THE MEDITERRANEAN, A RISK REGION. A VIEW FROM SPAIN

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> "But when the gods purify the earth inundating it with water, those who live in the hills shall be saved whilst those who live in our cities shall be carried away by the rivers to the sea"
>
> Plato. *Timeo*

"Without evoking any determinist ideas… Mediterranean civilisation surely owes much to its struggle against nature which has imbued its people with toughness and tenacity"… this was one of the five significant geographical elements which Orlando Ribeiro highlighted when determining the physical environment in his book "*Mediterrâneo"* (1962). Indeed it is so. The human being has constantly adapted to the conditions of the physical environment in the Mediterranean basin, which at times has been a fluid dialogue and at others ferocious dialectic. The paradox is that when one speaks of "what is Mediterranean" from the point of view of the physical environment, this is usually invested with features such as peacefulness, placidness, wellbeing and light. This is the impression which invades Kapuscinski's narratives when he describes Algiers in his "Travels with Herodotus": "I had never been in a place where nature was so kind and benevolent to the human being. Everything was there and all at once: the sun, the freshness of the breeze, the transparency of the air and the silvery gleam of the sea." Or the emotion Fabriel Miró feels when he describes in his lyrical prose, the sensations of a Mediterranean summer: "a flat sea, static, blind, looking at the rounded sun spreading a coppery glow over the closely-knit secrets of a sown field… and above it all, the breath of magnitude, the haze of salt and honey of the Levantine summer when dusk falls" (*Años y Leguas*, 1928).

The Mediterranean area does, however, also have an unfriendly face with regard to the behaviour of the natural elements: the development of extreme natural phenomena causing damage and on many occasions, deaths. This is well explained by F. Braudel in his “Memorias del Mediterráneo”: “we tend to believe too much in the gentleness, the spontaneous ease of Mediterranean life. The charm of the landscape easily misleads. Cultivable land is scarce, arid or largely infertile, mountains abound; rainwater is badly dispersed: it is abundant when the vegetation is at rest in winter and disappears when the budding plants most need it..” and he soundly adds: “the climatic drive of the Mediterranean can break down, the rain can become over abundant or insufficient, the capricious winds may inopportunely bring in their wake a drought or excess of water or spring frosts…” Neither is it just the weather and the climate that bring excesses. The tortuous geology of the contact area between the European and African tectonic plaques has also conditioned the development of Mediterranean societies. As Braudel states “earthquakes and eruptions relentlessly mark the past and threaten the present of the Mediterranean countries”.

The Mediterranean then, is made up of contrasts, adaptation and struggle against a physical environment which offers resources but also troubles. This less kindly face hardly appears when the significant geographical features of the Mediterranean lands are described but it is, without a doubt, one of the elements which provide it with territorial personality and which has acquired outstanding protagonism since the fifties of the twentieth century up until now.

The Mediterranean is a risk region, that is to say, a geographical space which is affected by several natural hazards affecting the populations, settlements and activities installed there, even to the point of momentarily or structurally preventing the development of a normal life in these societies. .

In 1975, the Plan of Action for the Mediterranean, an observatory aimed at the responsible management of resources in the Mediterranean basin, started an awareness programme – with a wide scope of vision – regarding environmental issues in this geographical area. Twenty years later, the review of the “Blue Plan” of the Mediterranean included the creation of a series of diverse reports about environmental, territorial and socio-economic aspects aimed at offering guidelines for the countries

involved in sustainable management of the area and its resources. One of them, on "*Natural risks*" (Les Fascicules du Plan Bleu, 1997), defined the future scenario of natural riskiness on the horizon of the year 2025, highlighting five aspects which would mark the evolution of this issue:

- urban concentration
-the sensitivity of the civil protection operational system for the management of emergencies
-environmental changes
-human actions liable to aggravate the environmental dynamics
-social sensitivity towards risks

A decade after the publication of the said report it must be pointed out that no further proposals for regional analysis of the natural risks in the Mediterranean basin have been made. The predictions made in it are being fulfilled, through a process of increased risk against extraordinary natural events which are not due to an increase in the development of natural hazards but in the multiplication of vulnerability and exposure to the said hazards. This is the most outstanding characteristic in the analysis of natural risks in the Mediterranean area and this trend is likely to continue over the next few decades. The issue therefore requires a regional vision, due to the existence of common causes in all the countries bordering on the Mediterranean.

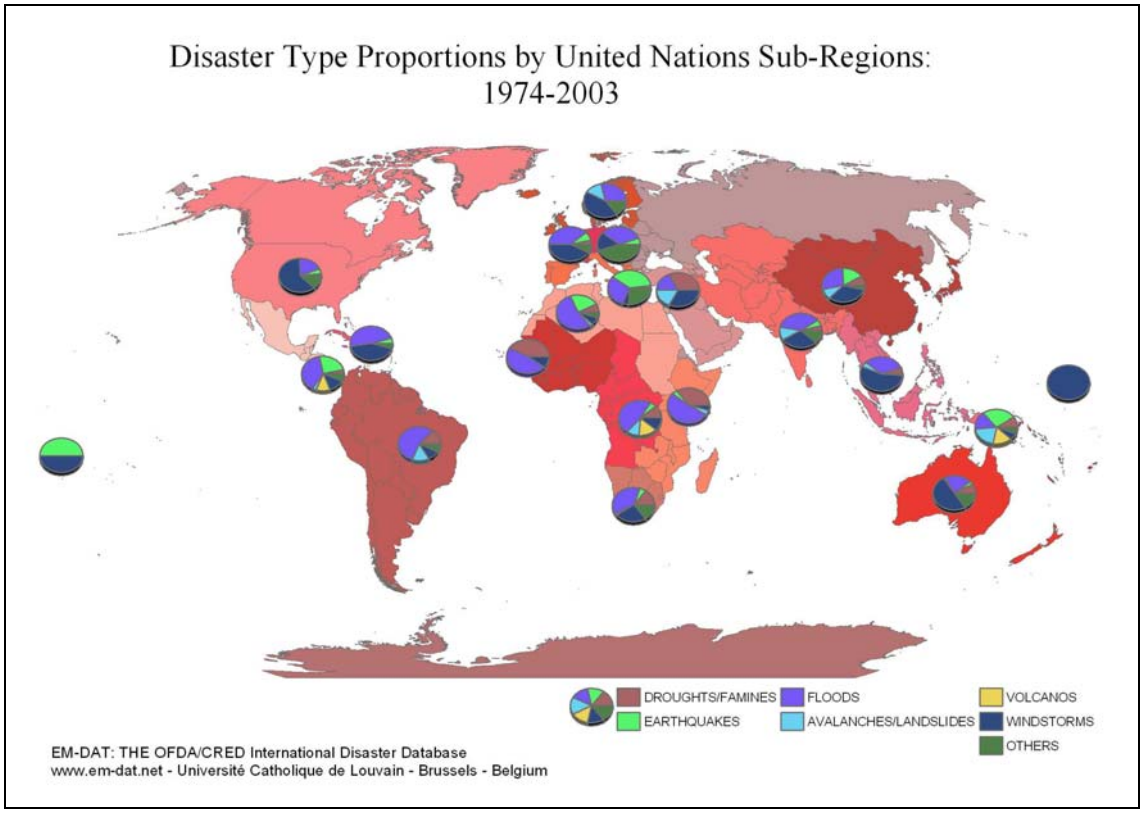
I. The Mediterranean, a geographic power with rising risks

There is a risk which makes the Mediterranean original in its characterization as a risk-region on a worldwide scale: the combination of almost all natural hazards existing throughout the earth's territory in these same lands. Indeed, the Mediterranean suffers from the highest geological hazards: volcanicity and seismicity; geomorphological risks such as landslides and erosion; forest fire, due to the particularly inflammable vegetation which may lead to mortal victims; and a large range of atmospheric hazards, among which the most frequent are: torrential rains, droughts, extreme temperatures, tornados, hail stones, wind storms. Only tropical hazards are avoided.

The actual geographic situation plays a major role, in contact, on the one hand, between the tectonic plaques (African and European) forming one of the most seismically active

areas of the earth's surface, and on the other, in the passageway of two general atmospheric circulation dominions (subtropical and temperate), which, by its nature, becomes a passageway of access to air masses and contrasted weather/time types. The first trait has led to the formation of young reliefs which form a peripherical border all along the Mediterranean basis. The energic nature of these reliefs and the presence of easily erodible materials in many cases, promotes the development of erosive procedures. In this respect, the Mediterranean basin has been characterised as one of the planetary areas with the highest risk of desertification within the framework of the United Nations Fight against Desertification Programme. The second trait confers the Mediterranean basin with the possibility of developing climatic hazards of subtropical and polar-temperate origins, i.e. the highest number of possible events in existence for the whole of the planet (see figure 1).

Figure1.Typology of natural disasters, leading to human deaths, on the earth's surface. In the Mediterranean basin floods and earthquakes are prominent.

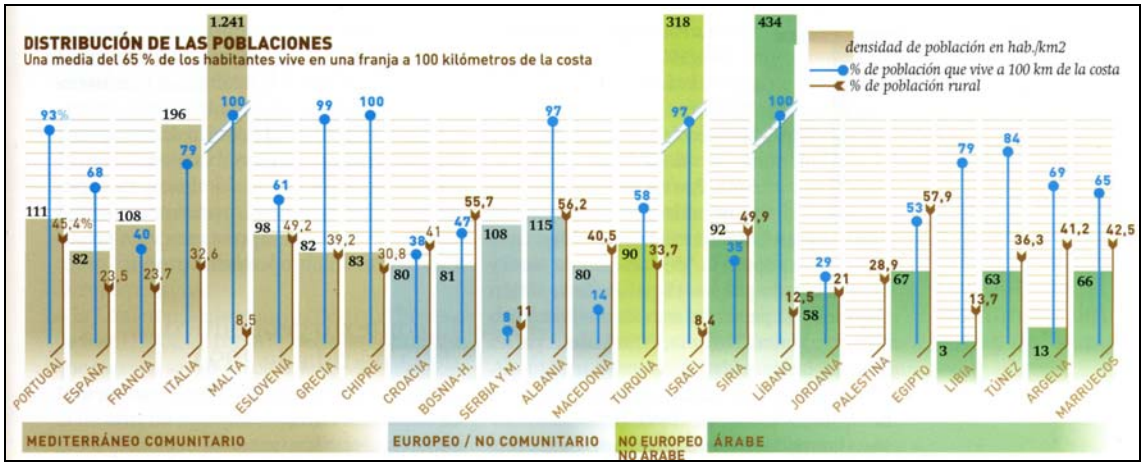


Source: EM-DAT. Catholic University of Louvaine)

To this may be added the reality of a dynamic, growing population (somewhat over 200 million inhabitants) which increasingly accumulates in coastal urban areas where the

fundamental economic activities are concentrated in the different bordering countries (see figure 2).

Figure 2. Demograpic densities and population distribution in the countries bordering on the Mediterranean (2005)



Source: Vanguardia Dossier nº 17, 2005.

POPULATION DISTRIBUTION An average of 65% of the population live in a strip 100 kilometres from the coast Population density of inhab. km2 % of population living 100 km from the coast % of rural population
PORTUGAL/SPAIN/FRANCE/ITALY/MALTA/SLOVENIA/GREECE/CYPRUS/CROATIA/BOSNIA-H/SERBIAAND M/ALBANIA/MACEDONIA/TURKEY/ISRAEL/SYRIA/LEBANON/JORDAN/PALESTINE/EGYPT/LIBIA/TUNISIA/ALGERIA/MOROCCO
E.E.C.MEDITERRANEAN/NON E.E.C.EUROPEAN/NON EUROPEAN, NON ARABIC/ARABIC

This confronts us with another of the characteristic traits in the risk analysis of the Mediterranean basin, the increased vulnerability and exposure to natural hazards which have occurred during the last few decades, within a process which will doubtless continue in the future. The consequence of this has been a very high number of deaths through natural hazards in the last twenty five years in Mediterranean countries as a whole (close to 100,000 people) (see table 1).

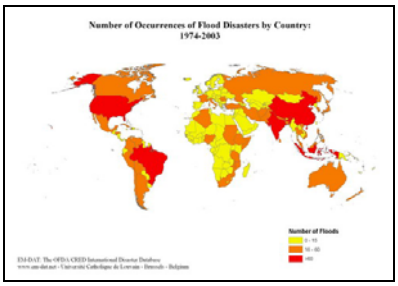
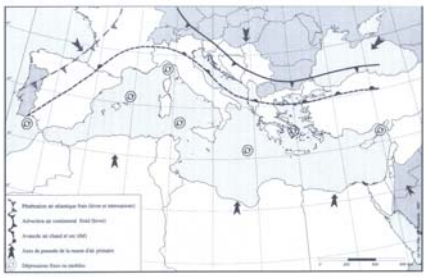
TABLE 1
NUMBER OF VICTIMS FROM NATURAL DISASTERS IN THE MEDITERRANEAN BASIN (1980-2006)

Country	Total	Droughts	Earthquakes	Epidemics	Extreme temperatures	Flood	Landslides	Forest fires	Wind storms
Albania	163	0	1	7	71	19	57	0	8
Algeria	6626	12	5160	1	40	1349	15	22	27
Croatia (became independent from Yugoslavia in 1991)	836	0	0	0	833	0	0	1	2
Egypt	1340	0	562	0	57	626	34	0	61
Slovenia	290	0	1	0	289	0	0	0	0
Spain	15659	0	0	2	15216	185	84	60	112
France	21538	0	0	21	20934	173	64	32	314
Greece	488	0	242	0	109	46	0	38	53
Israel	31	0	0	12	0	11	0	0	8
Italia	25341	0	4770	3	20108	164	221	8	67
Libya	0	0	0	0	0	0	0	0	0
Morocco	1654	0	628	0	0	979	32	0	15
Serbia-Montenegro	21	0	1	0	6	14	0	0	0
Syria	118	0	0	0	0	6	80	0	32
Turkey	21799	0	20495	35	97	565	524	13	70

Source: EM-DAT. Catholic university of Louvaine.

It is true that during this period genuinely catastrophic events took place in some Mediterranean countries: earthquakes in Algeria in 1980 and 2003, earthquake in Turkey in 1999, earthquake in Southern Italy in 1980, floods in Algeria in 2001, floods in Morocco in1995, floods in Egypt in 1994, waves of Saharan air in the summer of 2003 in France, Italy and Spain, wind storm in France in 1999 and several floods in the latter three countries at different times during the eighties and nineties. However, the fact that these disasters occurred confirm the existence of the high threat of these natural phenomena in the Mediterranean basin (see table 2).

TABLE 2
SUMMARY TABLE OF NATURAL HAZARDS CAUSING THE MOST VICTIMS IN THE MEDITERRANEAN

SEISMICITY		**Most affected countries**: Turkey, Greece, Algeria, Italy, Spain, Albania, Croatia, Bosnia-Herzegovina, Sector of tectonic plaque contact (African and European). Associated with this is the existence of volcanicity in Southern Italy.
FLOODS		**Most affected countries**: Algeria, Morocco, France, Italy, Spain, Turkey Risk calendar: spring and autumn months
DROUGHTS AND HEATWAVES		**Most affected countries:** Algeria, Morocco, France, Italy, Spain, Greece, Turkey, Slovenia, Croatia Droughts without any fixed seasonal appearance or development. Heatwaves: June, July and August

Own production

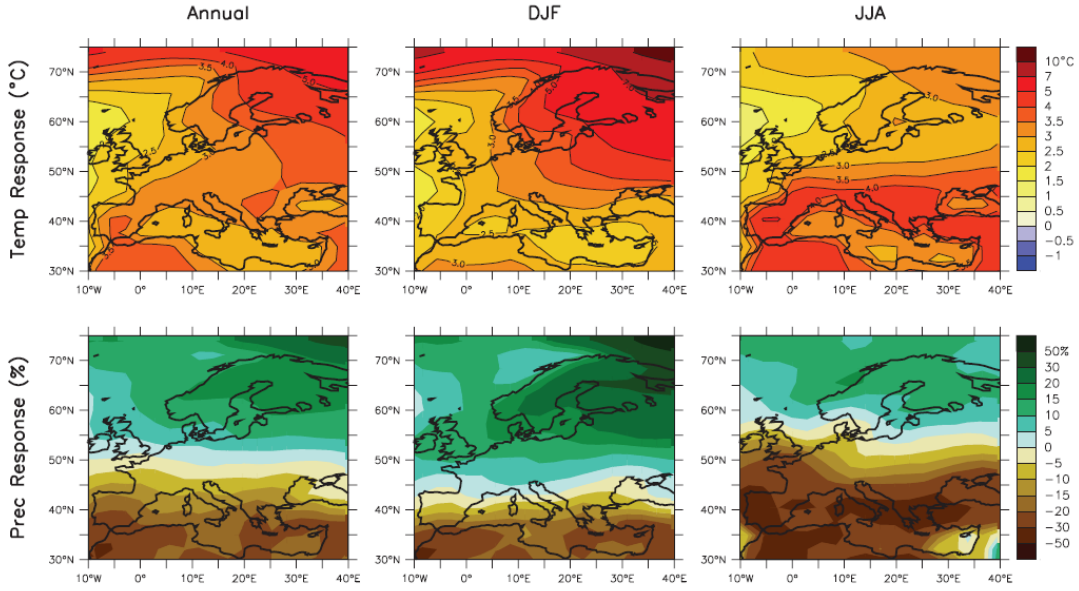
The risk of desertification must be added to these hazards, which, in the Mediterranean basin has a singular affect within the context of the planet. Furthermore, this process is two-fold in origin; natural desertification through erosive processes in favour of lithological conditions, slopes and extreme atmospheric phenomena (intense rains); and "anthropic" desertification due to the accelerated increase of artificial surfaces (urban development, installation of infrastructures, etc.) which lead to a loss of fertile soil through the radical transformation of it usage. Due to this, the Mediterranean basin

constitutes one of the working areas of the United Nations Programme against Desertification and Drought, for its special conditions affecting both processes

Within this context, the foreseeable results of climatic change through the greenhouse effect in the Mediterranean basin will not contribute to reducing the consequences of the climatic dangers but completely the opposite. The latest IPCC (2007) report underlines a more than probable increase in the frequency of the development of extraordinary atmospheric events, essentially floods, droughts and heatwaves. This will only increase the level of risk by also increasing the danger.

Lower availability of water for a growing population, particularly in the North of Africa and the frequent development of pluviometric torrential phenomena are the atmospherically caused processes which will characterise the increased risk in the Mediterranean basin. (see figure 3).

Figure 3. Effects of the climatic change through the greenhouse effect on the temperatures and precipitations of the Mediterranean basin



Source: IPCC report IV, 2007

We are therefore facing a decisive moment in recent Mediterranean history because the consequences of climatic change are no longer a lower risk than natural dangers.

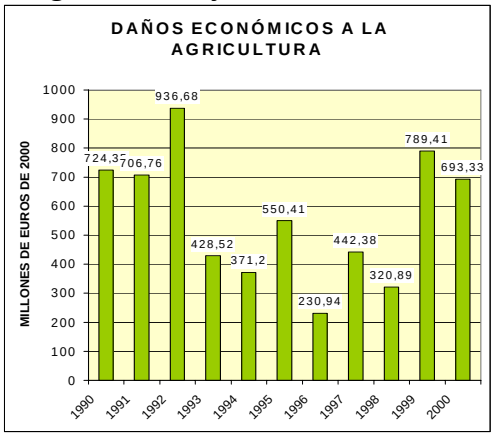
Instead, unless risk reduction programmes are put into practice, these dangers will increase, together with all that this may entail for the alteration of the socio economic dynamics of the Mediterranean countries.

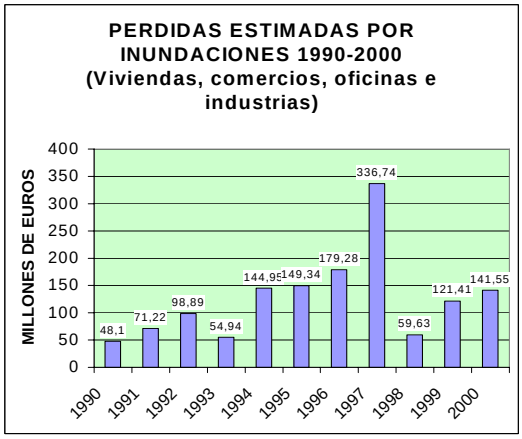
II. THE "COASTAL DEVELOPMENT RISK" IN MEDITERRANEAN COUNTRIES. THE SPANISH EXAMPLE

The Mediterranean is, as we mentioned before, a risk. region for natural dangers; one of the most important within the worldwide context, due to the coincidence of a complex and difficult physical environment and a dynamic growing population which to a large extent, is accumulating in coastal areas.

The Spanish Mediterranean coast is literally a unique risk analysis laboratory of all these traits in this regional context. Spain is, in fact, one of the geographical spaces in Europe most affected by natural hazards, due to its actual geographic position, the fact it is a peninsula surrounded by seas, its topography and human occupation of its territory which has been present throughout history. The financial conditions brought about by extraordinary atmospheric phenomena represent, depending on the years, between 0.15% and 1% of the .G.N.P., a high percentage of the same (60-70%) corresponding to the agrarian sector. During the 1990-2000 period, annual losses through natural risks in Spain rose to 7,350 million € (see figure 4).

Figure 4. Financial losses due to meteorological dangers in the agrarian sector and damages caused by floods in urban sectors





Source: IGME and Insurance Compensation Consortium.

Financial damages to agriculture Estimated losses due to floods 1990-2000

Millions of euros (Buildings, shops, offices and industries)

Millions of euros

During the 1995-2005 decade 704 deaths were registered in Spain due to natural disasters: on average 70 victims per year. Sea winds and floods are the natural hazards causing the highest number of victims.

The last twenty five years have been prodigious in natural hazards and especially in extreme atmospheric events. The serious drought at the beginning of the said period was touched by flood episodes in the Mediterranean area (Levant and Catalonia, October and November of 1982) and Basque Country (August 1983). New floods attacked the eastern side of Spain in 1985 and 1986; the first week of November 1987 was even more harmful, with serious damage in the Valencian comarcas of La Ribera and La Safor and overflowing of the Segura en la Vega Baja, which was to lead to the initiation of the emergency defence plans of the watercourses in the basins of the Júcar and Segura. 1988 was an extraordinary year for the number of hail storms which destroyed the Spanish countryside (June and July), whilst 1989 was thwart with drought (more hydrological than atmospheric) in the North of Spain (Basque Country) and serious floods, on the other side, in the Mediterranean area (Levant, Balearic Islands, Malaga). During the first half of the 1990's further disasters were added to this, the hard and prolonged drought in the central, south and southeast regions of Spain, the intensity of which was emphasized during the course of successive agricultural seasons reaching a rare level of alarm in the hydrological year of 1994-95. This continued lack of rainfall came to an abrupt end in the south and centre of the Iberian Peninsula in December 1995 and January 1996 with heavy rains. These rainstorms were repeated in Andalusia during the month of December 1996, with serious floods in the provinces of Huelva, Cadiz and Seville.

Due mention must be made, of the sudden overflow of the Arás riverbank, with its disastrous results, in August 1996 which, in a torrent of water, caused the death of 86 people who were enjoying their holidays in the Huescan Pyranees, the floods of Alicante on 30th September 1997 and those of Badajoz in November of that same year. In October 2000 a new episode of torrential rains shook the Valencia Community causing serious financial losses.

Two tremors altered the normality of the Murcian municipalities of Mula (1999) and Lorca (2005). In April 2002 a storm in the Canary islands caused damage and victims in Tenerife, particularly in Santa Cruz. The situation of extreme heat experienced in Europe during the summer of 2003 left 142 deaths in Spain. Again, in 2005, the two most important natural hazards of socio-economic and territorial consequences to take place in Spain (floods and droughts) rudely showed their face. Drought caused high financial losses and promoted the development of numerous forest fires; Autumnal floods in the Mediterranean coast caused four deaths in Catalonia. The latest major events linked to torrential rains took place in Autumn 2007, in several locations on the Mediterranean coast (Community of Valencia and the Balearic islands) and Andalusia, which claimed another 6 victims and high financial losses (see table 3).

What is striking is the fact. that the risk of natural hazards increases as man's exposure to new dangers increases. Thus the floods and windstorms have combined with heatwaves and avalanches as new risk agents provoking a high number of victims (235 and 60 deaths respectively between 1990-2004) and tornados which increased a great deal from 1995 onwards.

TABLE 3
MAJOR DISASTERS FROM ATMOSPHERIC CAUSES OCCURRING IN SPAIN IN THE LAST 50 YEARS

1956	February frosts. Great losses in the countryside.
1957	Flooding of the Turin in Valencia. October.
1961	Floods in the Vallés (Barcelona). September. 794 deaths
1973	Floods in the southeast of the peninsular. October. 250 deaths
1978-84	Iberian drought sequence
1982	Floods in the provinces of Allocate and Valencia. October. Break-down of the Tous dam (Júcar river)
1983	Floods in the Basque Country. August. Very serious damages.
1984	"Hortensia" cyclone on the Contrarian coast. October
1987	Floods in the Segura and Júcar basins. November. Anti-flood plans.
1989	Floods in the Mediterranean coast. September. Floods in Malaga. November.
1989-90	Drought in the Basque Country
1990-95	Iberian drought sequence
1995	Flooding in Andalusia. December
1996	Biescas (Pyrenees) camp site disaster . August. 87 deaths
1997	Floods in Alicante. September. Flooding in Badajoz. November

2000	Floods on the Mediterranean coast. October.
2000-2001	Autumn-Winter with heavy rainfall in the centre and north of Spain. Frequent flooding of the major peninsular rivers.
2002	Flooding in Tenerife. March. Floods in the Community of Valencia. April and May.
2003	Heatwave. July-August. 142 deaths.
2004-05	Iberian drought
2005	Earthquake. Several parts in the region of Murcia.
2005	Flooding in Catalonia. October 4 deaths.
2007	Flooding in Andalusia and Mediterranean coast. 6 deaths.

Own production

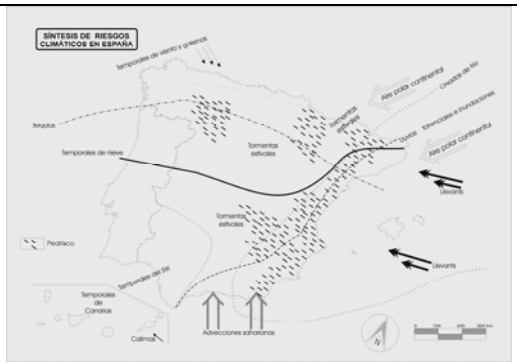
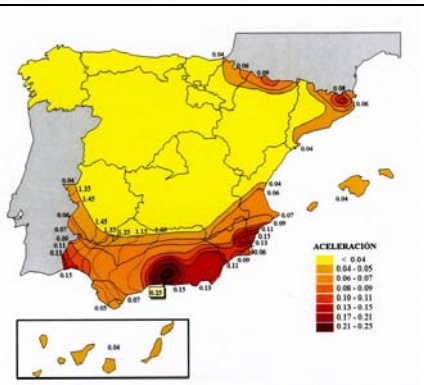
The Iberian Peninsula is party to an extensive range of natural hazards due to its actual geographic location and its relationship with the seismic activity areas (tectonic plaques) and areas of general atmospheric circulation.

The list of natural hazards in Spain, ranked according to socio-economic and territorial importance plus frequency of appearance, is as follows:

1-Abundant or torrential rains with flooding effects
2-Drought sequences
3-Wind storms
4-Cold and heat waves
5-Hail storms
6-Avalanchess
7-Seismicity

Very local phenomena may be added to this, such as tornados, lightening or landslides caused by rains, but lower in incidents. Hazards of a climatic nature are the main cause of the loss of human lives and economic damages annually recorded in Spain. The maps attached show the territorial distribution of the most important natural hazards in Spanish territory (see figure). Out of these, torrential rains with flooding effects and drought sequences are the episodes of extraordinary range which cause the most financial and territorial effects in Spain, without neglecting the importance of deaths linked to windstorms giving rise to intense swells along the coastline, as previously demonstrated.

Figure 5. Summary of the most important natural hazards in Spain

CLIMATIC RISKS IN SPAIN	SEISMIC DANGER IN SPAIN
	

Source: IGN and own production

Summary of climatic risks in Spain	Summer storms	Continental polar air	Acceleration
Wind storms and violent NW wind	Summer storms	Cold waves	
Droughts	Saharan advections	Torrential rain or floods	
Snow storms		Continental polar air	
Hailstones			
SW storms		Llevants	
Canary Island storms		Llevants	
Mists			

The catastrophe of the Biescas (Pyrenees, Huesca) camp site, in August 1996, with its 86 deaths, occurring within the context of current environmental thought, fully immersed in the hypothesis of climatic change owing to the greenhouse effect, set off a scientific and social debate on the possible repercussions of the said “change” in the increase of natural hazards. Notwithstanding, up until the present time, there has been no marked increase in torrential rains with flooding effects during the last few years. In fact, research into the effects of natural hazards occurring in Spain throughout the twentieth century and with detailed examination of the second half, allow us to conclude that since the 1970’s, victims of natural hazards have continuously fallen, probably the result of the reduction of infra-housing and the considerable investments in public works that has taken place, for its mitigation.

On the contrary, it may be affirmed that the risk of these natural hazards has increased, as the population has grown, as has the intensive occupation of land in some Spanish regions. This is a reality for the case of the two natural hazards which have the highest territorial and socio-economic effects in Spain: floods and drought sequences.

The previously mentioned flood episodes, plus the most severe floods on a human level in the last forty years, that of September 1962 in the Besós (Barcelona) basin, with almost 800 deaths, that of October 1973 Granada-Almería-Murcia with almost 300, that of October 1982 –floods caused by break-down of the Tous dam- with 38 deaths, the floods in the Basque Country in August 1983 with 40 deaths, or the episodes occurring between September and November 1989 in the Spanish Mediterranean territory, with 42 deaths, have one common characteristics, that of being *lightening floods,* torrential floods, in small and medium sized watercourse basins. In this type of event, the magnitude of the growth leading to overflowing, measured in terms of flow per km^2 or average flow, is very much higher than that of the rivers which drain the large basins, hence their greater severity. Moreover, they are usually accompanied by abundant solid matter which heightens their severity and they tend to occur much faster after the rain, normally a few minutes or very few hours compared with the days it takes a flow to run its course through a major river .

It should be noted that since the telegraph was installed 150 years ago, permitting prior warning of torrents to places further downriver, with its effect on human catastrophe, this is no longer a problem of the major rivers but of the small rivers, the watercourses, spates, torrents and streams. In many cases these are watercourses with a coefficient of extremely high irregularity, which go without water for months – or years – but which on occasions of intense or torrential rain, become violent running streams with instantaneous modules capable of competing with the average flows of large Iberian collectors.

This is the case of the Arás torrent which led to the disaster of Biescas, of the small brook which produced the victims in Yebra, of the Calamón and Rivillas watercourses in the province of Palencia, of the torrents causing victims in Catalonia, of the watercourses of Nogalte or Albuñol leading to the catastrophe of Puerto Lumbreras (Murcia) and Albuñol (Granada) respectively in 1973, of the Levantine riverbanks and

watercourses which were transformed into ferocious flows in October 1982 and September 1989, among others.

In these situations, the means of alleviation is not to be found in infrastructures since these are rendered ineffective against the violence and magnitude of the instantaneous flows, as was easily apparent in the dramatic catastrophe of Biescas where some 40 sediment-saving dams were demolished by the flood and the actual canalisation in the alluvial range was obstructed. Instead, restrictions on land usage need to be made, for more or less permanent accommodation and particularly of those more vulnerable installations such as camp sites or bungalows or wooden buildings.

For its part, the perception of droughts in Spain has been modified during the last few decades owing to the changes occurring in financial activities and the more urban nature of society. The demand for water has grown a great deal in Spain and this has not been accompanied by a water policy which foresees the said modifications sufficiently quickly. The result is that the Iberian territory is at greater risk of drought now than it was twenty or thirty years ago, owing to the fact that needs are higher and instead of increasing, natural resources have all but decreased during this interval. Drought combines physical and human factors in a more or less prolonged temporary sequence which provokes different consequences in virtue of the geographical space affected. At present this natural phenomenon is most heavily affected by human aspects, up to the point of them motivating its actual appearance, because the agrarian, urban and hydroelectric demand for water have caused an alteration of the drought threshold. Nowadays it no longer takes for a sudden reduction in rainfall to sound the alarms about the lack of resources to maintain normal economic activities. For drought to occur it only needs for lifestyle level to rise, Spanish society has moved from austerity in water usage to squandering, from adaptation to alarmism, only correctable with good and appropriate usage of available resources and in specific situations of structural deficit, increasingly them by means of transfer and desalination, as long as the possibility of having these new volumes of water do not justify future wastage.

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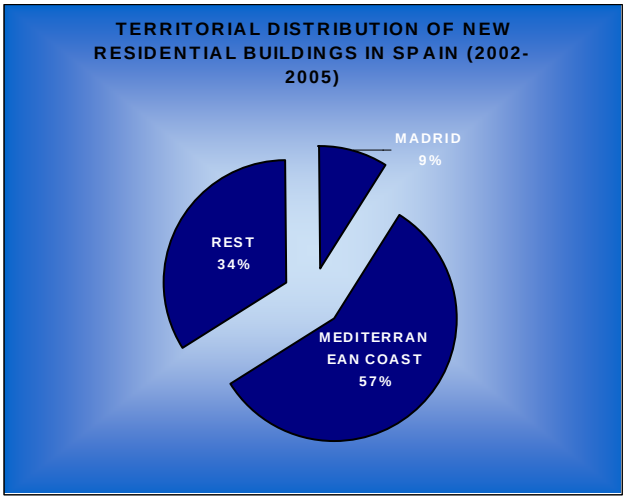
From the middle of the 20th century other interesting phenomena relating to the location of the risk areas in Spain have come about: the “coastal development” of the same. The loss of the socio-economic importance of agricultural activity, which was most exposed

to climatic hazards, has displaced the vulnerable setting from country to town and within those urban settings the development of leisure and tourist attractions has made these spaces a main focus of risk.

Within Spain as a whole, setting aside the capital of Madrid, the major focus of residential construction activity has taken place along the Mediterranean coastline as may be observed in the graph below. Several data are illustrative in explaining this process. To start with, over 50% of new residential construction in the last decade has taken place along the Spanish Mediterranean coast and during the last few years, this percentage has increased by almost 60% (see figure 6).

The construction of residential housing in the province of Alicante has been surprising during the last few years, situating it third in national ranking after Madrid and Barcelona, above that of the provinces with greater population (right hand population) such as Valencia or Malaga, in the Spanish Mediterranean coast, or of Seville. The latter province maintains a rhythm of around 12, 000 new residential houses per year.

Figure 6. Residential construction permits in Spain (2002-2005)



Source: 2005 Statistical Directory, Ministry responsible for public works

A major change in mitigation philosophy has taken place in Spain, to be taken into consideration when analysing the policies and practises of risk reduction. There has been a switch, which is still ongoing, from the majority of measures being structural to the beginning of non structural measures which are proving to be an increasingly more effective tool in town and country planning.

The physical environment is the basic element in urban planning and this has been valued by the town and country legislation and land planning since Spanish contemporary urban planning was structured in the middle of the twentieth century. It is incorrect to state that its treatment in Spanish urban planning regulations has been low or that no specific mention has been made of the need to undertake research into the conditions of the natural environment of the city when in the Law itself, of 12th May 1956 on town and country planning, references may be found to the need to carry out studies on "the state of the land" (art. 9.2.a). It is true that there are few mentions of the necessary insertion of physical environmental research studies and that to this may be added the lack of interest and lack of training of the teams writing up the municipal planning and land planning documents for analysis and evaluation of the importance of the physical environment for the city. National legislation and since the decade of the eighties, the legislation governing the autonomous regions, on land use controls and town and country planning have incorporated this issue into successive linking texts. Land legislation and land use controls do, in any case, whether they are state or autonomous, play a leading role on a local level. It is a fact that the general urban management plans have become a key instrument for the shaping of land policies. If the creation of a municipal planning document is well understood, it may become, as has been indicated, an effective tool for the prevention of natural danger.

The diversity of situations necessitates a detailed analysis of the consideration natural risks deserve in the different scales in which land usage planning is organised in Spain.

Of all natural hazards affecting Spanish territory, it is floods which merit more detailed treatment in legislation and, where applicable, in urban and country planning documents. They occupy the greater part of the references commented upon in this point. Notwithstanding, it should be noted that seismicity, volcanicity, windstorms,

drought, extraordinary atmospheric phenomena for farming activity (hail, frosts, wind) are contained in the relevant sectorial regulation (see table 4).

TABLE 4
ENVIRONMENTAL AND TERRITORIAL LEGISLATION AND CONSIDERATION OF NATURAL HAZARDS IN SPAIN

LEGISLATION	CONSIDERATION OF NATURAL DANGER
Coastal Law (1988)	-Establishes perimeters of protection -Land-Sea public dominium limited by the area affected in the maximum known storms
Water law (2001)	-Establishes perimeters of protection of hydraulic public dominium
National Hydrological Plan (2001)	-Drought and flood management
Land law (2007)	-Natural hazard areas should be declared rural land -Incorporation of maps of risk in planning documents
Seismo-resistent Regulation (1994 and 2002)	-Determines the seismic risk areas -Establishes regulations for the construction of buildings in risk areas
Combined Farming Insurance Law (1978)	-Includes the need to undertake danger studies of extraordinary atmospheric events (frosts, hail, wind , etc.)
Basic Civil Protection Directives (1994 and 1995)	-Imposes the creation of risk cartography (seismic, volcanic and floods)
Environmental impact legislation (2006)	-Environmental impact assessment process for actions relating to the introduction of new land uses including a study on environmental impact to which a risk analysis must be linked.
Environmental Management (Regulations UE 1836/93)	-In those of a territorial nature a natural danger analysis must be included.

Own production

Together with these state regulations, some autonomous communities have passed land laws and regulations on land use control and specific urban management plans which incorporate the analysis and control of natural hazards as an important element when programming new land uses. The last stage in this process was the approval of the Land Law of 2007 (Law 8/2007), in which the obligation to undertake cartography of the natural hazards involved during the phase of justification for the new urban planning procedures was introduced for the first time in a legal text on land usage and planning in Spain The need to harmonise nature and land activities, to achieve development in accordance with the environment, is progressively being demonstrated.

III. AN AGENDA FOR RISK ANALYSIS IN THE MEDITERRANEAN BASIN

The advance of possible valid conclusions for the geographical area of the Mediterranean basin as a whole, on the situation of natural hazards (research, policies and practices), are rendered ineffective due to the disparity of legal and administrative

situations in the countries within it. Even in the countries of Mediterranean Europe, where unity of action is taken for granted in these matters, it has not been until very recently that steps have begun to be made towards a co-ordinated policy regarding natural hazard management.

The following list may thus be regarded as recommendations which could be put into practice in the next few years within the countries forming the Mediterranean basin.

-Actions continue being taken "when disaster strikes" whereas instead they should be *acting with integral prevention policies of the risk.* In actual fact, in all Mediterranean countries the putting into practice of risk mitigation measures, whether they be structural or not, are linked to the development of a natural disaster which provokes political action. In the case of Spain the catastrophic event of the Bisecas camp site in August 1996 marks a major change in the consideration of risk by the governmental bodies involved in environmental and territorial issues. A similar occurrence took place in France several years prior to this with the approval of the Environmental Law of 1995 (Barneri Law), coming about as a response to a series of extraordinary natural events occurring during the second half of the decade of the nineteen eighties and the beginning of the nineties. Similar considerations led to modifications in Italian water legislation and the complete incorporation of risk treatment following floods occurring during the nineties (1994, 1996 among others) in several rivers. In the north of Africa, integral risk control measures have not yet been put into practice, but the popular reaction to certain disasters has provoked some governmental measures being taken forthwith. This was the case of Algeria after the floods in November 2001, when popular marches blamed the government for increasing the disaster which occurred in the city of Algiers, after a deliberate blocking, for political motives, of the sewer system in several sectors of the city. In Turkey after the earthquake catastrophe of 1999 measures were adopted for the control of the seismo-resistant regulations in existence since 1940 (subsequently altered on several occasions) with the derivation of authority on a local scale. This lack of anticipation in putting risk reduction policies and measures into practice is doubtless a trait of "Mediterraneaness".

-There are still no *global risk reduction programmes*. As has been pointed out, there is no integral conception of the Mediterranean as a risk-region. Moreover, in

each one of the coastal states measures usually exist to cover a single natural hazard but without consideration of the possibility of having integral treatment of control and reduction of natural risks overall. In the countries of Northern Africa conditions are even more difficult since there is no unity of political action between the different states. For the European area, the recent approval (April 2007) of the European Directive on floodable area control confirms this theory. No steps have been taken towards the need for an integral policy of risk control, initiatives have simply been made for the intervention into natural hazards regarded as the most pernicious in this geographical space, from a central European viewpoint. It is thus extremely significant that in the "exposure of motives" of the Directive proposal mention is made of the importance of flooding in Europe underlining those occurring in the Central European countries in 2002 and 2005, but no comment is made of those occurring in the Mediterranean countries during the last ten years which have left very serious scars of financial damage and loss of human lives. Nonetheless, what is remarkable is that at last the European Union wishes to put forward a flood risk reduction policy from the application of measures also governing land regulation. The Directive thus establishes a framework for the reduction of risk for human health, the environment and financial activity associated with flooding in the union's territory (art. 1). The member states will create three documents with respect of each hydrographic demarcation or the part of the international hydrographic demarcation situated in their territory:

-Preliminary assessment of the flooding risk
-Flood risk maps
-Flood risk management planes

The "preliminary flood risk assessment" should include:

-A map of hydrographic demarcation presenting the limits of the hydrographic basins and sub-basins and when convenient the associated coastal areas, and which indicates the topography and land uses.
-A description of past flooding .
-A description of flood procedures and their vulnerability to change, including the role of alluvial plans as a natural barrier or retention of overflow and the evacuation routes of floods in the present or future.

-A description of the development plans which could provoke a change in land uses or in population distribution and financial activities which could increase flood risks in the same area or in regions situated down or up river.

-A probability analysis of future floods based on hydrological data, flood types and the foreseeable impact of climatic change and land usage trends.

-A prognosis of estimated future consequences on human health, the environment and financial activity which takes into consideration long term evolution, including climatic change.

The European Union states are committed to carrying out this evaluation in 2010. Moreover, they will have to undertake a modernisation of the said evaluation before 2018 and then successive revision every six years.

The Directive also imposes, together with the flood risk assessment, the drawing up of detailed flood risk cartography which would include two types of maps, “flood maps” and “maps indicative of damages deriving from floods” or “flood risk maps” This cartography is to be undertaken on a hydrographic demarcation scale according to the official one included in the Water Framework Directive 2000/60- and must be concluded by 2013.

Flood maps will include geographical areas which could be flooded according to the following hypothesis:

(a) high probability of flooding (10 year probable return period)
(b) Medium probability of flooding (100 year probable return period)
(c) Low probability of flooding (extreme phenomena).

For each one of these probability levels the foreseeable water levels, speed of current, time occurring and the areas in which seashore erosion and drag sedimentation could take place, are to be indicated.

For their part, the maps indicative of damages derived from floods (“flood risk maps”) shall indicate the potential damages associated with these expressed through the following parameters:

(a) Number of inhabitants who may see themselves as affected
(b) Potential financial damages in the area

(c) Potential damages to the environment.

Finally, the reduction of flood risk must include, as indicated by the Directive, the drawing up of a “Flood risk management plan” which will contain two phases: an initial plan which must be finalised and ongoing by 2015 and a second plan or review and updating of the previous one, which will begin in 2021. The flood risk management plans will cover all phases of the flood risk management cycle, focusing on prevention, protection and preparation and bearing in mind the characteristics of the hydrographic basin or sub-basin considered. The Directive explicitly promotes active participation of all agents involved in land management with flood risk when drawing up the documents imposing the same. It is specifically highlighted that “the member States shall make the preliminary flood risk assessment, the flood risk maps and the flood risk management plans available to the general public”. They must also guarantee the active participation of all interested parties in the creation, review and updating of the corresponding flood risk management plans.

This is a necessary initiative but demands extension to other similar natural hazards or those of greater territorial and financial repercussions existing in the European Union (droughts, erosion, fires). The result would be the putting into practice of integral risk management and reduction policies to cover a wide spectrum of natural hazards.

The principals of this Directive may serve as the basis for the preparation of similar policies in the countries of Northern Africa, as a prior state to the production of a common strategy for the entire Mediterranean basin. The creation of Mediterranean House in Alicante, within the network of thematic houses of the Spanish Ministry of Foreign Affaire could be an ideal framework for the creation of a Mediterranean Risk Observatory where the bases are laid for future development of integral risk management programmes and policies in Mediterranean countries.

-*Risk management from land regulation* is presented as the most rational, sensible and economical means of reducing vulnerability and exposure. This issue has been taken into consideration by the European countries of the Mediterranean which has continuously approved new laws and regulations within environmental and territorial legislation, where risk analysis becomes an important element in decision making on the

planning of new land uses. A new framework has thus been opened up for the incorporation of natural risk studies, with applied finality in the new territorial procedures. Within this context there are a series of aspects which will come to life within the natural risk studies in the Mediterranean area. On the one hand, the necessary inclusion of risk analysis in all processes of assignation of land uses and on the other, the major role of natural risk management on a local scale. The 3rd United Nations Early Warning Conference, celebrated in Bonn (March 2006) acknowledged the major role of local involvement of risk and emergency management. This issue may be extended to the land control plans on a regional scale where some Autonomous Communities also requires the inclusion of risk analysis.

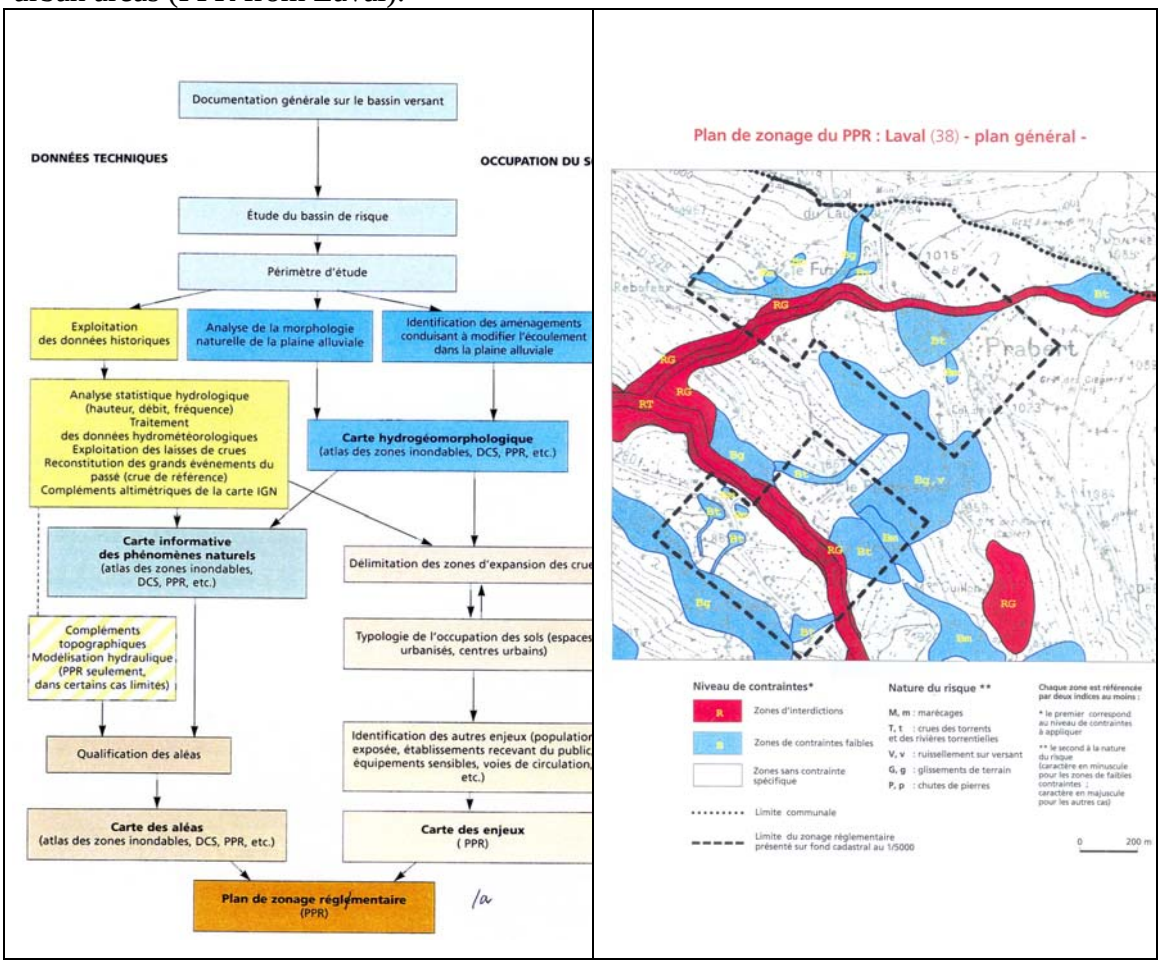
Several countries of Mediterranean Europe have begun to develop legal codes where the treatment of risk is fully incorporated into land policies. In the case of France, Italy, Greece and Spain it is necessary to include natural risk cartography and research studies. Thus, for example, In France the approval of the 95-101 Law of 2nd February 1995 relating to the reinforcement of environmental protection known as the Barnier Law, has become a landmark in the context of the European laws on environmental protection and an example to be followed by those States which lack any legislative framework on natural dangers. Indeed, Title II of this legal text concerns clauses relating to the prevention of natural risks and for the first time, is devoted to the principle of prevention of natural danger in an environmental regulation. Articles 11 and 12 contain the creation of an expropriation procedure caused by imminent natural risk which covers the obligatory displacements of persons on lands which are at risk, granting them a fully satisfactory expropriation indemnity. For its part, article 13 creates a high risk prevention fund to pay for the costs derived from the expropriation of land at risk. This fund is supported by a 2.5 percentage - in the new Environmental Code of February 2002, this percentage was reduced to 2% - on the additional payments or rates relating to the guarantee against the risk of natural catastrophe foreseen in the Insurance Code. Article 15 obliges the national government to present an annual report to Parliament on the management of the major natural risk prevention fund. Article 16 of the Barnier law replaces the previous natural risk exposure Plans (PER), created in 1982, with the new predictable natural risk prevention plans (PPR). A predictable natural risk is understood to be floods, landslides, avalanches, forest fires, earthquakes,

volcanic eruptions, storms and cyclones. The PPRs establish 3 areas (see attached figures):

-red area: forbidden to construct
-blue area: construction with obligations or recommendations
-white area: no foreseeable risk according to current knowledge.

The content of the Barnier Law in its final version in the recently approved text re-established the Environmental code of France (Law 2002-276, of 27th February, articles 561 to 563). In the French system of natural risk prevention, the local scale is particularly relevant since the municipal authority has full authorisation in the granting of construction permits and urban planning, With regard to flood risk, the local urban management plans forbid construction in areas most exposed to risks and in the areas of expansion of those which have grown established in the PPR. Art. 123-11 of the French urban planning code law (Decree 2001-260, 27th March) also underlines that local plans for urbanism must include their documentation, plans where those sectors with natural risks such as floods, forest fires, erosion avalanches, etc. are specified. in those municipalities where PPR is available, the latter must be incorporated into the documentation of the local plans for urbanism as well as public rights of way which affect the land usage (art. 126-1 of the Town and Country Planning Code). (see. figure7).

Figure 7. Table of flood risk analysis and example of the cartography of flood risk in urban areas (PPR from Laval).



Source: PPR from Laval. Ministry of the Environment, France.

In Spain, as has been stated, the recent approval of Land Law 8/2007, has been a very important advance for the incorporation of risk analysis in territorial procedures. In this legal text there is an obligation to classify as rural land (non building land) all those lands "with natural or technological risks, including those of flood or other serious accidents and however many others provided for by the land or urban planning legislation" (art.9). Further advance to the previous Land Law of 1998 has been made, since the latter did not specify how the risk of a territory could be "proven". Obviously there is no better way of proving the existing risk in a geographic space than visualising it on a map. For this reason, in the new 2007 land law, from now onwards, the urban planning actions must be accompanied by an environmental sustainability report where a natural risk map of the area to be regulated, among other studies, is included (art. 15). This is the first time that a Spanish land law imposes the incorporation of risk cartography among the documentation to accompany any new urban planning developments. Notwithstanding, neither in the new Spanish land law mentioned nor in

any of the land legislation and territorial regulations existing in the Autonomous Communities, is the possibility of expropriating properties located in high risk areas contemplated, as shown in the previously quoted Barnier Law. The solution to existing problems in many cases would have to be a continuation of putting structural measures into practice.

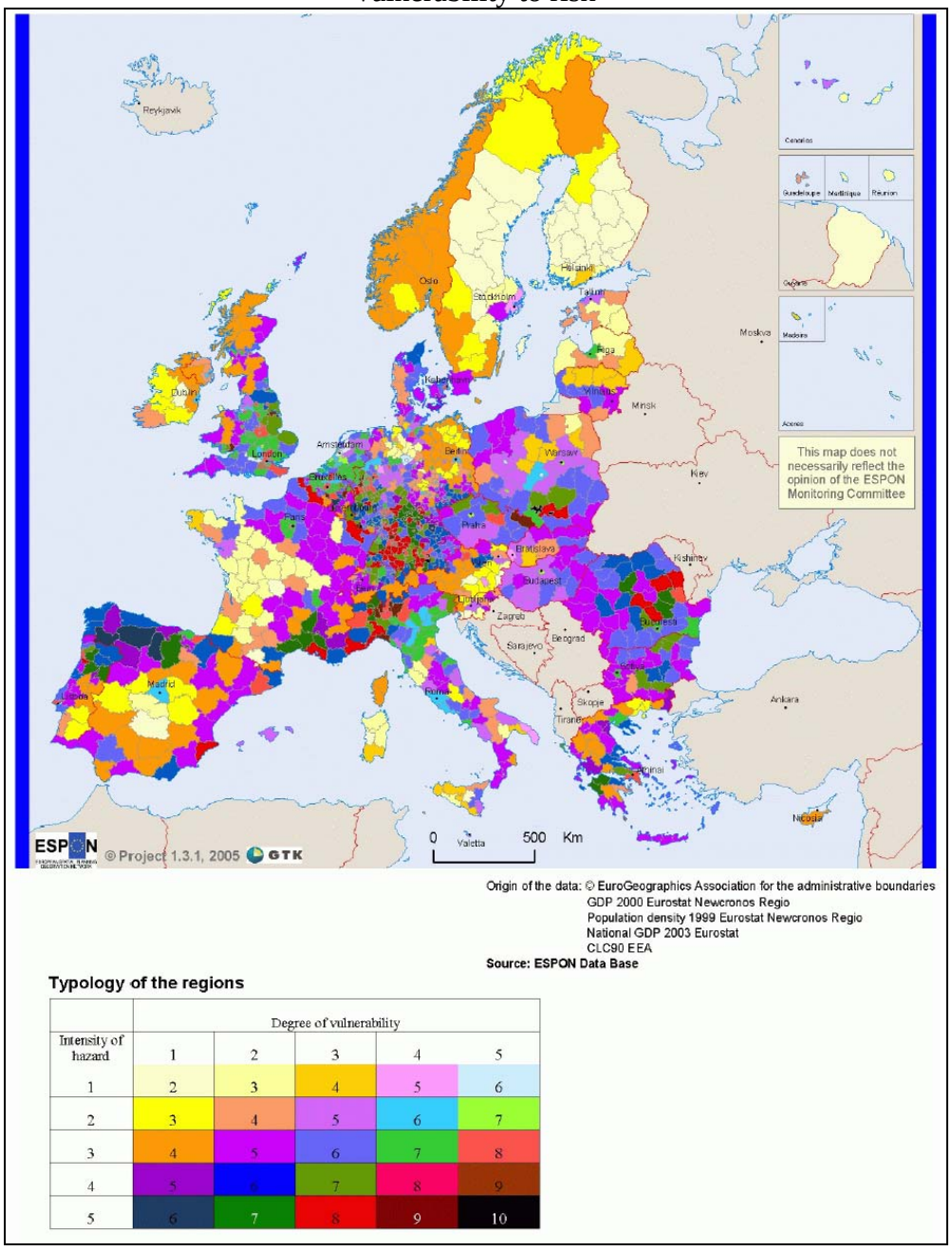
In this new context, one must hope for a significant advance in the *risk cartographies in the next few years, on the Mediterranean scale.* This is an essential tool in the natural risk studies, which has gone though a very notable, advance in recent years regarding the application of modern cartographic technologies. The possibility of immediately connecting land uses with natural danger in order to establish levels of exposure and vulnerability to an extraordinary event , has led to the production of risk cargographies, with the added advantage of their possible continuous updating. As Hartshorne pointed out, "if a problem cannot be essentially studied using maps then it is questionable that it belongs to the field of Geography", and this aspect is essential when a risk analysis is undertaken. In fact, the production of a risk map, where lands at risk to a climatic danger plus risk levels are located, is basic for the effective control of a geographical space. Moreover, the preparation of these maps has also acquired legal status and will become an essential requisite in foreseeable flood risk studies in the before-mentioned European Directive on flood evaluation and control.

Regarding the Mediterranean basin integrally, it would be desirable to produce a natural risk map of this area over the next few years, to include location of danger areas and representation of levels of vulnerability and exposure to the different extraordinary natural events. North African countries have a major task to do here, which could be backed up by international environmental programmes. At the same time, this could become a priority of International Strategy for the reduction of natural disasters.

-It is necessary to advance *from the "analysis of natural danger" to the study of vulnerability and exposure* to these natural dangers. Examination of the social and financial impact linked to natural dangers has become one of the main lines of research of risk analysis in recent years. In fact, knowledge of danger has received a major drive during these last few years throughout the world, whereas research into the field of vulnerability has not. In Spain, for example, there are very good studies on

climatic danger but few on vulnerability relating to extraordinary atmospheric events. The European Union, within the framework of the new land regulation policies derived from the approval of the European Territorial Strategy of 1999, is undertaking risk analysis (natural and technological) in the European geographical space which may serve as a reference when carrying out measures in the territory in each one of the member states. Risk maps have been made for this purpose, where the main criteria is the vulnerability of the lands to different risks. In this case vulnerability is not measured according to real or potential victims but in accordance with other socio-economic aspects. In fact, vulnerability is determined from the gross national product (regional scale), from demographic density, from the existence of areas in the territory which could be seriously damaged if a danger (natural or technological) occurred – this is what is called "*fragmented natural areas*" and from the state's capacity to respond to a disaster measured in terms of gross national product (national scale). From this, five categories of danger have been defined and another five categories of vulnerability, from the combination of which 25 risk levels in European territory are recognised. The attached map reveals the level of risk of European territories (NUTS level 3 of the European Union) according to the classification made by the European Observatory in the territorial regulation network, which considers vulnerability as a key element for the determination of the risk level of a geographical space (see. figure 8)

Figure 8. Typology of European regions (NUTS 3) according to their vulnerability to risk



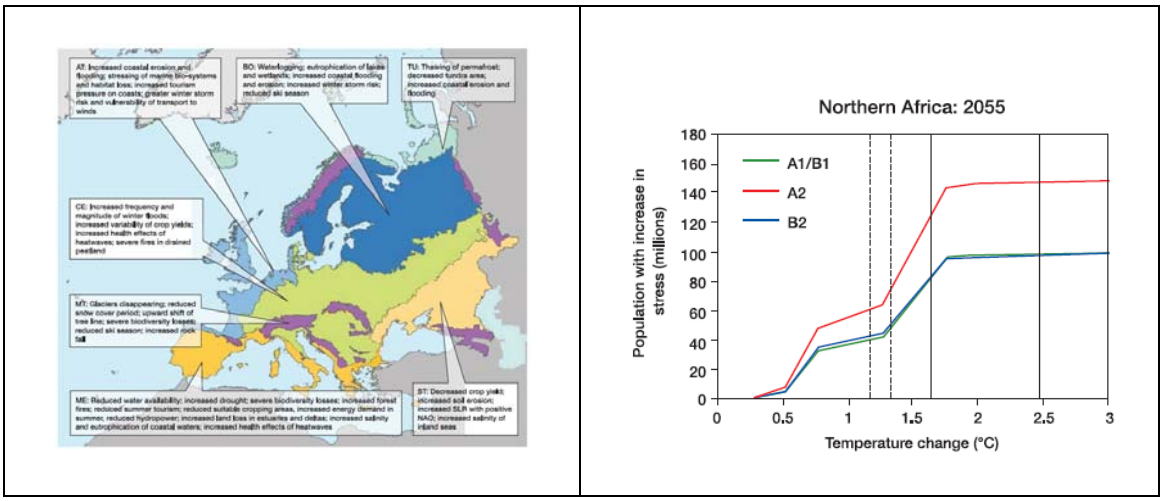
Source: ESPON, 2005.

The ESPON study is a good starting point for the improvement and adaptation of vulnerability analysis to specific climatic dangers and smaller territorial areas. From here it is likely that an increase will take place, from geography, of the approximations to vulnerability analysis.

-The new reality of climatic change due to the greenhouse effect demands a new strategy for risk reduction in the Mediterranean basin. Faced with common

problems, the response has to be common too. The rise in sea levels, the increase in climatic danger, the likely reduction of rainfall will bring very probable consequences in the Mediterranean countries (see figure 9). A common policy of adaptation to the new reality is thus needed. Again, together with structural measures, it will be necessary to use land regulation as a more effective means of reducing the new risks associated with climatic change. In Europe some countries have created land regulation strategies which consider the possible effects of climatic change as the main argument for the programming of actions. This is the case of Holland or the Baltic region countries. The latter, may serve as an example of territorial co-operation when defining common policies of action against the sea level rise in this area which may be the most outstanding territorial effect experienced by the coastal areas of this region in the new climatic scenario (Hilpert et alt., 2007).

Figure 9. Effects of the climatic change through the greenhouse effect in the Mediterranean basin and potentially affected population in the North of Africa due to reduction in precipitations



Source: IPCC, 2007

Curiously in 1972, Pierre Deffontaines in his essay on the Mediterranean asked if the Mediterranean climate was progressing towards an exaggeration of its characteristics, “to a decadence accentuating its actual appearance” and pointed out the causes of this process: “the seawaters are slowly continuing to warm up, the maximum of thermal anomalies are being emphasized and the differences in pressure are becoming exaggerated, winds will be increasingly more violent, the rainy season will contract and rains will become more irregular, more violent and also more useless, rivers more unstable, with an increase of low waters separated by floods which are increasingly

shorter and more dangerous. Erosions shall expand and worsen". Deffontaines concluded, "in our current state of awareness we cannot affirm it, but there is a threat". His arguments could not be more in keeping with the conclusions recently stated by the IPCC report of 2007 for this region. The strange thing is that these lines were written when climatic scientific literature demonstrated that the earth's climate was getting cooler. Come what may, the truth is that the new reality predicted in climatic scenes for this century does not augur any improvement in the current environmental conditions nor ultimately of the risk levels in Mediterranean societies.

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