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# Integration of Hydrological and Regional and Urban Planning in Spain

Alejandro Luis Grindlay Moreno

*Department of Urban and Regional Planning, University of Granada  
Spain*

## 1. Introduction

Planning is related to developing and managing a plan. It defines actions oriented towards specific objectives for a better future. Generally the political-administrative order of the different countries and regions establishes a legal framework to regulate this public activity. One of the first experiences in planning was sectoral, concerned with the development of plans for a particular department of public administration and which would eventually be realized through appropriate programs and/or projects. Usually the sectoral departments and their plans are segmented into different areas: services (healthcare, education, administration, commerce, security, etc.); environment (water and hydrology, protected areas, landscape, waste, etc.); and public works and transport (transport infrastructures - roads, rails, ports, airports, public transport facilities, transport services, buildings, etc.). Since the nineteenth century the developmental needs of a country have led to intense and continuous infrastructural planning and development, for transport, hydraulic works, and all utility and infrastructural systems.

One of the first planners to define the planning process from an urban and broad territorial perspective was Patrick Geddes (1915). He recognized it as a process of survey, analysis, and plan, and since then it has been developing in a similar way. In Spain there have been numerous experiences of urban planning from the success of Ildefons Cerdá's Expansion Plan ("Plan de Ensanche") in Barcelona in the middle of the nineteenth century, which spread to many other Spanish cities into the twentieth century. Since its legal regulation in the middle of last century, it has been established as a methodology for other sectoral planning, related to urban order and development, but with a limited territorial vision. Regional planning, which has a broader scope than sectoral planning, was not fully developed until the last two decades of the twentieth century, and was linked to the rise of an environmental paradigm and to a wide political decentralization process. The Constitution of 1978 signified a great political change which brought democracy to the country and created a quasi-federal state, divided into 17 regions or autonomous communities. It conferred the departments of regional planning to the respective regional governments, and sectoral departments were shared between the state and the regions but this gave rise to difficulties in planning coordination and integration.

In the next section the relationship between sectoral and regional planning in Spain and its traditional difficulties will be examined. These difficulties are based on the long

tradition and social relevance of sectoral planning, and therefore its evolution is only briefly covered, in contrast with more recent and complex regional planning. Given its central role in this work, the evolution of state water policies and hydrological planning will be depicted in its own section. The simplest and most segmented approach of sectoral planning, in contrast to wider territorial planning, must be considered, and the difficult development of holistic regional planning by a structured and compartmentalized administration with sectoral visions (Benavent, 2009). In addition, traditionally, their results would be most easily perceived by society than would territorial order and would be politically more effective.

The second section details the evolution of the hydrological sectoral planning tradition which, as in other countries, has normally been regarded as a separate management problem to spatial planning, and decisions regarding water have been made without reference to spatial planning (Woltjer & Al, 2007).

Starting from the origins of regional planning and its hydraulic considerations, the third section will demonstrate the numerous diverse experiences of regional and urban planning in Spain led by the seventeen regional governments and their territorial policies, laws and planning instruments. Specific instruments of regional planning related to hydrological aspects will be highlighted, such as the territorial sectoral plans of the Basque Country and territorial action plans within the region of Valencia.

Finally, conclusions and indications are proposed to improve the integration of hydrological and territorial planning in general.

## **2. Relationship between sectoral and regional planning in Spain**

Traditionally there has been a long experience of sectoral planning in Spain - mainly for transport and hydraulic infrastructures - from the second half of the nineteenth century, developed by civil engineering. The country needed to be developed and all infrastructures to be made and so sectoral planning was needed to organize and order all infrastructural development. Thus, one of its main characteristics is that it has very specific and functional goals. According to these, the conventional planning process goes from the knowledge of the current situation through documentation, information, analysis and diagnosis, identifying needs based on the goals and, after an analysis of alternatives, leads to the development of proposals and action programs for the future of the plan, in order to achieve those objectives. The need to prevent and take into account the possible environmental effects of these constructions, and later its integration with urban and regional planning, would not be formally considered until the last third of the twentieth century.

Different stages in the progress of the Spanish sectoral planning can be distinguished. The initial stage, which took place between the second half of the nineteenth century and the first half of the twentieth century, was based on the need to provide infrastructure. A second phase, between approximately the 1970s and 1990s, considered adapting infrastructure to demand, and the last phase from the 1990s until today where the existing adaptation and functionality is rationalized with the new, and quality and respect for the environment and sustainability are considered.

The stage of infrastructure provision was characterized by national or state plans. For example, the development of road infrastructure required four successive General Road Plans (1860-1864-1877-1914), the National Circuit of Special Pavements (asphalted roads) (1926-1939), a Plan for Modernisation (1951), and another four successive General Road Plans (1962-1977-1984-1991), the last two fall into the second stage of adapting infrastructure to demand. The early development of the hydraulic infrastructure also progressed through five successive National Plans of Hydraulic Works, as shown in the next section. The second phase was characterized by sectoral integration plans such as the state Infrastructure Director Plan (1993-2007), which considered the two infrastructures of hydraulics and transport together. In the last and current phase, new sectoral plans have been developed, not only integrating all transport infrastructural systems but also with a strategic perspective and considering environmental sustainability, such as the last Strategic Infrastructure and Transport Plan (PEIT 2005-2020). Furthermore the new regional governments during the 1980s, which were responsible for the departments of the infrastructures in their territories, mirrored the state administrative structure and began developing the provision of sectoral infrastructural plans, such as the Roads Plan of Catalonia (1985, revised in 1995) or the General Road Plan of Andalusia (1987) also to build a new territorial identity. In the same way, they have copied the sectoral integration plans of the second phase, such as the Infrastructure Director Plan of Andalusia (1997-2007), or the Transport Infrastructures Plan of Catalonia (2006-2026) (Grindlay, 2007).

During these decades municipal urban plans were also developed, although spatial planning was implicitly effected by the sectoral actions of transport infrastructures and by the large hydraulic works and their complementary colonization actions of new irrigated lands and villages.

However with the approval of the first regional planning instruments during the 1990s, such as the Regional Planning Guidelines of Asturias (1991) or the first regional plan in Catalonia (General Territorial Plan of Catalonia, 1995), the need to integrate the new sectoral plans with these documents will be clear, as shown later. As it has been recognized, regional planning has the purpose of applying a transversal perspective to the territory, and an integrated approach to territorial issues, which will be difficult to fit into a structured and compartmentalized administration, with a sectoral perspective (Benavent, 2009).

Therefore after this long tradition of sectoral planning, the first attempts to consider environmental effects during the 1970s, and later to integrate the sectoral transport plans with the existing or new urban plans in the 1980s, proved to be very problematic. As described by McHarg (1969), sectoral plans were considered regardless of their environmental, urban or territorial effects. Since the second half of the 1980s, the environmental impact assessment of the infrastructure projects was becoming generalized (as in European Directive 85/337/CEE), and a decade and a half later it was extended to the environmental impact assessment of plans and programs (as in European Directive 2001/42/CE). Subsequently there has been a significant development of new regional plans over the second half of the 1990s and in the last decade, and a change from the traditional segmented approach of sectoral planning towards closer integration as a comprehensive element of the most complex territorial plans. A new wide-ranging and holistic perspective is currently in consideration for sectoral planning. Nevertheless despite the short experience of the last decades in regional planning, compared the long

tradition of sectoral planning, later sectoral plans also consider the determinations of the holistic regional plans. Therefore, the new state infrastructure plan should consider not only all the existing territorial and sectoral plans of all the regions or autonomous communities, but also ensure new regional infrastructural plans are fully integrated in their respective territorial plans. One example would be the latest Infrastructural Plan for Sustainable Transport in Andalusia (2007-2013) (Consejería de Obras Públicas y Transportes [COPT], 2008), which develops infrastructure and is in full accord with the Spatial Development Plan of Andalusia (2006). Although these should have a holistic and complex territorial approach they are managed by a structured and compartmentalized administration, and the regional government has not created a superior department to coordinate the rest. What is more, the advantages of their proposed spatial order are largely imperceptible to society, when compared to the results of infrastructural projects. However, the integrated and territorial perspectives in planning will substantially improve the general quality of the territories and their spatial order, which is now considered as territorial capital (European Parliament [EP], 2007).

### 3. Evolution of hydrological planning tradition

Water planning and management is possibly one of the most critical issues in Spain due to the combination of historically cyclical droughts and a rapid increase in the number and types of water uses, which makes water policy a focal point of public intervention and a subject of political, socioeconomic, and territorial controversy (Font & Subirats, 2010). So far, water policy has risen as a strong sector policy, with an autonomous logic, fully consistent with a model of continued pressure on the hydro domain, and widely regarded as a source of production (Moral, 2009).

The background of hydrological planning in Spain is related to the solution of one of the main territorial problems in the Mediterranean area namely flooding which was addressed by the Flood Defence Projects of the rivers Júcar (1866) and Segura (1886). The key proposal of these Projects was a wide dam development along the basins. Their prime objective was to achieve defence from flooding, but with a secondary objective to increase water reserves for irrigation and supply purposes. In order to promote irrigated agriculture - at that time the main pillar of economic development - five successive National Plans of Hydraulic Works (1902, 1909, 1916, 1919 and 1933) were drawn up. Each one of these "works plans" was approved to review, revise and complete the previous dam building plans. Their purpose was to resolve the irregular spatial and temporal distribution of the essential water resources, and to remedy the shortage, considering the existing antecedents of the few Roman and medieval dams, and on the large hydraulic projects (dams and channels) poorly developed during the eighteenth century. The intense process of regulation of so-called "lazy rivers" had aimed at the promotion of irrigation for national wealth, as the principle of the "Regenerationism" movement.

Water boards, called "Confederaciones Hidrográficas" (Hydrographical Confederations), were founded at every main river during the 1920s (Ebro and Segura in 1926, Duero and Guadalquivir in 1927, Eastern Pyrenees in 1929, etc.). Their administrative area or geographical scope corresponded to the respective hydrographical basins, establishing an essential management spatial unit, and their main purpose was the exploitation of all water resources for economic development. They were public and autonomous organizations

assigned to the Ministry of Public Works as organizations with full self-determination. These entities have been functioning in Spain without interruption since their origins, playing an important role in the planning, construction and maintenance of hydraulic infrastructures, in the management and supply of hydrological resources, the protection of the public water domain, the granting of private rights of usage for water, and latterly, in the formulation and monitoring of hydrological basin planning and the execution of new hydraulic infrastructure, the control of water quality, etc. (Gómez & Grindlay, 2008).

After the breakdown period of the Civil War (1936-1939), hydraulic policy followed the principles of the last National Plan of Hydraulic Works of 1933. This was a genuine hydraulic works plan, considering a comprehensive overview of water issues among the various basins, and was conceived with planning criteria. Nevertheless it was integrated as a part of a major and general infrastructure plan, the General Plan of Public Works of 1941 for the national reconstruction. According to this, the second half of the century was to bring about the construction of large reservoirs designed for the regulation of rivers, power generation, flood control (primarily in the Mediterranean area), the improvement and increase of irrigated land, and the improvement of urban and industrial supply to satisfy increasing demand. This model of intense exploitation of water resources, incrementing regulation of surface resources and groundwater exploitation was usual in most developed countries (Biswas & Tortajada, 2003). For this development and supply model, one of the most significant actions, in line with the consideration of the national hydrographical imbalance (namely that there was an over-supply of water in some areas and an under-supply in others), was the Tagus-Segura Transfer. It had been proposed in the Plan of 1933, but was built during the 1970s to connect the headwaters of the Tagus (in east-central) Spain to the Segura River. This was claimed to solve the zone's hydrological imbalances between water-rich and water-poor regions (Gómez & Grindlay, 2008; Gupta & Van der Zaag, 2008).

After reaching a certain stage of development in the 1970s, some water boards conducted studies to prepare hydrological planning, by evaluating the possibilities of increasing exploitation of water resources by new dams. National planning directives (1979) were given to develop these preliminary studies for water resources planning. However, the major impulse to hydrological planning was driven definitively by the Water Law of 1985, which replaced that of 1879, and established the necessity of a draft hydrological plan in each basin and then the nationwide National Water Plan (NWP). It would coordinate them to resolve the imbalances and water deficits between basins, and would be the latest manifestation of the hydraulic paradigm in Spain. With the rise of the environmental paradigm, a major concern of this law was also water quality, which the intensification of water use had degraded. A key aspect was the joint consideration in the public hydraulic domain of all continental waters, surface and subterranean, in establishing a unified set of measures leading to a better rationalization in the use and development of increasingly scarce water supplies.

Flooding problems also received a strong hydraulic sectoral treatment during the 1980s in the Mediterranean basins of Júcar and Segura rivers with their Flood Defence Plans (1985 and 1987). This was underlined with the development of structural measures such as large hydraulic works of new dams and channelling, which increased the flood control capacity in the basins. In addition the limitations of purely hydraulic measures led to the need to

implement non-structural actions, such as the Automatic Hydrological Information Systems (AHIS) (first developed at the Jucar basin in 1989 and in the Segura basin in 1992). This is used to mitigate the effects produced by floods, and to optimize the management of water resources in the basin. Additionally the need of spatial planning measures was considered (Carmona & Ruiz, 2000; Gómez & Grindlay, 2008).

During the second half of the 1990s hydrological plans were being approved in different basins. Although these, in terms of timescale, were in a second phase of sectoral planning by adapting infrastructure to demand they were, in reality, closer to the supply oriented model. Their results encompassed the estimated hydraulic resources, all existing demands, the hydrological balance between them, and the infrastructure or solutions required to solve water deficits. The relationship with other plans, such as regional planning, was mentioned but not implemented in any way. The NWP was finally approved in 2001, and it included measures for flood control, water quality, and riverbank and wetland protection, but its leit motiv remained the development and transfer of water supplies. It estimated a very high water demand to be satisfied with water development schemes, from a supply-oriented conventional model, and a large piping scheme transfer from the Ebro River to the "in deficit" Mediterranean area was proposed (Biswas & Tortajada, 2003; Gupta & van der Zaag, 2008).

However, during these years there was a growing social concern about the environment and the consequences of the development model led to this NWP being highly contested through a broad social and environmental movement (Biswas & Tortajada, 2003; Font & Subirats, 2010; Garrido & Llamas, 2009; Jiménez & Martínez-Gil, 2005; WWF, 2002) because, among other reasons, it was contrary to the new European water policy founded in the recently approved Water Framework Directive (WFD) (European Parliament and Council [EC], 2000). The change in this water policy and its paradigms of management, was realized with its modification and substitution by the A.G.U.A. Program in 2004 ("Actuaciones para la Gestión y Utilización del Agua" - Actions for the Management and Utilization of Water). This contained a series of "Urgent Actions in the Mediterranean Basin" to increase water supplies through desalination of sea water - seeking independence from climatic influence, and to improve the management and quality of water, through water saving and reutilization, increasing efficiency in water use (Garrido & Llamas, 2009). The government chose desalination instead of large inter-basin transfers, exchanging a very tangible and immediate form of environmental impact for the less tangible environmental impact of additional energy production (Downward & Taylor, 2007).

All these new demand-oriented measures in Spanish water policy would be more in accordance with the WFD principles and, as shown later, its implementation would provide some integration between hydrological and spatial planning. In recent years new Directives related to water have been developed and approved to complement and consolidate the WFD, specifically in those aspects more relevant in Mediterranean Spain such as groundwater protection (EC, 2006) and flood management (EC, 2007).

Furthermore the administrative and departmental changes of the autonomous communities in the Spanish State in the 1980s and 1990s would increase the socio-political complexity of water planning and management in Spain. Those catchments which fall within a single region (intra-regional) have been devolved to the regional government, and six new

Regional Water Agencies have been created. In the case of rivers which cross regional boundaries (inter-regional), these are managed by the centrally controlled River Basin Authorities, the traditional “Confederaciones Hidrográficas” now linked to the Ministry of Environment. Intra-regional basins managed by the regions have reproduced the hydraulic bureaucratic structures replacing earlier state structures, as is the case of the Agencia Catalana del Agua (1999) which took over from the former Confederación Hidrográfica del Pirineo. Otherwise river basins whose territory spreads across several autonomous communities retain their state dependent administration, but the hydraulic bureaucratic structures have been expanded because of the creation of new structures at a regional level, e.g. the Agencia Andaluza del Agua (created in 2005, but it dissolved and became integrated in the new General Secretariat of Water of the Department of Environment, 2011) which coexists with the Confederación Hidrográfica del Guadalquivir. Additionally in this inter-community river arrangement the main region will claim a greater role in its administration, as in this case of Andalusia region with its new water law (9/2010) and the Guadalquivir river basin management. Therefore the existence of a greater number of autonomous communities will naturally create more difficulties in the relationship between both sets of planning - hydrological and territorial- (Grindlay et al., 2011). In accordance with the traditional water scarcity, water issues will be strongly linked to aspects of nationalism, regionalism and territorial identity. Regions are now utilising water as a means of achieving political legitimacy and to secure control over access to water both as an economic resource and as a source of territorial identity (a territorial claim), and lately the traditional state hydraulic paradigm is re-enacted at the regional government level (Lopez-Gunn, 2009).

#### **4. The experience of urban and regional planning in Spain**

From a functional point of view, traditionally in Spain, and similarly in other countries, a separation has existed between water and urban planning and territorial management and, in general, the regional functions of territorial management have been scarcely developed until recent years. Before addressing the experience of urban and regional planning in Spain a brief overview of its main background is necessary.

##### **4.1 Origins of regional planning and its hydraulic considerations**

The Scottish planner Patrick Geddes (1915) was one of the first planners to consider a broad territorial perspective beyond the city itself, including the physical environment, the need to think about its multiple zone levels, and the requirement to adopt a multidisciplinary approach. His ideas were later followed by his disciple Lewis Mumford, who founded, with other colleagues (C. Stein, P. Chase and B. MacKaye), the “Regional Planning American Association” (1923). They also considered the importance of the regional spatial unit for territorial planning, which, in the case of water processes, should naturally be the basin unit. Some of their principles, such as the basin spatial unit, were applied in one of the most relevant experiences of a complete development program of a river basin, the “Tennessee Valley Authority” (1931), in the American regional planning drive for economic development during the 1930s, described by Friedmann and Weaver (1979) in a survey of ideas concerning regions and regionalism in the United States (Weitz & Seltzer, 1998). It is also necessary to mention the original, well-known, German zoning



experiences in the 1920s, and the cases of regional planning in New York (1929), and of the United Kingdom from the 1930s onwards, which adopted the zoning technique to define green areas or areas to be preserved at the regional level, many of which would be related to water processes (Hall, 2002).

During the 1960s another Scottish planner, Ian L. McHarg, clearly defined in his book "Design with Nature" (1969), the necessity to consider natural and ecological processes in planning, of course, including those related to water. He highlighted such basic considerations as to avoid development of flood plains and other areas under risk, and the aquifer infiltration areas. Moreover he developed a methodology of territorial analysis based on superimposing information map layers, originating from the current Geographical Information Systems (GIS), with their multiple spatial planning applications (e.g. Zamorano et al., 2008).

As professor Gómez Ordóñez (2006) recognizes, spatial planning has been characterized throughout its history by the concern to harmonize the natural and the artificial, with consideration for the correct relationship between what is built and what is preserved, or reserved for the future, and it is precisely in this regard that water has played, and is playing, a leading role.

#### **4.2 Progress of hydrological considerations in Spanish urban planning**

The experiences of regional planning in Spain have been relatively recent compared to those of urban planning. As mentioned earlier, Ildefons Cerdà and his first urban expansion plan ("Plan de Ensanche") for Barcelona (1859), which was accompanied of his General Theory of Urbanization (1867), represents the birth of the urban planning discipline (García-Bellido, 2000). He had a high concern for topography and drainage as the foundation for his original urban development. With his famous phrase "ruralise what is urban, urbanize what is rural" he anticipated by almost half a century the ingenious diagram of the "three magnets" of E. Howard (1898), who uses it to explain the necessity of integrating the advantages of town and country for a new urban environ in his famous proposal of the "Garden Cities" (reproduced in Wheeler & Beatley, 2009).

The urban expansion or extension plans of the second half of the nineteenth and the first half of the twentieth centuries should include a section concerning studies of the physical environment (geology, topography, hydrography, etc.) as a basis of proposed developments. Urban planning has been a municipal responsibility in its spatial administrative realm, regulated from the perspective of urban infrastructure in 1924. Additionally the land law of 1956 is the first legal text for integral spatial planning of the territory from an urban point of view, and it is considered as the beginning of Spanish contemporary urbanism. It defined the municipal urban planning instruments as the General Plan and its content had to include an analysis of the natural characteristic of the territory and it should steer later urban development (Olcina, 2007). The progress of urban municipal planning during the second half of the century, according to this law, has been described as a "story of an impossible process", referring to the results developed in many cases, so different than those originally planned (Teran, 1978). Generally successive modifications of the plans intensified developments, even building-in originally protected green areas such as riverbanks. Also buildings were often illegally constructed on unauthorized areas such as flood plains. Therefore many spatial

developments have frequently been far from the spatial planning considerations regarding the hydrological environs.

One of the preliminary experiences on regional planning was a scheme for the reconstruction of Madrid (1939). Later this law also established a supra-municipal planning instrument, namely the provincial plan. Few were developed (Barcelona, 1963; Guipuzcoa, 1966; Majorca 1973 and the metropolitan plan of Barcelona 1976), all of these with an urban order perspective (Benavent, 2006).

The quasi-federal state established by the Constitution of 1978 conferred full responsibilities for urban and territorial planning to the respective regional governing bodies, and precluded the state from later establishing a national spatial plan (as dictated in 1997), making impossible a coordination between regional spatial plans. As in other European countries, the centre of gravity of spatial planning remained with the municipal land-use urban plan (Wiering & Immink, 2006). In 1998 the state land law was adapted to these changes to establish a common land legal framework but only with regards to the state responsibilities on property rights. In relation to hydrological risk, among others, land under natural risk according to sectoral planning should be categorized as (article 9.1) land with the status of "not to be developed". However it does not establish the degree of risk (Olcina, 2007), which would be required for the corresponding sectoral planning that would determine it. The last revision of the state land law was in 2008, which attempted to avoid conflict with regional departments on the matter, and among the basic criteria of land use was to address the principle of natural risk prevention and of urban and territorial sustainable development and environmental protection. It defines rural land or land not be developed with an equal status to the ground preserved by regional and town planning for its transformation through urbanization, which would include those areas with natural and technological risks, including floods. This also refers to a sectoral planning of flood risk.

As with other planning instruments, those of urban and regional planning are subject to environmental impact assessment in accordance with the provisions of the legislation to assess the effects of certain plans and programs on the environment (Law 9/2006, which supersedes Directive 2001/42/CE). In relation to this, the applicable state land law (Law 2/2008) establishes that the required environmental sustainability report of the planning instruments of urbanization actions should include a map of natural risks in the area under scrutiny. It also includes the necessity of reports from the hydrological administration on the existence of the water resources needed to satisfy the new demands, and on the protection of the public water domain. Thanks to this a major integration between the new urban planning and hydrological planning in Spain has been achieved.

A state document related to civil protection was approved, called "Basic directive of flooding" (1995), with relevant implications for regional spatial planning documents on the necessity of determination of flood areas and those at risk, considering the population, facilities and infrastructures potentially affected. It requires the analysis of flood zones and flood risk to be completed at local and regional levels but, in general, little has been developed by regional governments and hardly anything by municipalities (Olcina, 2007). It will be the new Directive on flood management (EC, 2007) and its transposition which will definitely drive these studies and plans as shown later.

### 4.3 The development of regional planning framed by EU policies

The development of regional planning in Spain took place on the basis of the principles of “The European Charter on Spatial Planning” (adopted in 1983), and in the progress of the decentralized state politically configured in autonomous communities. For the development of these responsibilities the respective regional governments began to develop their urban and regional planning laws, since their conformation in the 1980s, and later their planning instruments, also as a means to strengthen national identity of the regions. In consequence Catalonia (1983) was the first to set them up according to its very nationalist tradition and its own language, and similarly, later, the Basque Country (1990).

The development of the first regional laws on spatial planning of the seventeen autonomous communities in a chronological order has been: Catalonia (1983), Madrid (1984), Navarre (1986), Asturias (1987), Balearic Islands (1987), region of Valencia (1989), Cantabria (1990), Basque Country (1990), Murcia (1992), Aragon (1992), Andalusia (1994), Galicia (1995), La Rioja (1998), Castilla-La Mancha (1998), Castilla Leon (1999), Canary Islands (1999), and finally Extremadura (2001). Some of these were integrated urban and regional planning laws using the same legal stipulations as Madrid or La Rioja, and other communities set up different laws for regional and urban planning, as Andalusia (1994 and 2002 respectively). Many of them have been latterly revised and changed resulting in a complex and confused legal and planning system throughout the country demonstrated in detail by Benavent (2006).

Generally many of these new laws widely included the concepts and wording of “The European Charter on Spatial Planning”, and later they were also greatly influenced by the European Spatial Development Perspective (ESDP) (European Communities, 1999). This was a broad consensus document on spatial planning matters, based on the voluntary cooperation of the EU member states, which had a long and debated process of discussion and therefore has been the most global planning policy document to date (Faludi & Waterhout, 2002). Its objectives are both simple and comprehensive, as are the processes for how these objectives should be attained, particularly referring to the conservation of natural resources and cultural heritage, sustainable development and the protection of natural and cultural heritage (Faludi, 2002).

At a European level spatial planning is an individual responsibility of the member states, and spatial planning at this level is sufficiently distinct from the spatial planning at the national and regional levels (Dühr et al., 2010). Even at this broad level it is worth highlighting that the approaches of the ESDP, whilst correct, are quite generic. It rightly sets out water resource management as a special challenge for spatial development, and the need “to co-operate across administrative boundaries in the field of water resource management”. It also emphasises that “policies for surface water and ground water must be linked with spatial development policy” and, obviously, that “spatial planning can make an important contribution to the protection of people and the reduction of the risk of flood” (EU, 1999). These and other considerations around water issues will later be incorporated and broadly developed in the WFD, but divested of the spatial dimensions.

The laws on spatial planning of the autonomous communities have proposed planning or guideline instruments for the integration of the three main spatial dimensions of a territorial

model, which also coincide with the elements of the policy aims and options for the territory of the EU established at the ESDP: cities and urban systems, infrastructures and access and knowledge networks, and environmental and cultural heritage.

Despite the diversity of types and designations defined in these instruments by regional governments, however, most of them have founded a similar scheme with three types of documents:

- a. Integrated planning instruments at a regional level, which affect the entire territory of an autonomous community.
- b. Integrated planning instruments at a sub-regional level, which affect territories with provincial, district or just supra-municipal areas, and constitutes a development of the regional level instruments.
- c. Instruments attempting to integrate sectoral intervention with substantial territorial effects, such as territorial sectoral plans or regulations on sectoral plans and projects and standard assessment tools to control their territorial effects.

At the regional level there are also three types of documents: Territorial Plans (Andalusia, Cantabria, Catalonia, Madrid), Guidelines for Spatial Planning (Aragon, Asturias, Basque Country, Canarias, Castilla-La Mancha, Castilla y Leon, Extremadura, Galicia, Balearic Islands, Murcia) or Territorial Strategies (Navarre, La Rioja, region of Valencia) these last most influenced by ESDP, or European Territorial Strategy in the Spanish translation.

In the lower spatial level or sub-regional level there is a much greater diversity of documentation, as shown in the next table, but the Territorial Partial Plans, the Sub-Regional Spatial Plans or the Insular Spatial Plans for the islands can be emphasized. All of them will develop the corresponding regional level instrument in a particular territory.

However, for the purpose of this chapter, of great interest are those instruments attempting to integrate sectoral intervention with substantial territorial effects, such as territorial sectoral plans or regulations on sectoral plans. The Basque Country has been the region that has most promoted these instruments named as Territorial Sectoral Plans. These are developed by the Basque government departments with responsibilities that will produce territorial effects, and also develop the Regional Planning Guidelines (1997), which the regional territorial model established, in the sectoral areas. As, in general, it is based on the common scheme of three elements: physical environment, urban systems, and relational or infrastructural systems, the respective Territorial Sectoral Plans will develop one particular sectoral element. The approved Territorial Sectoral Plans are on the Regulation of the Margins of Rivers and Streams (1998), on Rail Network (2001/2005), on Wind Energy (2002), Public Land Creation for Economic and Commercial Equipment (2004), on Coastal Protection and Management (2007), on Roads (2008), on Wetlands (2004/2008), and on Gipuzkoa's Urban Waste Infrastructure (2009). Additionally the Territorial Sectoral Plans in preparation are pertaining to Cultural Heritage, Agroforestry, Land for Public Housing Promotion, Ports, and Intermodal and Logistics Transport Network (Departamento de Medio Ambiente, Planificación Territorial, Agricultura y Pesca [DMAPTAP], 2011).

The next table reflects the regional planning instruments developed by autonomous communities' governments.

Autonomous Community (first Regional Planning Law)	A. Regional Level Spatial Planning Documents	B. Sub-regional Level Spatial Planning Documents	C. Other Planning Documents
Andalusia (1994)	Plan de Ordenación del Territorio de Andalucía (2006)	Plan de Ordenación del Territorio (POT) de la Aglomeración Urbana de Granada (1999-2005).	Plan Andaluz de Vivienda y Suelo 2003-2007 (2007-2011)
		Planes de Ordenación del Territorio (P.O.T.s) del Poniente Almeriense (2002); Sierra de Segura (2003); Doñana (2003); Bahía de Cádiz (2004)	Plan de Infraestructuras para la Sostenibilidad del Transporte en Andalucía (2007-2013) (2008)
		P.O.T.s Litoral Occidental de Huelva (2006); Costa del Sol Oriental-Axarquía (2006); Costa del Sol Occidental de Málaga (2006)	Plan General del Turismo Sostenible de Andalucía (2008-2011) (2007)
		P.O.T.s Levante de Almería (2009); Aglomeración Urbana de Sevilla (2009); Aglomeración urbana de Málaga (2009); Costa Noroeste de Cádiz (2011)	Plan Especial Supramunicipal del río Palmones (2010); P.E. de Ordenación de los regadíos al norte de Doñana (2011)
Aragon (1992)	Directrices Generales de Ordenación Territorial (O.T.) para Aragón (1998)	Directrices Parciales de O.T. del Pirineo Aragonés (2005-2010)	Directrices sectoriales sobre actividades e instalaciones ganaderas (2009)
		Directrices Parciales de O.T. de la Comarca del Matarraña (2008)	
Asturias (1987)	Directrices Regionales de Ordenación del Territorio (O.T.) (1991)	Directrices Subregionales de O.T. franja costera de Asturias (1993)	
		Plan Territorial Especial de Ordenación del Litoral de Asturias (2005)	
Balearic Islands (1987)	Directrices de Ordenación Territorial de las Islas Baleares (1999)	Planes Territoriales Insulares de Menorca (2003); Mallorca (2004); de Ibiza y Formentera (2005)	

Autonomous Community (first Regional Planning Law)	A. Regional Level Spatial Planning Documents	B. Sub-regional Level Spatial Planning Documents	C. Other Planning Documents
Basque Country (1990)	Directrices de O. T. de la Comunidad Autónoma del País Vasco (1997)	Plan Territorial Parcial (P.T.P.) de la Rioja Alavesa (Laguardia) (2004)	Plan de Ordenación de los Márgenes de Ríos y Arroyos (1998)
		Planes Territoriales Parciales (P.T.P.s) de Álava Central (2004); del Área Funcional de Llodio (2005);	Plan Territorial Sectorial (P.T.S.) de Red Ferroviaria en la CAPV (2001/2005)
		P.T.P.s del Área Funcional de Eibar (2005); del Área Funcional de Mondragón-Bergara (2005); del Área Funcional de Bilbao Metropolitano (2006)	P.T.S. de Creación Pública de Suelo para Actividades Económicas y Equipamientos Comerciales (2004)
		P.T.P. del Área Funcional de Zarautz-Azpeitia (2006-2008)	P.T.S. de Zonas Húmedas (2004/2008)
		P.T.P. del Área Funcional de Beasain-Zumarraga (2009)	P.T.S. de Protección y Ordenación del Litoral (2007)
		P.T.P.s de Donostia-San Sebastián (2010); del área funcional de Balmaseda-Zalla (2010)	Plan Sectorial General de Carreteras (Álava - Bizkaia) (2008)
		P.T.P.s del Área Funcional de Igorre (2010); del Área Funcional de Durango (2011)	P.T.S. de Infraestructuras de Residuos Urbanos de Gipuzkoa (2009)
Canary Islands (1999)	Directrices de Ordenación Gral. de Canarias (2003)	Plan Insular de Ordenación Territorial de Lanzarote (1991)	Directrices de O. del Turismo (2003)
		Plan Insular de Ordenación de Fuerteventura (2001)	Plan Territorial Especial de la Costa Norte de Gran Canaria (2003)
		Plan Insular de Ordenación de la Isla de El Hierro (1995-2002)	Plan Territorial Parcial Plataforma Logística del Sur (2008)
		Planes Insulares de Ordenación de Tenerife (2002-2011); de Gran Canaria (2003-2011)	Plan Territorial Especial Ordenación Turística de Tenerife (2005)

Autonomous Community (first Regional Planning Law)	A. Regional Level Spatial Planning Documents	B. Sub-regional Level Spatial Planning Documents	C. Other Planning Documents
		Planes Insulares de Ordenación de La Gomera (2011); de La Palma (2011)	Plan Territorial Especial Paisaje de Tenerife (2010)
Cantabria (1990)	Plan Regional de Ordenación Territorial (N.A.)		Plan de Ordenación del Litoral (2004)
			Plan Especial de la Red de Sendas y Caminos del Litoral (2010)
Castilla-La Mancha (1998)	Plan de Ordenación Territorial de Castilla-La Mancha (N.A.)	Plan de Ordenación del Territorio (P.O.T.) del "Corredor del Henares y zona colindante con la comunidad de Madrid" (Guadalajara) (N.A.)	
		P.O.T. de la "Zona de La Sagra" (Toledo) (N.A.)	
		P.O.T.s de la "Mesa de Ocaña y el corredor de la autovía A-3"; del "Corredor Ciudad Real - Puertollano"; de la "Zona de influencia de Albacete" (N.A.)	
Castilla Leon (1999)	Directrices Esenciales de Ordenación de Castilla y León (2008)	Plan Regional de ámbito territorial del Canal de Castilla (2001)	Plan Regional de Ámbito Sectorial de la Bioenergía de Castilla y León (2011)
		Plan Regional de Ámbito Territorial "Valle del Duero" (2010)	Directrices de O.T. de ámbito subregional de Valladolid y entorno (2001)
		Plan Regional de Ámbito Territorial del Puerto de San Isidro (León) (2004)	Directrices de O.T. de ámbito subregional de Segovia y su entorno (2005)
		Plan Regional de Ámbito Territorial Zamor@-Duero (2010)	Directrices de Ord. de ámbito subr. de la montaña cantábrica central (2011)

Autonomous Community (first Regional Planning Law)	A. Regional Level Spatial Planning Documents	B. Sub-regional Level Spatial Planning Documents	C. Other Planning Documents
Catalonia (1983)	Pla Territorial General de Catalunya (1995)	Pla Territorial Parcial de les Terres de l'Ebre (2001-2010)	Pla director del delta de l'Ebre (1996)
		Pla Territorial Parcial de l'Alt Pirineu i Aran (2006)	Pla director de les activitats industrials i turístiques del Camp de Tarragona (2003)
		Pla Territorial Parcial de Ponent (Terres de Lleida) (2007)	Pla director urbanístic del sistema costaner (2005)
		Pla Territorial Parcial de les Comarques Centrals (2008)	Pla director urbanístic del Pla de Bages (2006)
		Pla Director Territorial de l'Alt Penedès (2008)	Pla director urbanístic (+13)
		Pla Territorial Metropolità de Barcelona (2010)	Plans director urbanístics de les àrees residencials estratègiques (+12)
		Pla Territorial Parcial de les Comarques Gironines (2010); del Camp de Tarragona (2010)	Pla comarcal de muntanya 2009-2012 (2009)
Extremadura (2001)	Directrices de Ordenación del Territorio (N.A.)	Plan Territorial de Campo Arañuelo (2008)	
		Plan Territorial de la Vera (2008)	
		Plan Territorial Embalse Alqueva (2009)	
Galicia (1995)	Directrices de Ordenación do Territorio (N.A.)	Plan de Ordenación do Litoral (2011)	
La Rioja (1998)	Estrategia Territorial de La Rioja (N.A.)		Plan de suelo de actividades económicas (2006)
Madrid (1984)	Plan Regional de Estrategia Territorial (N.A.) (Bases, 1995)	Estrategia Territorial Zona Oeste Metropolitana (1989)	Plan de Vivienda de la Comunidad de Madrid (2005-2008/2009-2012)
		Estrategia Territorial Corredor del Henares (1989)	Estrategia de Residuos de la Comunidad de Madrid (2006-2016)



Autonomous Community (first Regional Planning Law)	A. Regional Level Spatial Planning Documents	B. Sub-regional Level Spatial Planning Documents	C. Other Planning Documents
Murcia (1992)	Directrices de Ordenación del Territorio (N.A.)	Directrices y Plan de Ordenación Territorial del Litoral de la Región de Murcia (2004/2007)	Actuación de Interés Regional de Marina de Cope (2004)
		Directrices y Plan de Ordenación Territorial del Suelo Industrial de la Región de Murcia (2006)	Actuación de Interés Regional de Aeropuerto Internacional de la Región de Murcia (2004)
			Plan Regional de Vivienda (2007 – 2010/2009-2012)
Navarre (1986)	Estrategia Territorial de Navarra Directrices para la O.T. (2005)	Plan de Ordenación Territorial 1 Pirineo (2011)	Planes Directores de Acción Territorial (N.A.)
		Plan de Ordenación Territorial 2 Navarra Atlántica (2011)	Planes y Proyectos Sectoriales de Incidencia Supramunicipal
		Plan de Ordenación Territorial 3 Área Central (2011)	
		Plan de Ordenación Territorial 4 Zonas Medias (2011)	
		Plan de Ordenación Territorial 5 Eje del Ebro (2011)	
Valencia's Community (1989)	Estrategia Territorial de la Comunitat Valenciana (2011)	Plan de Acción Territorial del Entorno de Castellón (PATECAS) (N.A.)	Plan de Acción Territorial de carácter sectorial sobre prevención del Riesgo de Inundación en la Comunidad Valenciana (PATRICOVA) (2003)
		Plan de Acción Territorial del entorno Metropolitano de Alicante y Elche (PATEMAE); de la Vega Baja (N.A.); de las Huertas (Valencia) (N.A.)	Plan de Acción Territorial de carácter sectorial de corredores de infraestructuras (2005)

Autonomous Community (first Regional Planning Law)	A. Regional Level Spatial Planning Documents	B. Sub-regional Level Spatial Planning Documents	C. Other Planning Documents
			Plan de Acción Territorial Forestal de la Comunitat Valenciana (2011)

(N.A.) Not Approved

Table 1. Autonomous Communities' Spatial Planning Documents. Source: Author's own work based on Olcina (2007, pp. 161-164), and Moral (2009, table 1) and autonomous communities regional governments' web pages.

Naturally these spatial planning instruments (plans, guidelines, or strategies) will define a territorial model, in which one essential component is the environment, where the "not to be developed" lands and/or protected natural areas, and also the hydrological system are considered. Correspondingly the development model proposed should be consistent with the physical and environmental characteristics of the territory, and particularly with regard to the hydrological elements. Territorial planning must also take into account the consideration of water and the hydrological cycle in general and in particular in the distribution of the uses of the land, essentially in the future urban expansion and in the construction of infrastructures, and their conformation with the hydrological system, above all the fluvial dynamic. The traditional problem of floods and inundations in some Spanish areas has given rise to a particular concentration of attention on this question (Grindlay et al., 2011), as will be presented in the following section.

In general, as shown in Olcina (2007), most of the autonomous communities' laws on spatial planning explicitly consider the need to exclude for development those areas exposed to natural risks, such as flooding, and they establish use limitations around rivers or aquifers to protect the hydraulic public domain. However it is less common to establish the necessity for prior studies about availability of water resources to carry out the planned actions, as in the Mediterranean regions of Catalonia and Valencia, which have suffered drought effects and flood problems most intensively. All the issues referring to the hydrological system and flood risks are obviously most detailed in the sub-regional instruments, as in Catalonia and Andalusia, but especially in the territorial sectoral plans and the noteworthy experiences of the Basque Country and region of Valencia.

The first regional plan to be approved was the Territorial General Plan of Catalonia in 1994. It established the Catalan territorial model through territorial information, analysis and diagnosis, and territorial strategies and proposals. It also had a clear economic infrastructural orientation and its physical environment analysis is only considered as a basis for future developments (Benavent, 2006; Olcina, 2007). However it is widely developed in the Territorial Partial Plans of all its counties: Terres de l'Ebre (2001-2010) I' Alt Pirineu i Aran (2006), Terres de Lleida (2007), Comarques Centrals (2008), l'Alt Penedès (2008), metropolitan area of Barcelona (2010), Comarques Gironines (2010), and Camp de Tarragona (2010).

Also very interesting is the long experience in regional planning of Andalusia that approved its Regional Spatial Plan later in 2006, but after almost ten years of development. In this

Regional Spatial Plan programs named as “Water and Territory” have also been considered, with an adequate theoretical framework, but none have been developed (COPT, 2006). The restoration of the Guadalquivir River has also been proposed as an example, but without consideration for the rest of the fluvial system (Fig.1). This was addressed later in a regional Director Plan of Riverbanks (Consejería de Medio Ambiente [CMA], 2006). The Sub-regional spatial plans were being made earlier in the most developed and complex metropolitan areas, such as Granada (1999) (Fig.2), Poniente Almeriense (2002) or Bahía de Cádiz (2004), and in those areas with a high degree of environmental protection, such as Sierra de Segura (2003) or around Doñana (2003). All the most dynamic coastal areas and the metropolitan areas of Andalusia have a sub-regional spatial plan: Litoral Occidental de Huelva (2006), Costa del Sol Oriental-Axarquía (2006), Costa del Sol Occidental de Málaga (2006), Levante de Almería (2009), Aglomeración Urbana de Sevilla (2009), Aglomeración Urbana de Málaga (2009), and Costa Noroeste de Cádiz (2011) (Fig.3). In general the hydrological environ is widely considered in all these plans, with the protection and restoration of river areas and flood risk protection, and the improvement of water supply and wastewater treatment, with an integrated management system of the water cycle (Mataran et al., 2010). However, regarding the other sectoral actions to establish the proposals for territorial organization, these plans have generally been limited to forming the projected interventions for each of the sectoral administrations, without a revision of their institution for integration with the future territorial model, and without considering their, sometimes contradictory, effects on this.

#### **4.4 Specific instruments of regional planning related to hydrological aspects**

As mentioned above, in some autonomous communities specific instruments of regional planning related to hydrological aspects have been developed, whose common base is to regulate land use and urban planning regulations in flood areas, based on different zoning and hazard maps of the fluvial territories (Berga, 2011). These documents integrate an hydrological sectoral aspect into the regional spatial planning system, and therefore they are called “territorial sectoral plans” or “territorial action plans” for regulation of river margins or flood prevention.

Traditionally the region of Valencia and the Basque Country have been two of the autonomous communities most affected by flooding in Spain, and therefore they were the first to develop planning documents with particular reference to flood risk management to reduce and/or minimize flood hazards (Olcina, 2007). Given its relevance, the rivers management plan was the first approved among all Territorial Sectoral Plans of the Basque Country. The Territorial Action Plan of the region of Valencia was developed later.

The Territorial Sectoral Plan of the Regulation of the Margins of Rivers and Streams, under revision (2008), was approved in 1998 (Cantabrian basin) and in 1999 (Mediterranean basin), developing and detailing the Regional Guidelines’ chapter about physical environment in the Basque Provinces. According to this, “it has provided in these sensitive areas an integrated treatment with regards to their environmental values, hydraulic problems, and urban potential”. As its name indicates, this Plan establishes the spatial order and regulates uses around rivers and streams based on their “three components: the environmental component, the hydraulic component and the urban component”. From them is made a typological classification of margins, each one with specific management criteria (DMAPTAP, 2008). This constitutes an excellent example of integration in planning, between hydraulic sectoral aspects and territorial (environmental and urban) aspects (Fig.4).

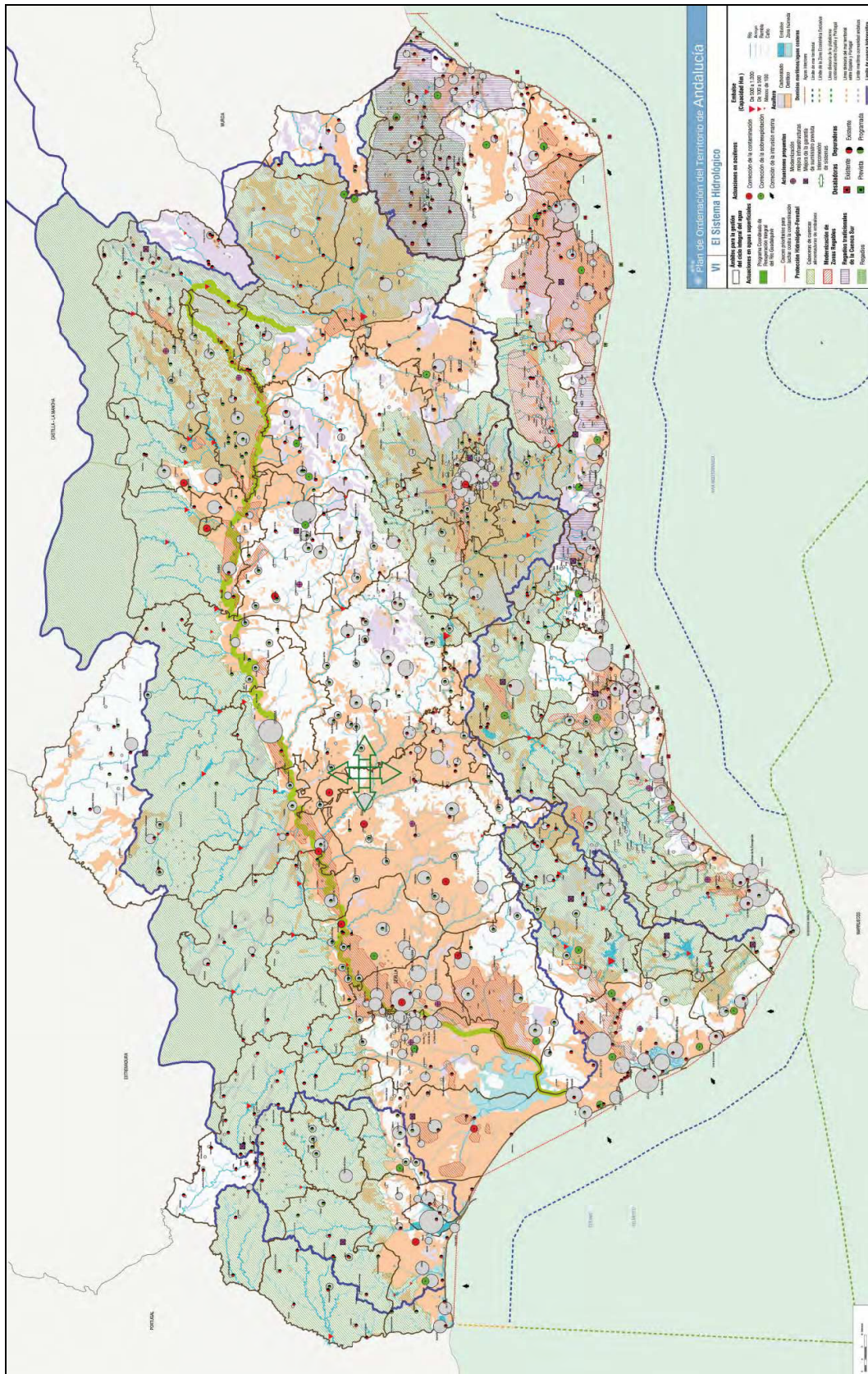


Fig. 1. Regional Spatial Plan of Andalusia. The hydrological system. Source: Consejería de Obras Públicas y Transportes (COPT), Junta de Andalucía (2006)

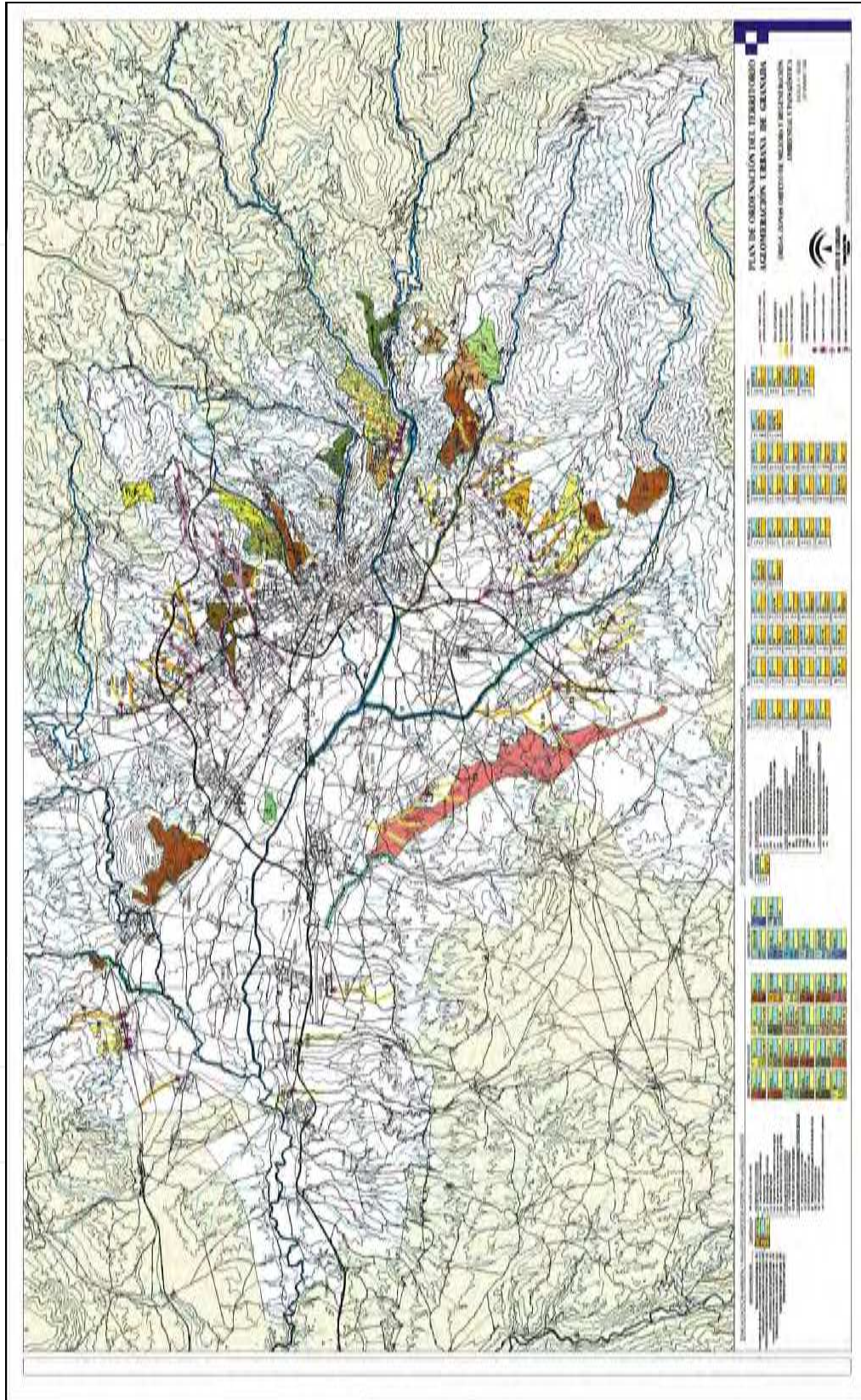


Fig. 2. Sub-regional Spatial Plan of the Agglomeration of Granada. Map of environmental and landscape regeneration areas. Source: Consejería de Obras Públicas y Transportes (COPT), Junta de Andalucía (1999)

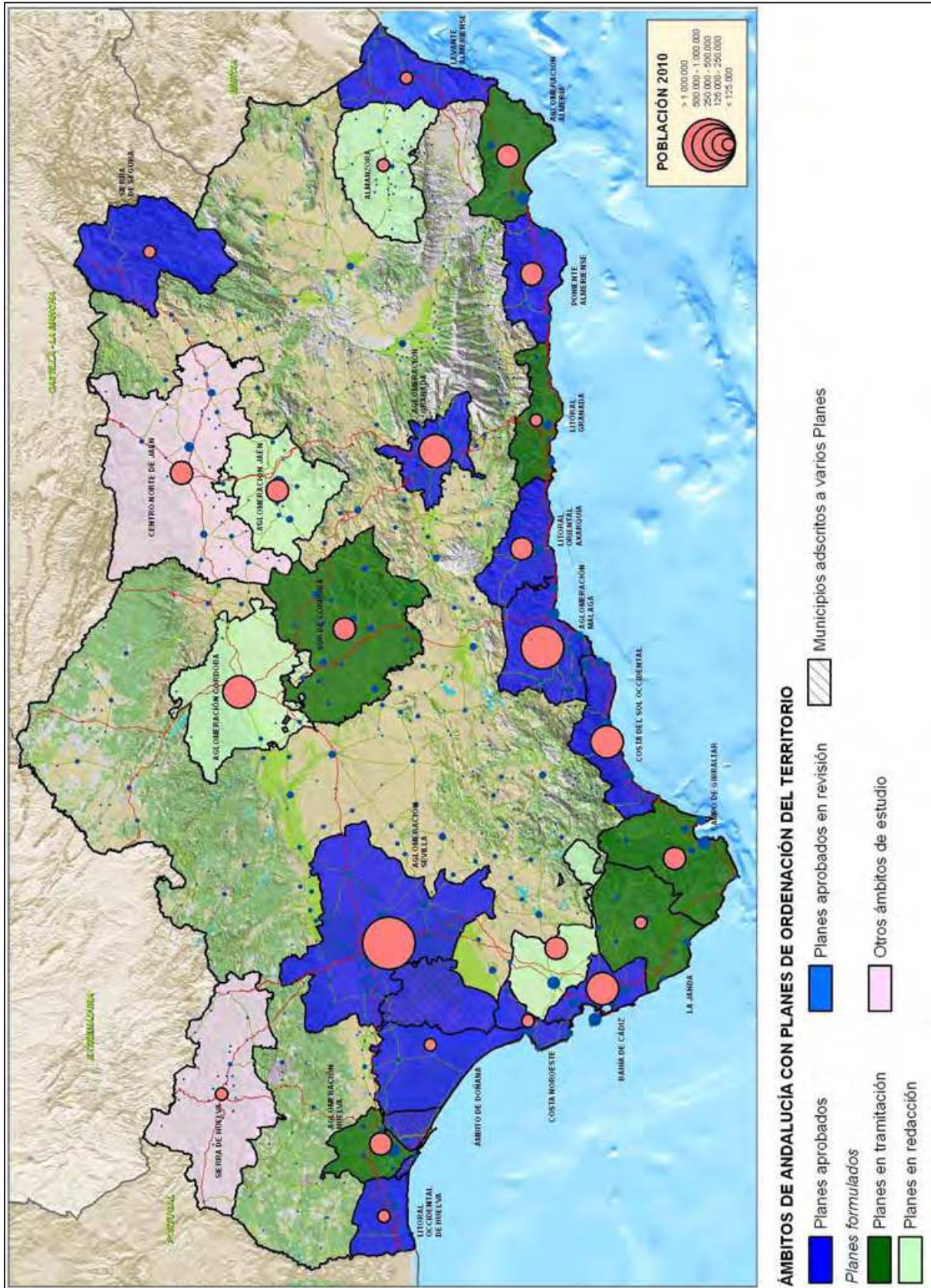


Fig. 3. Status Map of the Sub-regional spatial plans in Andalusia. Source: Consejería de Obras Públicas y Vivienda (COPV), Junta de Andalucía (08-2011).

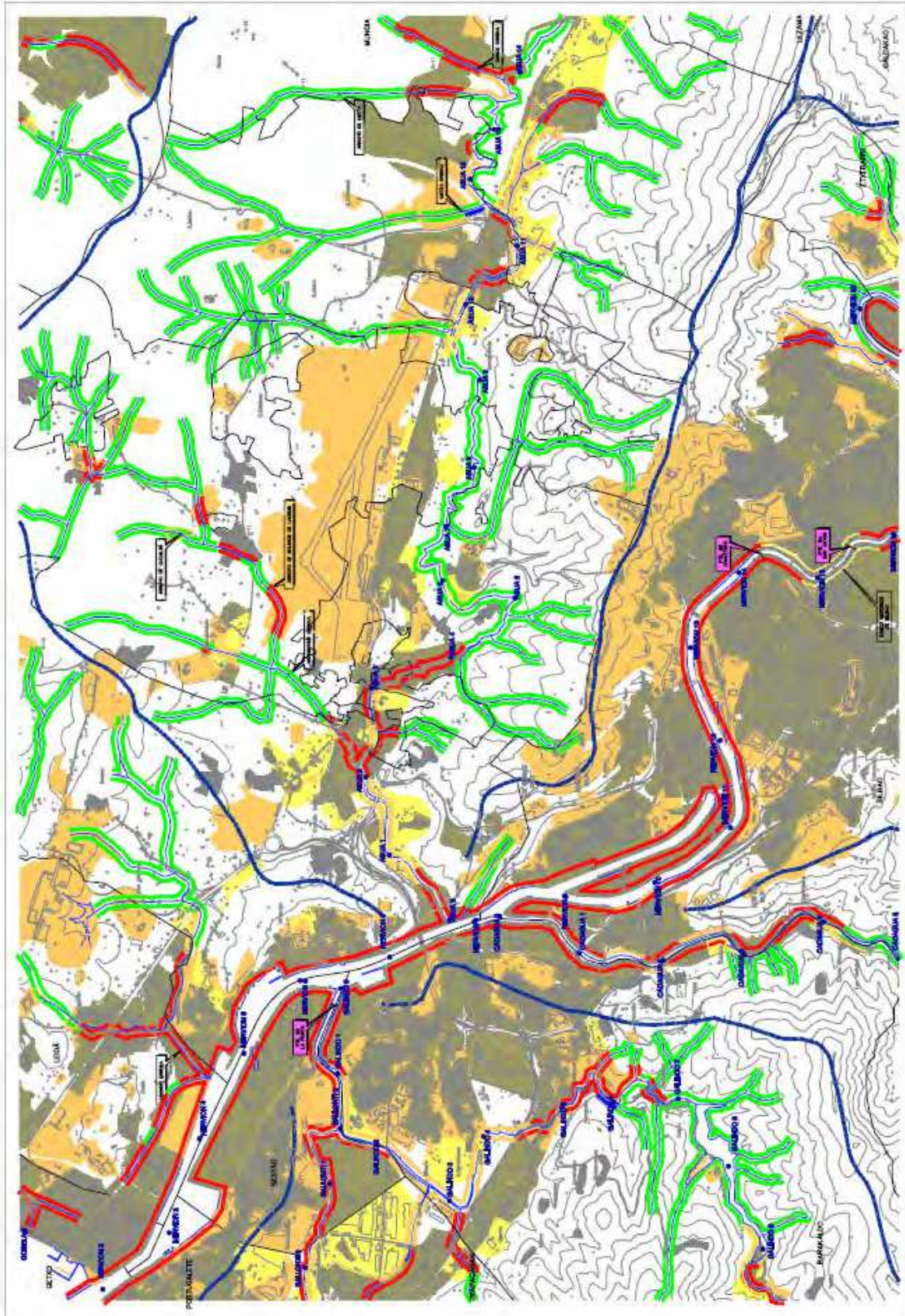


Fig. 4. Territorial Sectoral Plan of the Regulation of the Margins of Rivers and Streams. Sheet 061-II (A-4-08) urban component. Source: Departamento de Medio Ambiente, Planificación Territorial, A.P. (DMAPTAP) Gobierno Vasco (2008).

Another good example of integrated planning is the Territorial Action Plan on the Flood Risk Prevention in the Region of Valencia (2003), which was proposed in the regional planning law (1989). It was developed from flood risk cartography in the second half of the 1990s, and has later been linked to maps of existing and planned urban use. It has also added an action program and regulations for all regional rivers. The proposed actions were based on different measures: structural measures of a remedial character to reduce the actual impact of flooding, hydrological-forestry actions with their dual character of reducing risk and improving the environment, and preventive urban-regional actions which are aimed at avoiding the future impact of flood, and are constituted of land use regulations and building conditions. It defined 278 flood areas, representing 5.4% of regional territory, 73% of municipalities were affected, and 79% of the land affected corresponded to urban areas (Generalitat Valenciana [GVA], 2003) (Fig. 5). It is under revision and since its approval, according to government information (2009), it has prevented the urbanization of 1,428 hectares at risk of flooding.

From a more sectoral perspective Catalonia and Andalusia have both also developed several planning documents. The water agency of Catalonia is developing fluvial space plans, in a detailed analysis of its rivers taking into consideration all stakeholders. The agency has developed a methodology based on analysis of the natural and hydrological processes, to offer a comprehensive and set vision of hydrological-hydraulic, environmental and morphodynamic elements of river space. Their aims are to reach the WFD objectives and to reduce flood risk. There are several fluvial space plans in the process of being drawn up and processed. The Andalusian government, as a first step towards the implementation of a flood prevention plan, approved the flood prevention plan in Andalusian urban riverbeds (2002) (Fig.6). It made a diagnosis of the regional territory to locate vulnerable areas and classify them according to three degrees of risk, and immediate structural works were also proposed to reduce these risks (COPT, 2002) – many of these have been completed.

## **5. New hydrological planning and its integration with regional and urban planning**

The physical environment has, of course, always been a key factor for urban development, and later for regional planning. However hydrological and spatial planning have been autonomous disciplines that have been developed separately, and although water management and spatial planning are clearly and inherently connected they have traditionally been separated for policymaking (Woltjer & Al, 2007). In recent years, and as a result of the implementation of WFD principles, and also the most territorial responsiveness of urban and regional planning fostered under the realization of Strategic Environmental Assessments, little integration has been achieved.

However, although it is evident that water is present in all human activities and any activity and its geographic distribution (even without a direct hydraulic objective) influences its status, generation and circulation, it is accepted today, that the discussion on water policy and planning means putting into question the forms of occupation of the territory and the model of development, and these considerations have needed some decades to be fully accepted, hence, the great complexity as well as the deep territorial significance of the debate on water (Moral, 2009). The approach to water issues still remains strongly sectoral, but softened a little through integration according to the WFD, and from their spatial dimension through urban and regional planning, and similar areas are being promoted.



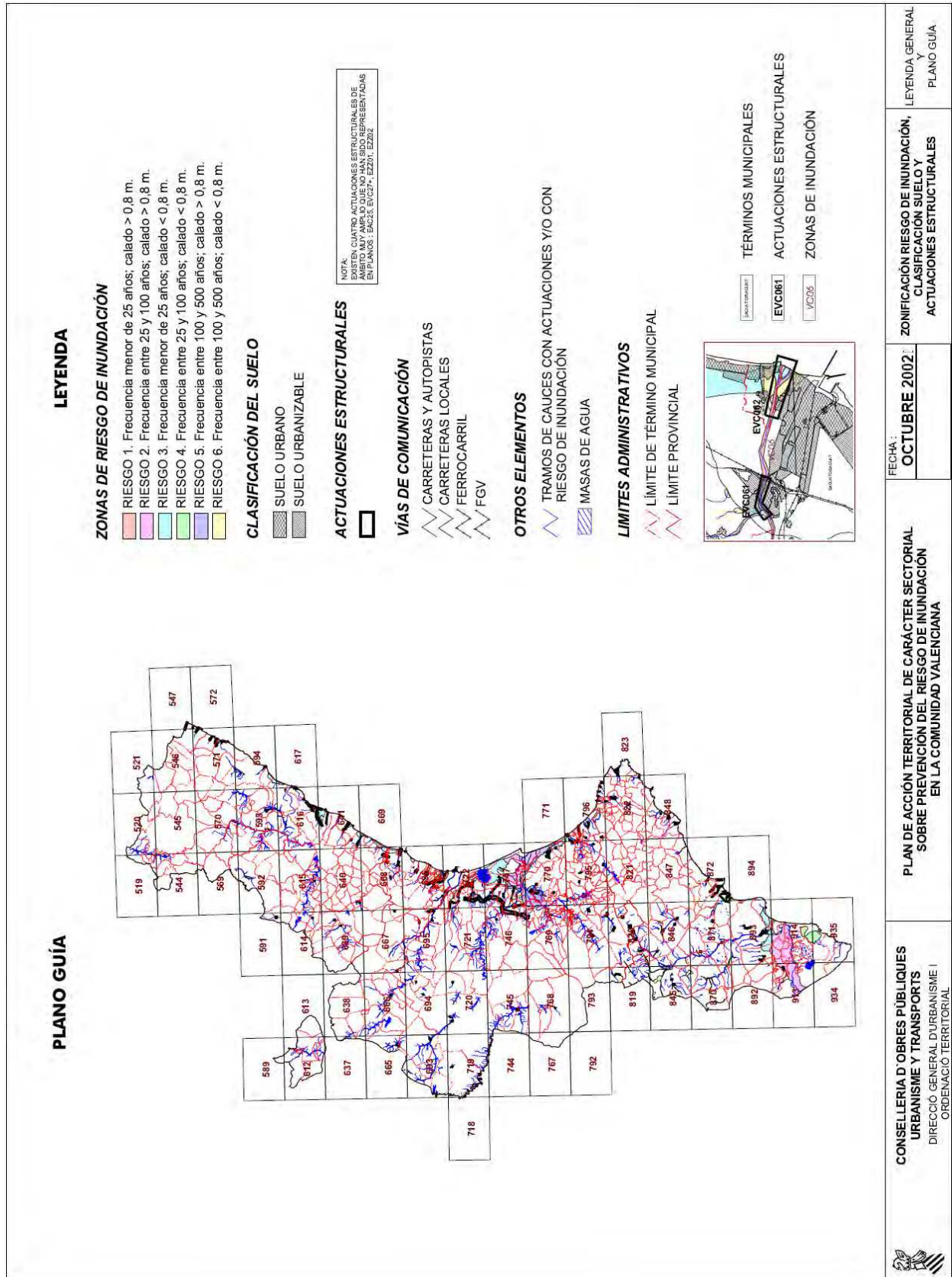


Fig. 5. Territorial Action Plan on the Flood Risk Prevention in the Region of Valencia. Guide map and general legend. Source: Generalitat Valenciana (GVA) (2003).

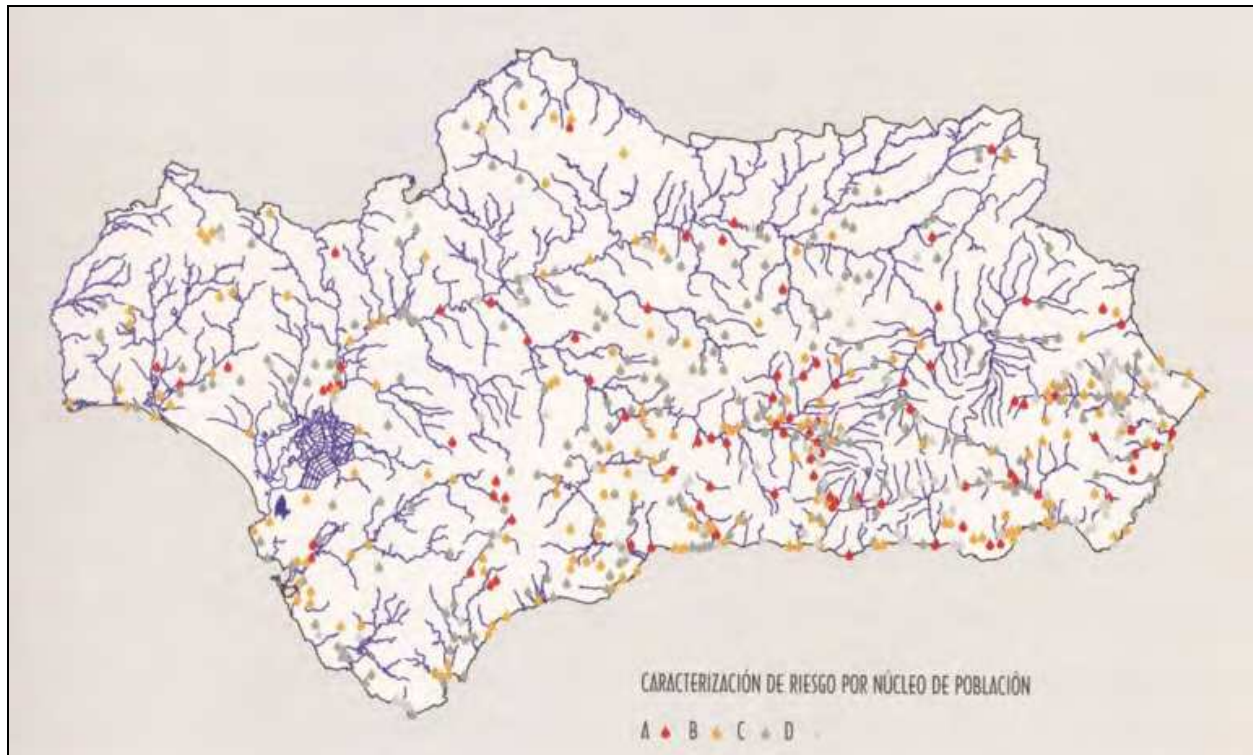


Fig. 6. Flood Prevention Plan in Andalusian urban riverbeds. Risk characterization of cities. Source: Consejería de Obras Públicas y Transportes (COPT), Junta de Andalucía (2002).

From the second half of the 1980s and in the 1990s little consideration was paid in sectoral planning to the potential urban-territorial and environmental effects, and was limited to those considered in the environmental impact assessment. Sectoral planning was prevailing over spatial planning and solely reports. However the necessity of coordination and even integration between different plans was clear.

Some accredited voices called for the strengthening of the water-territory relationship throughout an integrated management water-territory (eg. Gómez Ordóñez, 2006; López Martos 2000). Interactions and interdependencies between water management with spatial planning were obviously increasing with the new discourse of 'accommodating water', in which 'space for the river' was made, not least because of the eroding borderlines between land-use and water functions (Wiering & Immink, 2006). In fact spatial planning has been largely and clearly considered as one of the most effective measures to reduce the negative impacts of floods, restricting or if necessary preventing settlements, facilities and infrastructure in flood plains and areas potentially affected by floods (Berga, 2011; UN/ISDR, 2004; UN/WWDR, 2009). Additionally, well considered spatial planning will upgrade a region's resilience to flooding and its capacity for recovery (Woltjer & Kranen, 2011).

From a spatial planning point of view more complex methodological proposals have been put forward such a "Territorial Planning of Water" from a relational analysis of the hydrological system components and the territorial processes, to the joint planning of infrastructures and land uses, considering resource availability and reducing the environmental impact (Rodríguez Rojas, 2007), later developed to be adapted for WFD implementation (Rodríguez Rojas et al., 2008).

On the other hand, from the hydrological point of view, these reclaimed links between water management and spatial planning or land use planning will come from the Integrated Water Resource Management (IWRM) that has emerged, based on the recognition that the intrinsic complexity of interconnected biophysical, social, economic and political factors can only be addressed by combining and truly integrating social constructivist ideas of participation and empowerment with a cross-disciplinary approach ensuring that social, economic, environmental and technical dimensions are taken into account in the management and development of water resources (Global Water Partnership [GWP], 2000; 2009).

The WFD was the European response to the sustainable and integrated water management exigencies, establishing in 2000 the basic principles of sustainable water policy in the European Union and this has meant a radical change in the management of water resources (Brugge & Rotmans, 2007; Griffiths, 2002; Grimeaud, 2004; Kaika, 2003). One of the principles of the WFD is the integration of sectoral policies as a key factor for the protection of water and its related ecosystems (Moral, 2009, 2010). Its exigent objective of reaching the good status of all aquatic bodies will require significant land use changes (Carter & Howe, 2006; Volk et al., 2009). Thus the WFD is likely to influence spatial planning and prevailing land uses and, although there are no European responsibilities for spatial planning, the EU has gradually been gaining more authority over land use via directives such as this (Voogd & Voltjer, 2009).

The WFD has an approach to integrated river basin management, based on the holistic approach to water management at river basin scale: considering all waters (surface, coastal and groundwater); utilising ecological (biology, hydromorphology and physico-chemistry) and chemical standards and objectives; involving the public in management of river basins; and requiring the use of River Basin Management Planning (RBMP) through a system of analysis and planning based upon the river basin (Griffiths, 2002).

For the implementation of the WFD in Spain from 2003 the traditional river basin authorities were transformed to include, in addition to inland waterways, the coastal and transitional waters. A new administrative body has also been created, the Committee of Competent Authorities (Royal Decree 126/2007) which, in theory, is aimed at cooperation, requiring more than mere coordination between the state administration (the Ministry of Environment) and regional governments (which have responsibilities on both environmental and regional planning), where the hydraulic policy paradigm has changed in the last decades from a centred state administration to a regional government level. However, its regulation does not have an appropriate composition to address the relationships between the state and the autonomous communities, and does not provide a coordinating role, as would be consistent with the concept of integration, but only cooperation (Lopez-Gunn, 2009; Moral 2009, 2010). Thus the political-administrative complexity of the Spanish autonomic system, with some responsibilities shared between the state and the autonomous communities, has led to a lack of coordination in general but also in water policies in particular. The need to enhance and strengthen coordination between regional and state bureaucracies is at the heart of a functioning and effective federal state, and the failure to deliver effective coordination is at the heart of the tensions currently experienced in Spanish territorial politics (Romero Gonzalez 2009, cited in Lopez-Gunn, 2009).

Since the WFD approval, member states have been required to follow a rigorous timetable, establishing a river basin district structure within which demanding environmental objectives have been set, and developing a River Basin Management Plan (RBMP) by 2009 to

achieve their objectives. The implementation of the WFD will be integrated with the Strategic Environmental Assessment (SEA) as required by the directives. This will aid the realisation of the WFD's objectives and ultimately could encourage the sustainable use of water resources. As Carter and Howe (2006) show, this will be by strengthening the content of RBMPs, improving the quality and availability of baseline data, the advancement of integrated consultation and public participation procedures, the development of monitoring procedures and, finally, by encouraging the sustainable management of water resources, and therefore of its territorial dimensions.

Given the relevance of achieving the demanding environmental objectives in this new hydrological planning, with particular consideration for the water environment and with attention to protected areas, clearly, a complete integration of the sectional environmental aspects within territorial planning is called for. On the other hand, the need for accurate evaluation of water demands has required close attention to the studies of the new RBMP relating to the existing territorial dynamics, and also the proposed scenarios in the current urban plans, improving the consideration of spatial dimensions on water consumption by the use of demand units and Geographic Information Systems (GIS), and thus providing more integration with spatial planning. Additionally, a higher degree of integration has been reached in the present hydrological planning process thanks to a high level of public participation in contrast with other planning processes (Grindlay et al., 2011).

As mentioned before, one of the hydrological issues where traditionally the relationship with spatial planning has been most clearly seen is in flood management. Generally its treatment has produced a transition from the merely hydraulic measures such as building dykes (separating water from land use), to considering non-structural actions such as the need to give 'space for the river', from a defensive to an integrated approach (Jonge, 2009), and also usually when all possible structural actions had been made and the problem remained unsolved. Increased flooding has also been more in evidence and, above all, damages generated are due to the alteration of natural systems by humans and to the degradation and loss of hydrological integrity of catchment areas (Blackwell & Maltby, 2006). It is being developed at present, land use change and scenario modelling using GIS for flood risk mitigation and to improve the integration of hydrological and spatial planning (Feyen et al., 2009; Barredo & Engelen, 2010).

As in other countries spatial planning instruments have traditionally been ineffective in controlling developments in floodplains. In fact, as Moss and Monstadt (2008) recognize, "planning regulations to limit urban development on floodplains have in the past generally failed to halt the loss of existing floodplains, let alone encourage the avoidance or even removal of settlements and the restoration of flood plains".

Nevertheless spatial planning policy acts in holistic terms in the sense that it analyzes phenomena and developments by using a contextual perspective, such as a landscape, a region, or an area. Therefore in relation to the treatment of safety and risk around floods, the normative discourse of spatial planners reflects the more open and flexible perspective. Risk assessment, in this view, deals with complex relations between social, physical, and spatial aspects of a particular place or context. As Wiering and Immink (2006) demonstrate, the strategy of spatial planners is focused on the establishment of collaborative planning processes in which different visions of spatial development are communicated and in which the issues are addressed by multiple actors. They are also searching for new

(multi)functional and social relations between water and several types of 'environments' or contexts, by seeking new links between water and other spatial functions, and considering flood hazards to be relative, because the potential impacts of these risks depend on the presence of spatial functions in a particular landscape (differentiated in urban and rural areas) as well as the perceptions of both the place and the risk by people living and working there. The traditional, more restricted sectoral perspective of water management is evolving into new comprehensive concepts such as river-basin management, as well as new environmental and rural initiatives with area-specific policies, similar to the WFD proposals.

However the flood question was not completely addressed in the WFD, and later, another Directive to complement and consolidate it was needed. The new Directive "on the assessment and management of flood risks" (EC, 2007) is focused on flood risk assessment, the preparation of flood hazard maps and flood risk maps, and establishing flood risk management plans, but gives a merely sectoral treatment of this question which then will have a direct influence on spatial planning. Naturally the importance of land use policies and their potential impact on flood risk and its management (agriculture, deforestation, urbanization, land movements, etc.) is recognized. However spatial planning is only mentioned with reference to being taken into account by the new flood risk management plans. It is also stated that these plans may "include the promotion of sustainable land use practices, improvement of water retention, as well as the controlled flooding of certain areas in the case of a flood event", but all of these actions should be put forward in a spatial plan, though this is not mentioned to avoid conflict of responsibilities. They should also focus "on prevention, protection and preparedness", and it is not only with, as mentioned, "a view to giving rivers more space" or "maintenance and/or restoration of floodplains", indicating means, where possible "to prevent and reduce damage to human health, the environment, cultural heritage and economic activity", but also taking into consideration all territorial characteristics around watercourses so it should be provided by or coordinated with, according to the case, spatial planning. However coordination is only mentioned in the Directive in relation to "the reviews of the river basin management plans" required by the WFD, which "shall be carried out with", "and may be integrated into" them.

This Directive has recently passed into Spanish legislation (R.D. 903/2010), and it recognizes the necessity of non-structural actions such as civil protection plans, implementation of early warning systems (AHIS), hydrological and forest watershed corrections, in addition to spatial planning measures, but complementing traditional structural solutions, which have proved inadequate in certain cases. It is also indicated, as mentioned above, that the state land law (2/2008) confers the legal status of rural land to any land which is susceptible to flood risk, and the prevention of such risks is required, thus the need to include maps of natural risks in the spatial planning, and reports from the hydrological administration concerning the protection of the public water domain. Some of the instruments required by the Directive had already been considered in the revised regulation of the hydraulic public domain (R.D. 9/2008), which created the National System of Cartography of Flood Zones, and also by regional water laws, such as in Andalusia (9/2010).

In this Spanish regulation, coordination is not only claimed to be implemented in the general water policy of all basins, implicitly including their RBMP, as indicated in the Directive, but is also extended to urban and regional planning as necessary for the effective prevention and protection described in the current standard. Explicitly article 15 regarding

“coordination with other plans”, states that “urban and regional plans in their land use regulation should not include directives that are incompatible with the contents of the flood risk management plans, and should recognize the rural character of the lands at risk of flooding or other serious accidents” (R.D. 9/2008). This will prevent discrepancies between hydrological and spatial plans in such an important aspect, and the necessary coordination between the state and the administrations of the autonomous community administrations will be definitive, at least on this point.

In addition the relationship with spatial planning has advanced as the content of future plans for flood risk management has been incorporated within urban and regional planning measures, including as a minimum: “limitations on land use for the floodable area with reference to different flood hazard scenarios, and the criteria for considering an area as not to be developed, and construction criteria required for buildings located in a flood zone”. It also incorporates “the measures envisaged for adapting existing urban planning to the criteria outlined in the flood risk management plan, including the possibility to remove existing buildings or facilities that pose a serious risk, and this expropriation shall be considered as public utility” (R.D. 9/2008). Specifically this will resolve many cases of illegal and flood exposed constructions all over the country. For the first time a sectoral planning document makes explicit reference to contents regarding urban and regional planning.

With reference to urban planning, one of the fundamental coordination mechanisms is the report required by hydraulic administration, according to state and regional water laws, and later to state land law, about the water status or domain (Moral, 2009). Additionally recommendations of the regional hydraulic administration are given for new urban planning documents, and particularly on correct consideration of the hydraulic public domain and groundwater limits, and their protection areas; delimitation of the floodplains and areas at flood risk and land use regulations; adequate and assured quality and quantity of urban water supply, and availability of water resources to satisfy urban plan expectations; adequate urban wastewater treatment both current and future, taking into account expected urban growth; the consideration in urban plans of flood plains as transitional elements between the natural and built environment is also recommended, and the need to assign to them functions compatible with flood evacuation and the citizens’ enjoyment of the water environment (CMA-AAA, 2009).

European spatial planning policy guidelines of the ESDP have been expanded by the Territorial Agenda (2007) (towards a European Action Programme for Spatial Development and Territorial Cohesion) to six priorities for spatial development measures, among which are “promotion of trans-European risk management including the impacts of climate change” and the “strengthening of ecological structures and cultural resources as added value for development”. A study for the European Parliament about EU policies with a territorial dimension recognized that the WFD has “significant implications for spatial planning” and “restricts planning for urban development” because, “with its aim of reducing pollution, preserving protected areas and restoring and enhancing bodies of surface water it may easily conflict with urban growth strategies”. But it also pointed out that “in spite of the implications for territorial development of environmental policy, overall coordination between the two does not exist, sometimes leading to policy incoherence” (EP, 2007).

It has been recommended that the territorial dimension be included in the common Strategic Environmental Assessment (SEA), which “contributes to improving and assessing different

alternatives and should consequently increase the degree of positive coordination" (EP, 2007). Even better than this would be the use of Territorial impact assessment techniques for the integration of territorial aspects in sectoral policies (Golobic & Marot, 2011), such as the proposed projects on hydrological planning.

## **6. Conclusions and indications to improve the integration of hydrological and territorial planning**

The difficulties in the relationship of a long history between sectoral and spatial planning have been seen, particularly with hydrological planning, and its evolution.

After this long history of spatial planning, however, little attention has been paid to water issues. Naturally the physical environment has been a key factor for urban development (with topography and drainage as the foundation for these developments), but hydrological and urban and regional planning have been autonomous disciplines that have been developed separately. Only in recent years, as a result of the implementation of the WFD, a certain degree of integration has been reached. Now it has been accepted that water policy and planning is directly affected by the forms of occupation of the territory and the model of development and, conversely, this is limited by the water environment and its availability.

For both hydraulic and spatial planning administrations, the need for the coordination of their respective planning documents has been clearly shown, and some mechanisms have already been established for this, such as mandatory reports, but integration means going beyond the mere requirement to issue reports on the plans of other administrations for mutual problems. This integration appears particularly visibly in the current treatment of flood risk areas, not evident in the European directive, but which have been passed into Spanish legislation. In the recent Spanish regulation on the assessment and management of flood risks, coordination is not only claimed to be implemented in the general water policy of all basins, but is also extended to urban and regional planning as necessary for effective prevention and protection. Regarding this coordination with other plans, it is explicitly stated that "urban and regional plans in their land use regulation should not include directives that are incompatible with the contents of the flood risk management plans, and should recognize the rural character of the lands at risk of flooding or other serious accidents". This will prevent discrepancies between hydrological and spatial plans in such an important aspect, and the necessary coordination between the state and the autonomous community administrations will be definitive, at least on this point. Additionally the relationship with spatial planning has advanced as the content of future plans for flood risk management has been incorporated within urban and regional planning measures, including as a minimum: "limitations on land use for the floodable area with reference to different flood hazard scenarios, and the criteria for considering an area as not to be developed, and construction criteria required for buildings located in a flood zone". It also incorporates "the measures envisaged for adapting existing urban planning to the criteria outlined in the flood risk management plan, including the possibility to remove existing buildings or facilities that pose a serious risk, and this expropriation shall be considered as public utility". In particular this will resolve many cases of illegal and flood exposed constructions all over the country.

However both disciplines remain autonomous and greater integration is required. The current implementation of the WFD ensures a certain advance in integration with the

territorial dimension due to the broad consideration of environmental aspects, the uses and demands for water, public participation in the planning process and even the land uses with regards to their effects on the water environment. One of the principles of the WFD is the integration of sectoral policies as a key factor for the protection of water and its related ecosystems. In this sense, the WFD is likely to influence spatial planning and prevailing land uses in and around water environments, given its objective of reaching the good status of all aquatic bodies that will require significant land use changes. According to the relevance of achieving the demanding environmental objectives in the current hydrological planning, with particular consideration for the water environment and with attention to protected areas, clearly, a complete integration of the sectional environmental aspects within territorial planning is called for, but all land uses should be also considered. Moreover, the need for accurate evaluation of water demands has required close attention to the studies of the new hydrological plans relating to the existing territorial dynamics, and also the proposed scenarios in the current urban plans, improving the consideration of spatial dimensions on water consumption by the use of demand units and Geographic Information Systems (GIS), and thus providing more integration with spatial planning.

The recent recommendations of the hydraulic administration for new urban planning documents are a minimum basis to integrate spatial and hydrological plans, and they should be comprehensively considered, specifically: the correct consideration of the hydraulic public domain and groundwater limits, and their protection areas; the delimitation of the floodplains and areas at flood risk and land use regulations; the adequate and assured quality and quantity of urban water supply, and the availability of water resources to satisfy urban plan expectations; the adequate urban wastewater treatment both current and future, taking into account expected urban growth; and the consideration in urban plans of flood plains as transitional elements between the natural and built environment, and the need to assign to them functions compatible with flood evacuation and the citizens' enjoyment of the water environment.

Additionally, regional spatial planning now has to deal with the difficulty of establishing future scenarios with an increasing uncertainty, and it is becoming more strategic and flexible in character, adopting a broad consensus about prime objectives, as established for water issues in the WFD. However it is necessary to advance with a more strategic and broader perspective, introducing water considerations into regional planning, and vice versa, jointly considering an explicit territorial model or strategy of territorial development, for greater improvement of regional potential and territorial capital.

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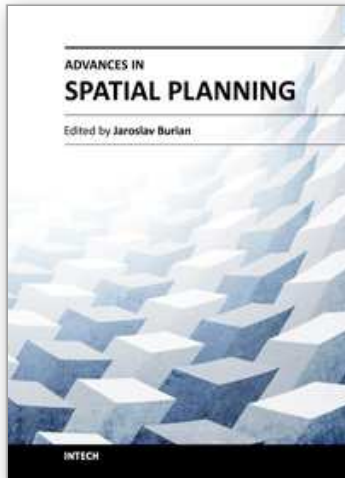
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Spatial planning is a significant part of geosciences that is developing very rapidly. Many new methods and modeling techniques like GIS (Geographical Information Systems), GPS (Global Positioning Systems) or remote sensing techniques have been developed and applied in various aspects of spatial planning. The chapters collected in this book present an excellent profile of the current state of theories, data, analysis methods and modeling techniques used in several case studies. The book is divided into three main parts (Theoretical aspects of spatial planning, Quantitative and computer spatial planning methods and Practical applications of spatial planning) that cover the latest advances in urban, city and spatial planning. The book also shows different aspects of spatial planning and different approaches to case studies in several countries.

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Unit 405, Office Block, Hotel Equatorial Shanghai  
No.65, Yan An Road (West), Shanghai, 200040, China  
中国上海市延安西路65号上海国际贵都大饭店办公楼405单元  
Phone: +86-21-62489820  
Fax: +86-21-62489821

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