activity has traditionally had in these spaces. In the beginning, landscape integration policies were restricted to protected natural areas, or valuable landscape areas within Rural Development Policies.

However, the need for the integration of buildings into the landscape reaches the territory as a whole, especially in areas with a more constructive dynamism. This need results in the presence, still incipient, of landscape integration in the housing and spatial planning legislation, and its inclusion in regional laws about landscape, as in Valencia, Cataluña or Galicia. In Andalusia, landscape integration is implicitly recorded in the housing legislation.

Nevertheless, despite these regulatory requirements, the concept of landscape integration does not have a precise and fully accepted formulation.

III. THE MEANING OF LANDSCAPE INTEGRATION.

The term commonly used for landscape integration indicates «*Making someone or something become part of a whole*». The subordination of one part to the whole entails understanding *integration* in the sense of *adaptation*. Landscape integration, so understood, constitutes an intervention strategy in the territory which aims at channelling the transformations of the landscape or correcting the ones which have been already carried out into adapting them to the landscape used as a reference. More precisely, it would consist of adjusting an object or territorial action to the physiognomic characteristics of a given landscape, or some of its components.

The overall objective of fitting human activities into the landscape can be achieved through various strategies of integration into the landscape:

1. Adaptation to the existing landscape. It consists of attaining the adaptation of the object to the physiognomic features of the landscape unit where it is inserted.
2. Adaptation to the existing landscape components. The adjustment or mimesis of the physiognomic qualities of one (or some) of the landscape components is intended.
3. Connexion to the existing landscape. This connexion can be understood as a stage prior to the full adaptation, establishing a dialogue between object and landscape.
4. Connexion to the components of the existing landscape.
5. Connexion to landscapes or landscape components of historical and heritage value.

The most common techniques used are mimesis or the object camouflage, its concealment, fragmentation or reduction in volumes.

The application of a landscape integration strategy constitutes a useful tool for various models of landscape management: protection of quality landscapes, improvement of valuable landscapes subject to a certain degree of alteration, recovery of degraded landscapes, and creation of landscapes.

IV. LANDSCAPE INTEGRATION APPLIED TO REMOTE RURAL BUILDINGS.

Landscape integration of human activities is not a particularly developed subject within the field of science. In studies of urban landscape, the integration into the landscape has been included only implicitly. As far as it is concerned, the integration of rural buildings into the landscape has focused on agricultural buildings (O'Farrell, 1987; Di Faccio, 1989; Mezquita, 2002) or greenhouses (Rogge, Nevens y Gulinck, 2008), and to a lesser extent on residential buildings (Tassinari, 2007). The heritage value of traditional rural buildings has also gained an increasing interest (Gakell y Tanner, 1998; Grazuleviciute, 2008). In Spain, the works of García Navarro (1997), Ayuga (2001), García Moruno (2003) and Hernández (2004) stand out, focusing particularly on agricultural buildings, as well as Mérida's y Lobón's (Mérida *et al.*, 2004, 2005), pointed towards rural buildings, being fully understood as a rural complex and being connected to the features of the landscape where they are located.

Remote rural buildings as the subject of landscape integration.

Remote rural buildings take part in the rural landscape at a different extent. The intensity of their presence depends on the nature of the type of dominant rural landscape and the proximity to radiating points from the construction activity, as well as the structure of the property of the land.

The landscape prominence of remote rural buildings derives primarily from its typological singularity. Due to their small size and scattered nature, their participation in the landscape does not materialize in the formation of types of landscape but their consideration is restricted to being a component of specific nature from the landscape they belong to. On a more detailed scale, these landscape components leave their specific nature behind and acquire a superficial nature, incorporating constructive ramifications, space elements and linear components. Thus, the remote rural building, being understood in its broadest sense, is constituted by a set of components among which the main construction is just one more component, though one of the most important. The set generates, at this scale, a microtype of landscape.

The impact of remote rural buildings on the landscape varies, depending on factors such as the peculiar sizes of the whole, their location and the type of construction used. In generic terms, there are two patterns in the relationship between architecture and landscape typology which can be distinguished. In the first of these, which is the most common, the rural building is a dominant element in the landscape, acquiring an important role. This is the case of farms, both organic with an economic role and those purely residential. The opposite pattern is formed by the buildings that blend in the existing landscape, giving up their role. This occurs in various typologies associated with forest and mountain environments.

Integration of remote rural buildings into the landscape.

The process of integrating rural buildings into the landscape entails a number of methodological steps: study of the existing landscape, characteristics of the traditional environment, definition of the criteria for landscape integration and evaluation of the degree of integration.

The knowledge of the scenic characteristics of the territory is necessary to determine the value of the landscape and to establish the layout of landscape management and landscape integration strategy to be adopted. Secondly, the study of the landscape will be useful to assess the presence and the importance of the environment as a component of each type of existing landscape in the area of study. It will also be helpful to know the existing relationships between traditional building types and landscape units where they are inserted. Fourthly, it will be essential to take as reference the construction environment in order to be able to establish landscape integration measures. On the other hand, the detailed analysis of a given landscape unit will be useful to determine the most appropriate locations for certain typological patterns, by means of the study of the conditions of vision. Finally, determining the nature of the landscape will be essential for the selection of items, marks or traces that allow their use as a reference for the integration of buildings, following the corresponding strategy for landscape integration.

As for the deep knowledge of the varieties of the traditional existing environment in the territory, it also represents a decisive stage for the establishment of landscape integration criteria, as some of the strategies for landscape integration which are likely to be used, can take the traditional environment as the landscape component of reference. On the one hand, this is explained because a traditional construction is automatically integrated into the landscape to which it belongs: traditional structures are rooted in the territory, due to their constant presence, at a human scale, in time. Furthermore, traditional buildings provide the landscape with intangible values such as the ones of identity character. On the other hand, the traditional environment still constitutes the principal modality of scattered environment over large rural areas, as it happens in large inland parts of Andalusia. Chronologically, traditional buildings have been considered to be those prior to the great transformations undergone in the Mediterranean countryside around the decades of the 50s and 60s last century.

In Andalusian rural areas, the existing models of traditional architecture are numerous. Some are very vast and are found in virtually all the areas studied, such as farms, both the more functional ones, of organic growth and irregular morphology, and the more formal ones, which are planned and regular in their design. Other traditional typologies have a more restricted location to certain regions and types of landscape: rectangular single-storey houses traditionally used by farmers in the North Mountain Range of Seville, mountain-houses in Aracena, large orchard-houses also in Aracena and in the area of the Guadalquivir valley, salt houses and tide mills on the Atlantic coast of Andalusia, typical houses from La Alpujarra, mills from Cabo de Gata area, stone buildings at the peaks of Sierra Nevada and Sierra de Baza, houses where farmers and herd stay in Doñana, and so on. Among these architectural types, buildings of administrative origin are also included (houses for road workers, mining villages, old railway stations) as well as more unusual types, such as mixed constructions (cave houses from the eastern betic high plains) or

primary buildings such as small huts, buildings made of vegetable materials on the Atlantic coast of Andalusia, or stone buildings in the area of the subbetic mountain range.

Landscape integration criteria

Common integration criteria which all constructions must carry out have been distinguished from the specific integration criteria applicable to the different types of architecture which new constructions follow. To this end, two important typological groups have been established: typologies adapted to some of the architectural models existing in the environment of the new construction, and typologies unconnected with traditional architecture.

Among the common landscape integration criteria, location stands out because of its importance. As a general rule, a construction integrates more easily into the landscape if it is located in a unit or type of landscape where the environment, regardless of its typological characterization, constitutes a notable component in its landscape.

The remaining common criteria have to do with different elements: land alterations, access and internal roads, parking esplanades, functional elements of the building, auxiliary facilities, signalling and signage elements, and infrastructures (exterior lighting, wiring, solar panels, fuel tanks, etc.). Finally, it is necessary to establish general criteria for the buildings layout, both with regard to the mechanisms of aggregation, in the case of detached buildings, and also to the distribution pattern, in the case of detached multiple buildings (e.g. bungalows).

Rural buildings must also fulfil some integration criteria of a specific nature which deals with the typological modalities used. First, it deals with the typologies adapted to the traditional architecture models existing in the territory. Specifically, the measures proposed consist, on the one hand, of the new construction adaptation of volume, composition and physiognomic features from its respective typological pattern in all the relevant landscape varieties, and both in the main building and, where appropriate, in auxiliary buildings: size, composition, holes, coatings, coverings, round outlines, vegetation, etc. On the other hand, a spatial criterion should also be followed, as is the location in the distinctive physiographic units of their typological model.

On the other hand, specific landscape integration criteria for constructions which are not adapted to the traditional architecture have been established. These criteria are more restrictive, and aim to achieve a reasonable degree of physiognomic adaptation of the construction to the existing landscape or to some of its close components (relief, rocky areas, vegetation, etc.). The suggested measures affect, for example, the location of the building, its volume, the treatment of facades and roofs or the use of visual displays. Regarding the location pattern, reduced visual basins and poor visual impact are the general parameters that an appropriate landscape integration of these constructions has to fulfil. The volume of the construction must be, in general, of limited dimensions and with a predominance of horizontality in its composition, especially on the roofs. The use of natural materials or appropriate colours in the treatment of facades produces better results from a landscape point of view.

The use of visual displays constitutes a palliative measure for landscape integration which can turn out to be very appropriate for typologies of difficult adaptation to the environment. In any case, the most effective visual display is the one provided by an appropriate location adapted to the topography.

The evaluation of landscape integration

The evaluation of the degree of integrating constructions into the landscape consists of two stages. The first one consists of assessing the degree of compliance of each of the criteria by establishing a numerical scale. The assigned values can vary from the measurement results, from previously established ranges, or from a qualitative estimate of the existing difference in the measure degree of compliance, on those variations which are not susceptible to mathematical treatment.

The evaluation proposal combines the reckoning of the degree of compliance for each of the landscape integration criteria with the exclusive ratings given for serious deficiencies of some of the variables used. By means of the first procedure, a sum of the points which have been reached is made in each of the criteria, setting a threshold which shows an acceptable level of integration; from this threshold on, the integration is considered positive, though it is susceptible to improvement in certain aspects. Through the second procedure, the cases which don't fulfil some of the criteria marked as most relevant are intended to be excluded, even if they fulfil the other criteria properly. In the case of buildings typological different from the traditional architecture, the evaluation of the integration criteria must estimate the final level of integration achieved through the implementation of the different integration criteria, individually or jointly. Therefore, even if it is advisable to ensure an acceptable level of compliance in each of them, it is technically possible to achieve a reasonable degree of landscape integration with the extensive use of only one criterion.

In any case, the best integration is achieved before the construction process. For this reason, one of the primary objectives of a policy of integration of remote buildings into the landscape in rural areas (and for landscape integration in general) consists of introducing the integration in the design stage, to make it a crucial component for its final design.

V. CONCLUSIONS AND PERSPECTIVES

Landscape integration constitutes a social and institutional demand more and more consolidated. This demand requires theoretical foundations and methodological developments in order to avoid its transformation into a set of isolated and inconsistent activities. In this sense, a set of theoretical contributions have been proposed in this piece of work. They can contribute, on the one hand, to the necessary conceptual basis for landscape integration, and, on the other hand, to go into the knowledge of its genesis and evolution in depth. Likewise, it also presents a methodological contribution applied in various research projects and specific pieces of work which have been carried out in the Andalusian territory. It is useful for the analysis of the integration of remote rural buildings into the landscape. Its methodological design, efficiently adapted, can be extrapolated to other human interventions in rural areas, such as infrastructures.

Landscape integration, particularly in the case of remote rural buildings, also means an outstanding tool for the value enhancement strategy of particular interventions on the territory. In this sense, the new functionality of rural areas requires new forms of intervention, and landscape integration emerges as one of them. The fact of developing it properly is a challenge for rural environment managers and society in general.

REDISCOVERING GOVERNANCE BEHIND RIGHT GOVERNMENT PRACTICES. DEMOCRACY AS BASIS, TERRITORIAL DEVELOPMENT AS RESULT

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I. INTRODUCTION

After authors' work on this topic along last years, one can verify how discourse on governance has been clearly adopted from academy, technicians, citizens and even —nominally— by decision makers. However, in practice, lack of political will and weak empowerment of civil society difficult right and coherent implementation of policies. Academicians feel we reach a limit in this issue. This paper argues this limit has to be broken because the inefficiency of current system; because things can be done in a different and more positive way, as compared analysis of experiences demonstrates; and because academy should follow offering interpretations and answers both, to the single mindset (or ideology) and pragmatism imposed by short term results that guides politics by now. For this objective, trying to stop the current 'way to the bottom', it is decisive restoring true democracy values and the citizens' voice and action. Together with public ethics, democratic values and public participation constitutes the basis for a new sustainable socio-economic territorial development. Citizens are not satisfied nor agree with a democracy too domesticated and heavily adjusted to the rules some specific groups control and manage for their own interests. Here the question is how to make things change in order not all continue being the same.

II. GOVERNANCE VERSUS REINFORCED GOVERNANCE: TAKING POSITION

1. State, Market and Civil Society Relationships

Reinforced governance, from a neo-institutional point of view that confers to the State preeminent role among Market and Civil Society, is not a common understanding on governance from other than non Spanish (and Mediterranean) perspective (e.g. Canadian Institute on Governance, 2003). In this case these three spheres are understood in a

symmetric and not hierarchical relationship. From this point of view citizens, as consumers, can influence on market asking enterprises for social, economic and environmental responsibilities (something we could name Corporative Territorial Responsibility -see Fig. 1.1 and 1.2). These relationships, however, are very different according each specific territorial context due historical, cultural, religious... reasons (Jessop, 2004; Sorensen & Torfing, 2009; Swyngedouw, 2005). Where civil society is not strong enough it is finally subordinated to interests of dominant groups, economic and public powers that act separately or in connivance (see Fig. 2.1 & 2.2). Then is not possible talk about full democracy in strict sense.

How to reverse this situation calls for citizenship empowerment. Governance and government more than antagonist are complementary if not consecutive; both are related in an increasing spiral (see Farinós, 2008: 14). However, nor right government nor governance ensure *per se* governability due some hegemonic actors will conserve advantages trying to keep them out the rule of law. This is just main field for civil society control, looking for general interest maintenance and common goods' custody.

Traditional statutory models and formula were not so efficient, but either de-regulation or free market. Feasible solution points in two directions: new focus, methods and routines to policies design and implementation; and control, monitoring and evaluation instruments. A third one promotes the two previous ones: convenient cultural and political culture development and maintenance. This last is a large long term goal for which imbrications and bridges between academy, technicians, policy makers and civil society will act as engines.

2. Reviewing Four Dimensions of Governance

According to ESPON Project 2.3.2, Territorial Governance dimensions are: vertical/multi-level (among diverse political-administrative levels), horizontal (including three components: cross-sectoral policies, territorial cooperation and partnerships among actors), participation and economic development. Until now, we have focused our work on the horizontal one (considering Spatial Planning as favorite field for application of territorial governance); on results of participation practices for territorial sustainable development; and on polity, multi-level relationships and (dis)coordination among public administrations. Right now we are interested in completing the fourth one. As some reports try to demonstrate (JRC-IPSC, 2010: iv, 33; WEF 2010: 4-9, 13) institutions and governments' efficacy, regulation quality, rule of law strength and control of corruption (from the public side), and corporative governance quality (from the private sector), represent fundamental pillars to improve regional economies potential. Without suitable politics, good policies are not possible; either without apt and strong enough political culture and citizenship.

III. SPAIN IN EUROPE: ANALOGIES, DEFICITS AND PATHOLOGIES

Along several years many European countries tried to develop new ways of territorial government and governance; also places and urban and regional scales became more relevant

(Carter & Pasquier, 2010; Henderson, 2010; Pike *et al.*, 2011). One can find some European good practices, more difficult at Spanish level. In this case, not so happy cases (Nieto, 2008: 31) are very much frequent than best practices (Pascual & Godàs, 2010).

1. Multi-level Territorial Government and Governance in Spain: Rhetoric and Reality

Despite profuse regulatory instruments and plans developed by Spanish political-administrative levels of government, governance practices are so far from European (EU, Council of Europe) recommendations and standards for good government, coherence, territorial cohesion and democratic governance. In polity terms, Spain represents a case of federal structure without a federal tradition nor culture (Moreno, 2008). Spanish de-centralization process deeply modified polity system; however that did not suppose better governance practices but more fragmentation of public policies and the institutional map. In addition, still remain old perspectives and procedures, un-coordinated, compartmented and too sectoral oriented. Tradition and inertias sometimes impose to reality. We present some examples.

2. Some Examples of Multi-level Territorial Governance Deficit between Spanish Government and Autonomous Regions

A) Integrated Coastal Zone Management: Real Estate bubble effects shows how difficult is to talk about a true ICZM strategy at Spanish level. Territorial actions from diverse administrations act in parallel, usually juxtaposed, with very different intensity and usually low effects; as impressive land development process and coast destruction clearly demonstrates (Ministerio de Medio Ambiente, 2007:13; Romero, 2009:127-141; Barragán, 2011a & 2001b; Farinós, 2011). Academicians have made an attempt to do all was in their hands, but politics frustrate more meaning progresses.

B) Water Basins Management: Public water management failure at Spanish level reflects incapacity to organize multiple and diverse public and private stakeholders involved, and synthesize much more territorial governance deficits. The result: failure of the last three hydrologic plans (since 1993) and not so clear expectations for current alternative (AQUA Program) because lack of consensus and political commitment among administrations and stakeholders. Without a general Spanish framework, Autonomous Regions tried to achieve exclusive competences instead inter-regional agreements. Spanish Constitutional Court (as in its Rule of 16-17th March 2011) should act in order to play the role that politics neglected, by solving conflicts instead develop political agreements and pacts. That tells about both governance and governability in this field.

C) Transport Infrastructures Planning: According to a rigorous economic, mobility and sustainable analysis and diagnostic is not possible at all support the current model, priorities and projects of transport infrastructures; it only could be explained because parliamentary majorities and interests (Albalade y Bel, 2011). Furthermore there is an evident discoordination among national and regional administrations, with the additional paradox that Spanish Ministry in charge of infrastructures has not any competence in Spatial Planning (is a exclusively regional one) but in fact decide main axis and corridors that vertebrate

territory. Surprisingly, this National Infrastructure Policy runs backwards or not coordinates with autonomous regions governments.

3. Territorial Government and Governance at Autonomous Regions Level

Spanish polity system offers Autonomous Regions great opportunities to develop coordination and cooperation principles at regional and sub-regional scale in order to improve territorial coherence of policies and lead -in a harmonic way- influence and territorial impact of those local policies (Romero, 2009: 148-213). Even though all regional governments -with very diverse ideological orientation- have adopted territorial governance rhetoric, notwithstanding only in few cases were produced significant advances on coherence and territorial development. Usually is difficult to go further on formalities because the lack of political will.

4. Government and Democratic Governance at Local Level

The local is the level for most important progresses on territorial cooperation both to face common challenges and threats and to develop strategic plans and projects (Romero y Farinós, 2005 & 2006; Junta de Andalucía, 2007; EU, 2007; VVAA, 2007; Brunet, 2011). Unfortunately, from an spatial/land use planning point of view, territorial fragmentation in municipalities without a clear defined common framework has been lethal for the biggest part of the Spanish territory. Urbanism practices reflect in many cases a situation of public policies 'capture' (Matsuda, 2007) and political corruption, that involves much more than politics (Iglesias, 2007; Jiménez y Villoria, 2008; Transparency International España, 2008).

A) Urban and Metropolitan Regions as Best Laboratory for Territorial Governance: Despite 'partenarial fatigue' and failures, there are so many examples of good territorial governance practices in European urban regions and metropolitan areas (Pinson, 2011). Similar comments can be made at Spanish level (Feria & Albertos, 2010); however good practices are punctual: *Bilbao Ría 2000* (Mas, 2011) and Barcelona Metropolitan Area Law (in July 2010). The reason is key factors for success underlined by Kübler & Heinelt (2005: 22-23) are not usually present in a combined way: civil society strength, functional legitimating of local governments, and open nature of networks of relevant political actors at different levels.

IV. A REVIEW TO EUROPEAN SITUATION

According to ESPON Project 2.3.2 (ESPON, 2007) advances at EU level in multi-level relationships are much more evident than policies coordination and coherence. Also partnership and territorial cooperation initiatives are well represented. History and tradition play an important role for openness and participation. However, from a dynamic point of view, evolution to new governance practices are clear and so much faster as big is the impact of European Structural Funds. Nevertheless advances are difficult when territorial actors'

relationships are conflictive, particularly regarding soil property rights (as in Mediterranean countries). In a synthetic way, one can conclude the following:

- There is not a single model of governance but several, depending on each institutional and cultural specific context.
- National, regional and local governments play still the main role, and so many preconditions and parameters for decision making depends on hierarchical relationships among them.
- Decision makers still are who mobilize territory.
- Participation, openness, effectiveness and accountability seem to be the most important elements for good territorial governance. Public participation is increasing its importance.
- Favorable pre-conditions for territorial governance are: experiences on (and attempts of) participatory processes and partnerships development, combined with decentralization and devolution processes (accompanied by correspondent budget allocation at local and regional levels).
- Coherence can be promoted through evidence based planning. Academics, technicians and experts voices could be more actively profited by.
- Main barriers for territorial cooperation, mainly in South European countries and New Member States, are related with technocracy, legislation complexity, administrative rigidity and persistence of authoritarian structures of government and bureaucratic procedures.
- In some cases one can speak about ‘deformed governance’ to refer to excessive power concentration at local level, or too preeminent presence of important groups of interest (stronger than local powers) at this level (Wassenhoven y Sapountzaki, 2010: 22-26).

V. CONCLUSIONS: THE ANSWER HAS TO COME FROM INSIDE

Even though State - Citizen relationships has been also incorporated into neo-liberal interpretation of governance, in this paper authors defend a renewed interpretation of neo-institutionalism with a re-interpretation of democracy and protagonist role of public powers. As we underlined in ESPON Project 2.3.2 territorial governance has to be ‘democratic governance’ and not only political economy responding particular interests.

Governance is a process very linked to particular conditions of each specific context. Good practices coming from other scales and contexts only can be used as reference, by analogies. In the Spanish case territorial democratic governance is not a clear or well defined issue. Academy has been working in right direction on this topic but is not the case of politicians nor decision and policy makers. They have incorporate rhetoric on governance to the political discourse, as sustainable development was, but practical effects are really scarce. Main difficulty is placed at political level, more even when territorial governance mainly bases on coordination and cooperation principles.

Situation in Spain is worst due weakness of social web that reinforce (as consequence as well as cause) weight of political parties and their capacity for institutional control. As

result, they fight against any new emerging citizen movement, as it was the case of recent '15 of May' one coincident with local and regional elections in Spain in 2011. Promoting cooperation from 'top-down', as in the case of France, could offer good results; but also it is necessary a complementary 'bottom-up' approach from local level, cities and urban regions. For that, local governments need ensure financial sufficiency as well as brightness about powers and competences. In the Spanish case this is a key issue to territorial policies.

In addition to coordination and cooperation, territorial governance requires empowered civil society. However it is being difficult promote openness and participatory processes in a right and useful way. Democratic innovations as such have to face some resistances. Sometimes progresses are much more limited and contradictories than expected (Echebarría *et al.*, 2007; Kübler; Faure *et al.* 2010, Brunet, 2011; Farinós & Sánchez, 2011). Also common are risks of 'fatigue', 'window effect', tactics instrumentation, conflicts among local actors, and avoiding representative democracy without clear understanding about limits and possibilities of participative democracy (Subra, 2007).

Nonetheless it is worth to go forward and try to promote socio-institutional and territorial innovations at this time when new attitudes and proposals are emerging and claim for a renewed way to understand and play democracy and territorial government. Academicians, technicians, mass media and citizens' movements show how society is changing; also its values and priorities. It is an expression of increasing process of empowerment and of social, cultural and political re-composition (Alfama *et al.* 2007; Cruz, 2010). Politics right now has the greatest responsibility to lead straight to a democracy of quality (as illustrated in Fig. 1.2).

For achieve this goal top-down and bottom-up strategies have to be combined. From a top-down perspective political will and leadership are essential in order to facilitate and promote new practices. There is a large pending agenda for the three levels of public administration, mainly for regional and local governments: transparency, accountability, openness and rights of information, and improvement of financing. From a bottom-up perspective by creating new participation and democratic innovation opportunities, specially at local level.

Opposite to ambiguous or neo-liberal interpretations of governance —also legitimate— in this paper we claim for more and better politics, more democracy, more public ethic and defense of general interest, and a greater prominence of public sphere in the process of construction of a decent society in which could cohabitate, as a sign of maturity, Civil Society, State and Market. At last, in front of de-regulatory trends, of minimum State and market prominence, we advocate for more democracy, more civil society and any better State.

MUNICIPAL WASTE IN CATALONIA (SPAIN): GENERATION AND RECYCLING RATES AS SUSTAINABILITY INDICATORS

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I. INTRODUCTION

Economic development of society is supported by a range of economic activities using a large amount of natural resources. These resources have been exploited throughout human history according to the available technology. Unfortunately, most of them are non-renewable resources because the generation rates are lower than the current extraction rates. One of the main features of the economically developed countries, as a consequence of using natural resources, is the production and consumption of a large number of products to satisfy their needs. Most of these products have a short life cycle and they could become a waste. Nevertheless, the total waste amount is also composed by the waste that is generated during the extraction and processing of raw materials. All human activities, including biological ones, generate residual products and some of them can be harmful to human health, animal and plant life and to the environment. Waste generation or what to do with the generated waste is an important issue at present because if there is no doubt that each territory has a limited capacity to receive socioeconomic activities (physical support) and transport and communication infrastructures, it seems evident that there is an also limited capacity to assume increasing amount of generated waste. For this reason, it is necessary to carry out a good waste management as well as policies to reduce total amount. Otherwise, it can become a serious environmental problem.

There is a wide typology of residual products with a different behaviour related to environmental agents, potential evolution over time and impacts on environment and human health. According to toxicity and hazard, waste is classified in three main groups: inert, special and non-special. In 2002, the European Waste Inventory (EWI) came into force and 20 categories were established, indicating required management: recovery, treatment and/or refuse disposal. Last category in the EWI (number 20) corresponds to the municipal waste, which includes waste originated from households and also the waste from commerce,

services and institutions. Municipal waste has grown dramatically in recent decades around the world, including in Spain, according to the 2009 Annual Report of Sustainability in Spain developed by the *Observatorio de la Sostenibilidad en España*. In 1990 around 12.5 million tonnes were generated while in 2007 the value exceeds 24.5 million tonnes. Distribution among Spanish population shows an increase in the amount per inhabitant from 323 kg/year in 1990 to 556 kg/year in 2007 (above EU-27 average). Municipal waste management has both environmental and economic costs. Nevertheless, they are more important if waste management is conducted to refuse disposal, either land filled or incinerated, than recycling. Most of municipal generated waste must be recycled but equally or more important than recycling is the reusing and the reducing of waste generation. The so-called triple R.

Taking as starting point the above information, the aim of this work is, first of all, to analyze the evolution of municipal waste generation and the recycling rates in Catalonia (Spain) and in its 41 counties and secondly, to establish the Catalan sustainability level by means of an indicator that combines the two mentioned variables (amount per inhabitant and recycling rate). The study period is 2000 and 2009 years.

II. SOURCES AND METHODOLOGY

Data have been obtained by means of two governmental institutions. Municipal waste data are available at the *Agència de Residus de Catalunya (ARC)* website, meanwhile population data are available at the *Institut d'Estadística de Catalunya (IDESCAT)* website. The *ARC* provides municipal waste data once a year on 31st of December. At present, household and commerce collection is not taken into account separately at the most of Catalan municipalities. For this reason and in order to achieve comparable results, we have used the data of total municipal waste, which are expressed in tonnes per year. Municipal waste is distributed among those which are collected separately (glass, paper, cardboard, plastic, organic matter, etc.) and those which are allocated to refuse disposal. Even that municipal waste generation per inhabitant/day is also supplied by the *ARC*, these data have not been used because municipal waste refers to 31st of December and population data to 1st of January. A new ratio has been calculated using as quotient the average between two consecutive years. The Population data of Catalonia and the 41 counties have been obtained through *IDESCAT* and they correspond to the sum of population of various municipalities. As it has been indicated previously, since 1996 population data correspond to the 1st of January. So if 2000 and 2009 are the analyzed years, the population collected data is from 2000, 2001, 2009 and 2010. Municipal waste generated during the whole 2000 (2009) has been imputed to the population average between 2000 and 2001 (2009 and 2010), both cases dated on 1st of January. Although we agree that it is not the optimal solution, especially when calculating a value (kg/inhabitant/day) based only on the registered population, it is a better approach than the *ARC* one. Results are shown using numerical representations (tables), as well as cartographic figures in order to compare between 2000 and 2009 years. The analyzed aspects are:

- a) Population and municipal generated waste trends.
- b) Ratio per inhabitant and day.

- c) Recycling rates.
- d) Organic waste collection.
- e) Regional sustainability level.

The sustainability level has been calculated by means of an indicator that combines total municipal waste generation per inhabitant and recycling rate. Five sustainability thresholds have been defined both for generation and recycling rate: very high, high, moderate, low and very low sustainability. At the same time, these labels have been associated with a numeric value (see Table 1 in the Spanish version). The overall sustainability has been obtained from the sum of the values of the two variables. Nevertheless, generated waste per inhabitant has more weight (1.5) than the recycling rate. Although there is no doubt that the increasing recycling rates are very important, even more important is to reduce the total generation. There are 25 possible combinations, each of them associated with very high, high, moderate, low and very low sustainability (see Table 2 in the Spanish version).

III. RESULTS

In 2000 the municipal waste generated in Catalonia was almost 3.5 million tonnes while in 2009, it was 4.2 million. That means 20.8% higher. However and for the first time in the last decades, waste generation amount in 2009 has been lower than previous year, when it exceeded 4.2 million tonnes. Nevertheless, important differences exist at regional level. Increasing rates are not equal around the 41 Catalan counties. There are relevant differences and whereas in some cases the increase has been lower than 15% (inland rural counties) in other cases the change has been up to 50% (*Conca de Barberà, Priorat* and *Ribera d'Ebre*).

It seems logical that municipal waste generation increase is due to another increase: population. Catalan population in 2009 is 18.7% higher than 9 years before, although rates have not been uniform across the territory. Population growth largely explains waste increases, but not totally, especially at the county level. The main reason is the coming of visitors, temporal residents and tourists. They all generate municipal waste that actually is imputed to resident people. At the same time economical variables have to be taken in consideration.

Municipal waste generation per inhabitant in Catalonia has risen from 1.51 kg/day in 2000 to 1.53 kg/day in 2009. Increase has been lower than 5% and it must be noted again the improvement in comparison with 2007 (1.64 kg/inhabitant/day). The Catalan Municipal Waste Management Program (*PROGREMIC*) target for 2012 is 1.48 kg/inhabitant/day. According to previously defined thresholds, 2000 and 2009 values are considered low sustainability (>1.50 kg/inhabitant/day). Nevertheless 22 of 41 Catalan counties achieve *PROGREMIC* target. The best rate corresponds to *Terra Alta* county (1.02 kg/inhabitant/day), and other 6 counties that have high sustainability level (<1.25 kg/inhabitant/day). On the other hand, sustainability in 19 counties is low or very low. In some cases, rate is higher than 2 kg/inhabitant/day: *Alt Empordà, Baix Empordà, Baix Penedès, Selva* and *Val d'Aran*.

People of these counties generate more waste than *Terra Alta* ones actually? Maybe they do, but are the differences shown real? Absolutely not, because total municipal waste

generated at *Baix Penedès* county computes to only 100.000 resident people while waste has been generated by a much larger population (tourists included). Comparing 2000 and 2009 values, opposite features are shown but the best and the worst counties in terms of waste generation per inhabitant are, practically, the same.

Recycling rate has improved significantly, almost twice, in the last years in Catalonia from a very poor 17.7% in 2000 to 37.5% in 2009. However, improving can be more significant according to potential recycling rate estimated in 80% of total municipal generated waste. Low values are due to recent past of selected municipal waste collection in Catalonia and also in the whole Spain, especially referring to the organic fraction. In terms of sustainability, recycling rate is considered very low (<20%) in 2000 and moderate (>35%) in 2009. At regional level, only 2 of the 41 Catalan counties recycled more than 20% in 2000 (*Alt Urgell* and *Garraf*), meanwhile the worst value was in *Baix Penedès* with only 1.9%. Despite recycling rates lower than 20% are maintained at 2 counties in 2009 (very low sustainability), in other 6 are higher than 50% (high sustainability). The best value corresponds to *Ribera d'Ebre* county with 556.9%, curiously the county with the highest municipal waste generation increase.

There is not doubt that organic fraction collection must play an important role in order to increase recycling rate. The *Agència de Residus de Catalunya (ARC)* estimates that organic fraction weight represents approximately one third of municipal generated waste, but this value may vary significantly taking into account social, cultural and economic aspects. Organic fraction collection in Catalonia began in 1996. Almost 30,000 tonnes were collected in 2000 (<1% of total municipal waste). This small value can be easily explained: organic recycling was available in only 71 of the 946 Catalan municipalities. Nevertheless, despite the amount collected in 2009 was 340,000 tonnes (and 574 municipalities), it only represents 8.1% of the total municipal generated waste.

Is the municipal waste generation increasing because of the glass, plastic o cardboard packaging? Is it increasing because life cycle of many products is short? Generation per inhabitant has increased, but are results biased by the presence of non-resident people? We can assume than in all the cases the answer is YES.

At this point, sustainability of the whole Catalonia and its 41 counties is assessed. It has been carried out by means of an indicator where municipal generated waste per inhabitant and recycling rate are combined according to the previously explained methodology. The results show a very low sustainability level (3.75) for Catalonia in 2000, as a consequence of the low sustainability level in waste generation (1.51 kg/inhabitant/day) and a very low sustainability level in recycling rate (17.7%). Municipal waste generation per inhabitant is 1.53 kg/day in 2009, but it is within the range of low sustainability (>1.50 and ≤1.75) and at the same time recycling rate has increased significantly until 37.5% (moderate sustainability). Although since year 2000 general sustainability level has improved (8.75 in 2009), it is already qualified as low.

There are important differences at regional level. Only four counties (*Gironès*, *Pla d'Urgell*, *Segarra* and *Terra Alta*) have a high sustainability level; but meanwhile in 2000 only 9 of them had a moderate sustainability level, 9 years later there are 20. On the opposite side, 15 counties had a very low sustainability level in 2000 and there are 8 in 2009.

IV. CONCLUSIONS

The analysis of the municipal waste generation in Catalonia between 2000 and 2009 shows a significant increase. Catalonia's population has also increased, although less than waste. Consequently, that means there had been an increase in generation per inhabitant in the last 9 years from 1.51 to 1.53 kg/day. However, the 2009 result has been better than the 2008 one. Target established by the *Agència de Residus de Catalunya* for 2012 is the reduction of the value to 1.48 kg/inhabitant/day.

Recycling rate has improved significantly during the last years (17.7 % - 37.5%), despite it is not a high value yet. Diminishing municipal waste sent to final disposal (landfilled or incinerated) is very positive in terms of economic and environmental aspects. There is no doubt that recycling rates would be higher when organic fraction will be collected at all Catalan municipalities.

Catalonia shows considerable differences at regional level (counties). Population and municipal waste generation increase has not been uniform, being more important in the coastal zone and in the regions where tourism activity has a significant weight in the economy. The highest ratios of waste generation (> 1.75 kg/inhabitant/day) are found in the most tourist counties placed on the coast and in the Pyrenees Mountains. On the other hand, the lowest values are in the westernmost region (rural area) of Catalonia. There are important differences in recycling rates: in some counties value is under 20% meanwhile in six are over 50%.

The sustainability level in Catalonia assessed by means of an indicator combining municipal waste generation per inhabitant and recycling rates in 2009 is moderate but it was very low in 2000. Results would be better if recycling rates will be improved (easy) and municipal generated waste per inhabitant (more difficult) will be reduced. The characteristic of indicator makes possible to update results and evaluate the Catalan and other regions sustainability level.

Finally, some questions have not been answered. The main one is related to calculation of municipal waste generation per inhabitant. At present, only the resident population is taken into account but there are some regions where an important portion of municipal waste generated by tourists and visitors. For this reason, it is required to work with data on a monthly basis, distributed by municipalities and, to have seasonal population data, which is more difficult but essential.

V. ACKNOWLEDGMENTS

The author acknowledges the support of the *Ministerio de Ciencia y Innovación* of the Spanish Government funding the project *Innovación territorial y modelos de desarrollo en destinos turísticos litorales. Análisis a diferentes escalas temporales (INNOVATUR, CSO2008-01699)*. This work has also received support from the DOW/URV Chair of Sustainable Development. Finally, the author acknowledges at two anonymous reviewers for their comments in order to improve the paper.

TREND OF THE RAINFALLS AND TEMPERATURES IN A SMALL FLUVIAL BASIN OF PENINSULAR SEMIARID SOUTH-EAST

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I. INTRODUCTION AND JUSTIFICATION

The global change is understood as the interrelationship of changes induced by the natural processes and by the human action in the global environment, and their implications in the operation of natural ecosystems, and in society. This complex process includes many factors heavily interrelated which highlights the alterations in the climate, presently known as climate change. The changes in climate seems to affect, so important, ecosystems and in particular to the semi-arid systems mediterranean with a accentuation of water stress and increase the aridity. By this and other reasons the need to know and deepen the climate variability in escenarios vulnerable and uncertainty as are the river basins mediterranean and in particular the Southeast Spain.

New environmental and social challenges, and others related to the management of the territory and resources, arise due to the environmental deterioration prompted by the man and the real threats of climate change, which according to experts will have different consequences in each climatic zone. Climate change is a matter of a passionate scientific debate and poses a sharp uncertainty about weather, zones and its magnitude. However, there is an important consensus in its veracity and in the consequences that will increasingly become apparent in ecosystems and economic systems

II. OBJECTIVE

This work aims to contribute to the knowledge of the climate variability, in the framework of global change, in a small river basin in the semi-arid Southeast of the Iberian Peninsula, the river Quípar one, through the study of the evolution of the precipitation and temperature, analysing the possible patterns of change and, in turn, conclude the most direct impact that the climatic variation can have on the population and its activities.

III. AREA OF STUDY

The field of study is the River Quípar basin, located in the North-West of the Region of Murcia, in the Spanish Southeast, where the climatic aridity is one of the main defining characteristics. The total area of the basin is 826.4 Km². Its altitude ranges between 200 and 1,900 m, though, 50 % of its surface is above the 800 m. The basin of this river is an anthropized space, where the agricultural techniques and traditional uses of the territory are of great importance, emphasizing dry-farm crops and the limited irrigated land in fluvial terraces

The climate, its geology, its geomorphology and the soils determine the biophysical particularities of the territory. Aridity is the main climatic trait, the geology is dominated by the characteristics of the morpho-structures of the Betic Ranges and geomorphology manifests itself in some processes of erosion and accumulation that have caused a set of specific geoforms (karst, talus, alluvial fans, glacis, gullies, fluvial terraces, etc.)

The climate of the area under study is identified as humid temperate with dry summers, also known as Mediterranean climate. Nevertheless, it is necessary to clarify that in the north and northwest area of the basin, where there are territories of higher altitude, the Mediterranean influence is attenuated, and the relief determines the decrease in temperatures and an increase in rainfalls. In these mountain scenarios, the dominant winds from the West generate a certain föhn effect evident in the fact that the slopes orientated towards the Western part receive more rainfalls than those placed in the Eastern part. The importance and orientation of the relief shows itself as one of the most important factors that determine the climatic characteristics in the basin.

The rainfalls in the area under study tend to be scarce and quite irregular in time. The total number of the hydrological year often records rainfall averages between 300 - 400 mm, with two maximums of rain, spring and autumn, more accentuated the second one because of the phenomena of DANA (isolated depression at high levels in the atmosphere).

The annual average temperature is around the 16 °C, with a thermal swing of about 12 °C, which impregnates the climate with a certain continental character. The winters are relatively cold, with an average temperature of 9 °C. The spring has a soft character, with a few average values of temperature of 17 °C. The summers range between moderate and warm with a temperature around 23 °C. Finally, autumn is fresh with a few values of 12 °C.

IV. METHODOLOGY

The climate characterization of the basin is done through four weather observatories distributed through the territory. The methodology is based on the treatment of the data of the climatic series coming from the state agency of meteorology (aemet). The available series present gaps in data in some variables and temporary moments. In order to solve this error, known univariate and multivariate methods are applied. The former has been used when the lack of data was produced at a time with values in other stations, while the univariate methods have been applied when the gap did not have this type of correlation.

it has been used the univariate method «approach of the differences», which consists of replacing the lack of a monthly record with the value of the previous month, adding the average value of the differences between the previous month, and the month in question. This method is expected to be valid for series which have a high autocorrelation, so that it is not very appropriate for the precipitation variable.

The multivariate method is the «Weighted Linear Combination» (CLP). It consists of replacing the lack of data with data of neighboring series, in such a way, that each incomplete piece of information is obtained by means of the weighted linear combination of data of the series that will be used for the completion. Such data have, a burden in the CLP which is proportional to the coefficient of correlation of Pearson with the incomplete series, provided that this is higher than an acceptable critical value.

Once the complete climatic series is obtained, an analysis is carried out based in the interpretation of the trends followed by the precipitation and temperature. Due to the marked seasonal nature of the climate in the basin, the implications of the changes and trends will be different depending on the season. So, a seasonal analysis is made related to the changes in climatic variables. This analysis is based on the observation of the variations in the seasonal concentration of precipitation and temperature as well as on the analysis of trends of precipitation and temperature through its calculation by means of a linear regression. But given the wide dispersion of data that the variables studied show, the linear regression presents a very low goodness of fit, so that it may be valid to give a general idea of the tendency of the data, but not to illustrate periods or specific cycles. This type of information is offered by the polynomial regressions, which show a high correlation with the reality and which make possible to observe different moments or trends over the series.

On the other hand, an assessment of the variability in the course of the period under study has been made, calculating the coefficient of variation on moving 10-year averages, accumulating the values annually. In addition, it is established a classification of the seasons of the year on the basis of the direction and magnitude of the termopluiometric anomalies.

In the analysis of the data of each observatory, all operations are carried out both for the annual average, as for each time of year. In addition, with the complete series of rainfall available, IT is attributed to each monthly data the percentage value on the annual total, and so with all the years, for the final establish an average, the percentage weight that each month has on the annual value. Finally, it is estimated that average for the last 25 years, in this way, it is possible to appreciate if I know this changing the regime of rainfall.

V. RESULTS, AND DISCUSSION

1. Annual values of precipitation and temperature

The evolution of the annual rainfall in the basin, follows a slightly declining trend, but with some differences. Although these differences reflect the extent of the period of data and its weight, they have the various wet or dry periods in the linear regression. In any case, the extent of the series of rainfall in the observatory of Alfonso XIII seems adequately to describe the rainfall pattern, which keeps on registering wet and dry periods not as sharp as before 1950.

The annual temperatures present a slight tendency to increase, being very frequent the values higher than the average in the last two decades. However, in the last five years annual values of temperature below the average are detected.

With regard to the moving average, there are cycles of 20 years in precipitation, evident in all seasons. In the case of the temperatures, the less availability of data makes difficult a similar reading, nevertheless, it is also noted a certain bidecadal periodicity. So, there is a great correspondence between humid and fresh periods and dry and hot periods, especially since 1960, which makes droughts and affections in natural and human systems much more severed.

A special attention must be paid to the analysis of the evolution of the moving bidecadas averages. They show that the temperature record a marked increase over the whole period, and this rise presents significant cycles. On the other hand, rainfall seem to be more stable. In this way, there seems to be some stability in the rainfall pattern, with the exception of wet and dry cycles at the beginning and half of the period respectively. For that reason it cannot be stated that there is clear increase or decrease in the annual rainfall. Nevertheless, the linear trend shows an average downward bias of more than 30 mm total accumulated.

2. Values and seasonal trends of precipitation and temperature

The annual average hinder the study of the relationship between rainfall and temperature, and the perception of the implications which the changes in the main climatic variables have on the ecosystems and the population. That is why there is a need in carrying out a seasonal study.

To star with, in winter there is no significant trend in its development, although the winters in recent decades are considerably warmer. The winter rains show some increase so that its weight in the total annual has increased.

Spring shows the same pattern than winters, being quite significant a slight reduction in precipitation.

In summer, temperatures are stable but with an upward bias. The most remarkable issue is the sharp downward trend in the rainfall, which poses a significant decline in the summer rains, with the consequent impact associated with it.

Autumn seems to be the most stable season of all, both in terms of the rainfall or temperatures, since both variables appear apparently stable over the time. However, this stability or slight increase means that in a widespread context of decline of rainfall, autumn increases its importance as the rainiest season.

3. Variability and seasonality of thermal and rainfall anomalies

There seems to be a decline of the variability in temperatures, so that, in the last ten years more than 40 percent of the seasons are considered as very close to the average, which is higher than any other previous decade. There is no clear evidence of an increase of frequency of hot or cold seasons, but it is noteworthy the fact that the linear annual trend shows (very cold, cold, normal, warm and very warm), a slight increase towards warmer values, especially in winter, in accordance with the rest of the analysis carried out.

Regarding the precipitation, there is no clear sign of a tendency towards a greater or lesser humidity, although it is true that the trend here also coincides with the other analysis, appearing a clear bias towards the increase in dry or very dry years. These values coincide with the expected seasonal pattern, more regular and humid winters and autumns and irregular and dry summers, characterized by a strong humid tension, marked low water levels and some intermittent storms.

4. Evolution of the pluviometric seasonal variability

The analysis of the seasonal variability is essential for the study of the water availability and to predict risks associated with the recurrence of periods of drought and intensity of torrential rains. In this regard, it is apparent that contrary to some predictions and studies about the Spanish Mediterranean domain, in the river Quípar is taking place a clear reduction of the variability of rainfall on moving 10-year averages. Seasonally, the greatest reduction takes place in summer, followed by spring and winter; on the contrary this variability increases in Autumn. In this way, in outline it seems that rainfall are more stable in the basin, presenting annual values which are closer to the average, falling in this way the aggressiveness of major droughts and also of the torrential episodes.

The greater autumnal variability is even more significant than the trends in the rest of stations, as it is the rainiest season, with more than one third of the total of rainfall. So, this increase in the variability could well be due to a more irregular interannual pattern in the episodes of DANA, with a greater activity of these.

This decrease of variability on moving averages is likely to lead to a reduction in water availability in Quípar River Basin, verified on the other hand taking into account the 1980s, a period in which there is a marked reduction in the flows of the major rivers and springs in the Segura Basin. It is also important to note that it is precisely from this period on, when a more evident decrease of variability starts.

5. Changes in the precipitation and temperature regime

In the last 25 years there has been a percentage decrease of rainfall in the summer months, during which the highest temperatures and the water tension become more pronounced. The rainfall increase in the months of February, May and September but they decrease in April.

In line with this, temperatures, in the same period of time, show stability or rise in every month compared to the average values, highlighting that this rise is greater in the central months of the year, especially in summer. In the basin studied, it is confirmed the fact known in the Mediterranean area related to the existence of an inverse relationship between the rainfall and temperature.

VI. CONCLUSIONS

The previous results involve some implications, both for the natural environment as for the social environment. On the one hand, it cannot be found a clear variation in temperature and precipitation in the territory related to the total values, although it can be

seen a significant downward trend in the summer precipitation, followed by a slight rise in temperatures, as well as a change in the seasonal regime of these variables, in addition to a significant reduction in the variability on moving 10-year averages. It should be added that, all the analysis about trends show that the temperatures are experiencing an upward trend whereas precipitation are downward.

These changes become evident by analysing the seasonal pattern of climate which proves that there is a marked reduction of rainfall at the end of spring and early summer, and a moderate rise in temperatures. These phenomena are verified by other studies and areas of the Spanish interior and by climatic models where the greater reduction is expected in Spring.

On the other hand, in the rainfall pattern and temperatures in the Quípar Basin, it can be observed that when warm periods occur, the precipitation decrease and during colder periods rainfall increase, which causes more severe droughts. In addition, the decline in the variability coefficient, especially pronounced in summer, expresses a less severity in droughts or in torrential rain.

This climate pattern has a series of implications, such as the alteration in the hydrological cycle, changes in land use, impact on the dry farming, rise in demands for water for irrigated agriculture and supply to populations, etc. For water resources, the first impact is a reduction of the flows of rivers and springs, of the contribution of the course of water, of a lesser availability of stagnant water and therefore a widespread decline in the availability of water. Before the likelihood that the precipitation decrease significantly and the temperatures rise, as it is showed, among others, in the IPCC reports (2008) and the AEMET (2010), both the uses of the soil as the population should get adapted to the new climate scenarios that will be emerging in the coming decades. In short, the recent changes in the regime of precipitation and temperatures in the Basin of the River Quípar, pose new challenges of adaptation of the natural and socio-economic systems to new conditions, in the framework of global change.

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GEOMORPHOLOGICAL CLASSIFICATION OF FLUVIAL SYSTEMS FROM G.I.S. TOOLS

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This paper gathers a valid method for the geomorphological classification of fluvial systems, as well as its development with Geographic Information Systems (G.I.S.). The characterization and reach-making of the fluvial network is based on valley geomorphology, streambed slope and channel geomorphology. A process of simplification is necessary to achieve an applicable classification, which is explained with an example (Cabe river, Lugo, Spain). 14 hydromorphological types have been differentiated. There is a clear dominance of alluvial sinuous channels in valleys of moderate confinement and wide valley-floor. The incorporation of G.I.T. (Geographic Information Technologies) tools in fluvial geomorphology has marked a substantial change in the analysis of processes and classifications, as far as its versatility and its possibilities obtaining precise and fast information. Likewise, in the last years the geomorphology begins to settle as the central point of many projects about restoration and comprehension of the natural dynamics of fluvial systems, the reason why is basic to establish guidelines and methodologies that help in this task.

I. INTRODUCTION

Rivers have been traditionally classified and managed based on hydrologic and biological features, leaving channels to background, as much as both its genesis and its dynamics or repercussions as a maintain of the biological components. However, in the last decades the importance of geomorphology as the basis to understand and value natural environments has increased.

The remarkable increment during the past few years of the Geographic Information System (G.I.S.) as an analysis technique has yielded in a new approach and a new methodologic frame in praxis of environmental sciences. Thus, this paper approaches the characterization

of fluvial geomorphology using the calculation power of these tools - sometimes assisted by specific softwares - in order to identify quickly and easily the internally and functionally homogeneous fluvial sections by three geomorphological variables: valley geomorphology, streambed slope and channel geomorphology.

II. METHODOLOGY

The set out methodology constitutes an open protocol of action in which the own investigator settles down the most suitable descriptors for that concrete territory based on other studies and experiences. In the present work it has been carried out a test in the Lucense river basin of the Cabe river (733 km²) on the stream with more than 20 km in length.

The standardization exercise of the network consists of establishing internally and homogeneous hydrogeomorphological sections but different from each other using the previous sectioning work developed from the three geomorphological variables mentioned above. In turn, these variables have been decomposed in six fundamental descriptors and each one of them were also divided in many subtypes.

III. RIVER NETWORK CHARACTERIZATION AND CHANNEL REACHES

3.1. Valley geomorphology

There are three great approaches set out to classify valleys: topographic, physiographic and genetic. Altogether, consist in different and independent ways to proceed, however they are not excluding and integrated one with the other.

Quantitative criterion of topographic perspective is the one that best characterizes valleys, once it makes possible to obtain ecological and geomorphological functional types. Also, entrenchment and the bottom extent of the valley are both extremely important factors for classification by the intense interaction they maintain with the channel.

From the G.I.S. scope, cross-sectional sections were calculated as well as certain parameters of interest using MorfoPerfil-T (*Cartografía GeoAmbiental y Teledetección (CGAT)*, Departamento de Ingeniería Cartográfica, Geodesia y Fotogrametría de la Universidad Politécnica de Valencia © (<http://cgat.webs.upv.es>).

3.2. Channel slope

The slope variable can be classified in different categories in order to attend the type of information that is needed. We denominated longitudinal slope the one that corresponds to this variation throughout the channel in homogeneous sections, being the one of greatest adaptability for geomorphological characterization of fluvial systems.

The slope's channel development was done using G.I.S. with the support of the extension of spatial ecology Hawth's Analysis Tools ® (Dpto. of Biological Sciences of the University of Alberta, Canada).

3.3. Channel geomorphology

The riverbed is the element of most relevance in fluvial hydromorphology works. Study and definition of geomorphological types of channels from the T.I.G. counts on interesting cabinet methodologies with important advantages, once they allow to obtain a plant vision of the channel or determine a global analysis, which not only includes the actual channel but also the environment in which it passes through. This really triggers in a rapid and very effective fluvial classification from a different perspective from the one obtained in field.

Among the mappable elements, sinuosity is one of the most important parameters. Although, it does not depend so much on the photo-interpretation but further on the type of used method.

IV. RESULTS

The methodologic application gives as result a differentiation of 14 hydrogeomorphological classes. It is also observed a clear dominion of winding alluvial channels in moderated entrenchment valleys with a large bottom width. Sinuosity index has similar values in both entrenchment sectors (in many cases derived from sobreimposition processes) and in areas of greater fluvial mobility.

Resulting typology of channels was reduced to two main types: alluvial river and bedrock river. Also, the entire network was considered as an unique channel because of the unrepresentative nature of the other variants.

The exercise of correlation between the dependent variable sinuosity and the independent slope shows low and negative values, except for Cinsa river ($r=0,062$). The low explanatory load of the slope has led not to consider establishing classes in this river basin.

V. CONCLUSIONS

- The idea of an action protocol instead of a closed and predefined classification supposes to be the investigator —a true knower of the study zone— who determines the suitable parameters for the hydrogeomorphological characterization.
- This type of classification is of extreme interest to understanding of natural systems, as well as of its operation and its value, besides a new instrument to be considered in the plans of territorial management with a remarkable benefit for natural means and the society.
- Slope has not been shown as an explanatory factor of sinuosity nor therefore discriminating factor of the dynamic environments of differentiated processes. Nevertheless, the intensity of this bond is variable according to the number of factors that interact at certain point of the fluvial system, in such a way that the slope itself also can indicate the channel geomorphology in other contexts.
- The transition from one typology to another occurs gradually. However, each sector is quite distinguishable from its surroundings, especially from the channel where the

bedrock rivers are perfectly recognizable. Changes from one valley peculiarity to another is more diffuse and in many cases it is necessary to use quantitative criteria to establish limits. Though, in these zones of typological contact it was not verified a noticeable combination of fluvial styles that could suppose to establish types of transition. A special case that is also present in the study area is the altered channels or sections affected by an impact, which is interpreted as a total or partial loss of the natural geomorphological behaviour.