

GIS APPLICATION IN THE ELLABORATION OF THE SUBSIDIARY PLANNING REGULATIONS OF A RURAL DISTRICT

Arturo Colina Vuelta and Pilar García Manteca
INDUROT - University of Oviedo
E - 33004 - Oviedo - Asturias

Abstract

The purpose is to specify a methodology in order to facilitate the performance of the urban regulations in rural districts.

The investigation is based on the data collection about different topics, both regarding the physical environment as well as the human factors which influence on it, and an analysis method of the subject matter information is developed, using a SIG as working tool.

The result is a map divided into areas in a rural district in the North of Spain.

1. Introduction

Territory organization is the discipline which tries to obtain the best distribution of the economic activities in an area. Therefore, it tries to coordinate measures for a specific and a general sector in order to achieve the balanced development of the territory over which it exerts its influence, materializing both the economic as well as the social aims of the people, and assigning the proper uses to the typical potentialities and characteristics of each of the different spaces which are part of it and share it. This general purpose makes it be one of the subjects in which the concept of interdisciplinary has a complete meaning. Within the scheme made up by the different organization pieces which comprise the Spanish territory planning system, one of the basic instruments the Spanish legislation has are the General Plans and the Subsidiary Planning Regulations with a municipal scope of application, understood as integral organization patterns where the models of ground usage are established, and with it, the future development for the part of space where they exert their influence.

The practice of territory organization needs, as previous measure, the most accurate possible knowledge of the space reality over which action will be performed. Therefore, data have been collected about different subjects, both regarding the physical environment as well as human factors acting over it, which in a further stage, will constitute the basis over which the organization decisions will be based. The diversity of subjects and the need of establishing space relations between the different subjects are the reasons that suggest the use of tools such as the SIG.

2. Characteristics of the Proaza district

The Proaza district is located in the Principality of Asturias (North of Asturias). It is a region with mountains that are 1,489 to 173 m high. The greatest part of the district is included within the basin of the Trubia river the characteristic of which is its location, showing very steep slopes, specially in the areas placed over the 400 m of height. The most frequent orientations are the ones facing the East, which represent 47% of the territory. The rest of the orientations show lower values which are equivalent one to the other.

The geological substrate of the district is made up of Paleozoic formations [1]. Though it is frequent the alternacy of siliceous and carbonated lithologies, the first ones are more frequent as they cover an area of nearly 60% of the district. The capital is located in the extreme plain which separates it from the river and on the sidehill base, and the surrounding area is the opening of the basin and the greatest plain surface of the district. The small resistance to erosion of the slaty lithologies has given birth to the formation of an

alluvial plain with a plain valley basis. On it, strong soils with high quality are developed, which considering the plain topography of this area, make it have a clearly agricultural condition, and they have to be properly preserved for this purpose. The existence of this plain might have been the main reason for the foundation and development of the present nucleous of Proaza, which is located in one of its peripheral areas.

The greatest part of the district is located in the phytogeographic province called "Cántabro-Atlántica" [2] (Oviedo subsection) with oceanic influence and low summer dryness rate, the predominant plant species is the *Quercus robur*, and the characteristic elements of this area are the oaks *Quercus ilex* and heaths of *Erica mackaiana* and *Erica ciliaris*. Only the highest areas are included in the "Ubiñense" subsector of the Cantabrian province where the following plant and trees species are present: oak (*Quercus petraea*) and beech (*Fagus sylvatica*), and the defining elements of this area are the *Genista florida* subsp. *polygalifolia* and the *Quercus rotundifolia* and *Quercus ambigua*.

Considering the fauna, Proaza is between the Cantabrian Mountains and the central valleys. The strong human transformation of the territory has caused a loss in the silvicolous species increasing the ones on the earth. In spite of this fact, the territory of Proaza is characterized by a high animal density and variety. Thus, some especially important vertebrates, related with the central area of the Mountain Chain, such as the brown bear, are present in Proaza, reaching notorious densities.

The population density of this area where the district is located, is remarkably low, 12.5 inhabitants/km², according to the data of 1991, and for the district is of 13.5 inhabitant/km². The district shows a clear tendency of demographic decrease and it has already reduced its quantity of inhabitants in more than 5% between 1986 and 1991. The main economic activities are the primary activities, specially stockfarming and forest exploitation. Within this sense, it is important to point out the change of production pattern that stockfarming is suffering both in the district of Proaza as well as in the rest of the region, and the farming activities are turning into a redimensioning of sizes in order to achieve profitable economic units with stable and non-stable systems. The replacement of the traditional production pattern has caused the production loss of an important area of the territory which, some time ago, was used as grass. Industry appears nearly as a testimony while the scarce services rendered in the district are concentrated in its municipal capital city.

3. Working Methodology

3.1. Basic information collection

A subject cartography at a scale of 25,000 was prepared for the subject matter regarding plants, surface formations, population nucleous, infrastructure, public utility mounts and rocky areas. Subject information which had been prepared by other bodies such as geology, topography and hydrographic network, was also used [3]. Alphanumeric data coming from bibliographic or field work sources were also taken in order to complement the cartographic information.

3.2. Derived information collection

The basis cartography was digitalized and incorporated in a SIG, for the attribute adjudication and its further consideration. Alphanumeric data were stored in data tables related with maps by means of an item in common.

From these subjects, with joining and intersection operations, buffering and type classification, some other subjects were elaborated the information of which proved to be necessary for some aspects of the zone organization. These topics are lithology, obtained from the surface formations and geology; hydrology in which the main aquiferous of the area were represented, as well as the hydrographic basins; slopes and orientations obtained from the topographic map with a triangle irregular network pattern; the soil usage map which shows a summary of plants; or the maps of fauna quality and quality of the bear habitat in the preparation of which many things have taken into account such as rocky maps, the map of

soil usage, maps of the distribution of the female bears with breedings, refuge maps, trophic value maps and an important volume of zoologic data [4]. A map of soils was also prepared using information from the lithologic, plant, slope and rocky area map.

3.3. Criteria for the zone organization

Regarding urban matters, public legislation establishes several types according to which the territory will have to be classified [5]. Due to its characteristics, in the Proaza district there are two: urban soil -category in which the municipal capital is included- and non urban soil -to which the rest of the territory belongs- and which is defined as those lands which have to be preserved of the uses of urban nature due to their extraordinary agricultural, forest or farming value, possibilities of exploitation of their natural resources, landscape, historical or cultural values, and for the defence of the fauna, flora and ecological balance. The autonomic government has divided the non-urban soil in several categories, based on their characteristics [6], of which the following are found in Proaza:

1. Special Protection non-urban soil: which includes the lands that due to their extraordinary importance enjoy a high level of protection.
2. Interesting non-urban soil which will be protected regarding its farming or landscape peculiarities.
3. Rural area with the category of non-urban soil, which is used as place of residence.
4. General non-urban soil: those places which due to their nature or location are not included in any of the previous categories.

After the analysis of the subject information and the performance of the corresponding territory diagnosis, a future hypothesis is made, using the social, economic, demographic, preservation and traditional use protection and future need criteria. This may be summarized in a general aim: the performance of an eco-development which gets good use of the economic and heritagetage, cultural and natural possibilities but without causing their destruction. This intention will be present at the time of establishing the urban area organization which will rule the distribution of uses in the next years.

Based on it, the following zone organization criteria are established:

1. Respect for the important landscape and natural values of the territory, protecting the formations and communities with speculative or inadequate economical usage.
2. Concentration of buildings in such areas, like population nucleus and municipal capital city, which have already registered this type of use, avoiding dispersion.
3. Order and foster the forest uses due to the general process of abandonment of the marginal agricultural lands.
4. Preserve the important plain areas from the building construction process and foster their usage as areas for hortifruit exploitation for which they have the best characteristics.

3.4. Area organization

The area organization is the result of the automatic application of the criteria established about the information stored. It is carried out with GIS tools, choosing in each case, the types which fulfil the characteristics established. In order to have the final map, all the types of information mentioned in chapters 3.1 and 3.2. have been used. This automatic zone organization is then revised with the purpose of performing a correction applying subjective criteria in some cases where the result negatively affect particular or social interests.

4. Results

When applying these criteria to the space affected by this regulation, the following categories of non-urban soil appear:

1. *Non-urban soil with special protection of natural ecosystems with high fragility:* in this category -which is the one with maximum protection within the scope of the regulations- the following topics are included: very fragile and important ecosystems of the district, oaks, oligotrophic and eutrophic *Quercus robur* forest, *Arbutus unedo* scrubs and *Alnus glutinosa* forest, as well as bushes which are in the limit of these forests, necessary for guaranteeing preservation and recovery by means of natural or induced recolonization. At the same time, there are some critical areas for the survival of the Cantabrian brown bear which have been included. In these areas, and with the purpose of keeping the necessary natural condition and quietness in order to guarantee the survival of this species, all the activities which may alter the present environmental conditions will have to be regulated.
2. *Non-urban soil with special protection of forests:* the protective plant areas and the autochthonous forests which have not been included in the previous category and the areas called "for recovering forests", with bushes and plants in the limits, the possibilities and best use of which are clearly the preservation of the autochthonous forest areas.
3. *Non-urban soil with special protection of landscape peculiarity:* in this group we can mention the soils which, due to their situation, panoramic views, hydrology shapes, etc have deserved to be the object of special protection. In general, actions which cause a negative visual impact will have to be forbidden.
4. *Non-urban soil with special protection of public trenches:* in this category all the public trenches are included, together with a buffer of 75 m on each side of the river bed when this has not been included in the category of Natural Ecosystems of High Fragility or in any of the categories of special nature.
5. *Non-urban soil with special hidrologic protection:* in this category there are areas which are in charge of capturing the hidric resources which feed the underground aquiferous. In general, the regulation of the uses which is suggested has the purpose of protecting these important water extensions which are "dammed" in the aquiferous in order not to be contaminated.
6. *Interesting non-urban soil from the plain point of view:* in this category there are river plains, i.e. plain, low and fertile lands located on both sides of the rivers, generally, areas for harvesting and cultivation. These areas will have to be protected due to their high agricultural profitability, because they are rare in a territory full of mountains and due to their importance as landscape. Besides, these are areas highly affected by floods, thus they have to be free of buildings.
7. *Interesting non-urban soil from the agricultural point of view:* in this category, the agricultural lands which do not show strong grading, with good sunlight, well-developed and strong soils and good accessibility are included, with excellent possibilities for developing intense hard agricultural and farming activities in them. Therefore, they will have to be strictly preserved from other uses which are not of agricultural or farming nature.
8. *Agricultural and forest interesting non-urban soil:* In this category, we will include a group of lands which are at present being used with agricultural purposes, in general of medium or low quality, specially for sowing and harvesting which are far away from the towns, in places with very difficult access, strong slopes, etc. Many of these lands have been abandoned and their usage has been stopped during the last years; others are being abandoned and the rest is estimated to be abandoned in the next few years. These marginal lands will have to be turned into forests.
9. *Forest interesting non-urban soil:* in this category, we include the chestnuts, the areas with exotic trees, specially eucalyptus and pines, and the bushes the characteristics of which show that the most reasonable and profitable use for them is to be forests.

10. *General non-urban soil*: the lands the future usage of which may be, though with a municipal or supramunicipal nature, a source of services for the local community.

11. *Rural areas*: non-urban soil areas where a population is settled down with 10 or more houses which, due to their characteristics, functions, morphology and shape of implementation on the territory are not susceptible of being considered as urban areas.

5. Discussion

The methodology described has turned to be useful for the area organization of rural municipalities in which the natural (non-urban) spaces have important value and surface, which indicate the interest of considering them with special seriousness.

It is essential to begin with detailed and precise information in order to obtain satisfactory results, which recommends the investment of efforts during the first stage of information collection.

The consideration of the cartographic information with a GIS gives the possibility of automizing the derived map collection process, applying the criteria previously established by the specialists, with the purpose of obtaining a correct area organization. The further revision of the results will be interesting in order to implement the subjective criteria which are difficult to be automated (as it is the case of the *Non-urban soil with special protection of landscape peculiarity* category).

References

- [1] Pello, J. (1974). *Mapa Geológico Nacional escala 1:50.000 hoja 52 (Proaza)*. Instituto Tecnológico y Geominero de España.
- [2] Diaz Gonzalez, T.E. y Fernandez Prieto, J.A. (1994). El paisaje vegetal en Asturias: Guia de la IX excursión Internacional de Fitisociología (AEFA). *Itineraria Geobotánica* 8:5-242
- [3] Marquinez, J.; García Manteca, P.; y Felicísimo, A.M. (1991) Metodología para una cartografía básica ambiental en zonas no urbanas, *Second International Congress on Regional Planing*, pp 1941-1946. Valencia
- [4] Marquinez, J.; García Manteca, P. J.; Naves, J. y Ruano, A. (1993). Aplicaciones de un Sistema de información geográfica (SIG) a la metodología de análisis de la calidad del hábitat para el oso pardo en la Cordillera Cantábrica. En *El oso pardo en España*. ICONA. pp 201-221.
- [5] Real Decreto Legislativo 1/1992, de 26 de junio, por el que se aprueba el Texto Refundido de la Ley sobre el Régimen de Suelo y Ordenación Urbana (*BOE num. 156, de 30 de junio*).
- [6] Ley 6/1990, de 20 de diciembre, sobre Edificación y Usos en el Medio Rural. (*BOPAP nº 6, 9 de enero de 1991*).