ROBIN WOOD PROJECT

COMPONENT: **HYDROGEOLOGY**

"REPORT ON CONTEXT AND ECOLOGICAL NEEDS OF HYDROGEOLOGICAL ECOSYSTEMS: PROTECTED AREAS AND SOURCES OF INSTABILITY"

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1 INTRODUCTION AND OBJECTIVES

1.1 INTRODUCTION

This report for hydrogeology component of the RobinWood project has been built up by the Murcia Region partner. The work derived by the survey as well as SWOT-analysis results interpretation of the study areas involved in the project. Starting by the contributions sent to us from all working groups it has been possible to define a detailed description on the hydro geological context of each territory of the project.

The survey focused on "the hydrogeologic systems and their relationship with forests". It has been defined to get some information about the current state of the hydrogeologic scenario in terms of rivers, groundwater, wetlands, etc in each region of the project. The inquiry has been directed to check the territorial condition by an ecological, geological, geomorphological, socio-economic as well as policy point of view.

The SWOT-analysis has been addressed to get information about the capacities and the limitations to the project definition. The SWOT analysis is an analytic instruments based on the identification of four internal and external factors. Weaknesses and strengths are internal elements cause their strictly relation with the organization and structures of the project, while external components are threats and opportunities. Those are independent to the organization and they can affect the development of the objectives. As requested to the correct use of this analytic tool the relationships among the four components has been examined for the territories studied utilising a SWOT matrix to set strategies.

1.2 OBJECTIVES

This overview has allowed setting up common and specific situations of the territories examined in order to define the dataset necessary to the following stages of the project. The present work is part of the first phase of the RobinWood project to carry out studies based on the specific issue of the component defined: hydrogeologic systems. The outcomes derived have allowed to draw a picture of the hydrogeology state for the territories and to point out technical information. In detail the survey and the SWOT-analysis has been useful to characterize the peculiar hydrogeological conditions of the target territories to define actions addressed to the sustainable management and the protection of those ecosystems. The results of those analytic tools are presented in this report. Furthermore this report provided information on problems and driving forces that can affected the project development, in terms of the component considered. To the baselines realisation of the second phase of the project, that consists on subprojects definition, this work highlighted the common and the specific opportunity to develop hydrogeologic proposal for the region involved in RobinWood. The overlapping and the difference in terms of investigations needs have been pointed out.

The main outputs that have been established in this investigation work can be summarized as follow:

To define the **hydro-geological state** of the areas of the project.

To get information to realise **Geographic Information Systems (GIS)** maps on the hydrogeology theme.

To outline a **technical overview** in order to define the ability to get the information.

To define the **regional overview** for the areas of the project focus on the hydrogeological studies.

STRATEGIES

2 HYDRO-GEOLOGIC ECOSYSTEMS

The data obtained by the survey are summarized in the follow points. The hydrogeologic analysis and the relationship with forests has been driven through the assessing the availability of information in each area involved.

The aspects in which the survey was focused can be defined by three points:

1. State of the territory such as: hydro-geologic ecosystems, hydro-forest systems, drainage networks, humid areas, regulation infrastructures and systems, problems related to hydro-geologic issues (e.g. collapses, changes in groundwater depth, etc).

2. Environmental situation in terms of the present, past and future demands of water.

3. Attention to protected areas (territorial context, legal regulations, plans and the ecological necessities of the protected zones).

2.1 HYDROGEOLOGICAL STATE

The outcomes of the survey underlined profound differences between the countries analysed in terms of hydrogeological state. The keys hydrologic and geological, as geological risk, problems are distinct in the target territories of RobinWood. Precipitation and temperature highlighted very different values for each area (Figure 1 and Figure 2). Rainfall varies widely in respect to the regional context as well as to the seasonal period analysed. The average for the precipitations is ranging from the 300 to the 1433 mm*year^{-1} whereas the temperature achieved the maximum in Murcia (avg. 18.8°C) and minimum in Brandenburg and Slovakia (avg. 8.75°C).

These values allow to identify two typical climatic areas that can be resumed like:

- Mediterranean commonly suffering of salinization and water shortages.
- Continental generally suffering of acidification.

In spite of these generalisations it is possible to say that all the countries registered modifications related to the climatic changes and consequences related with. Mostly we have to speak about slight increase in average temperature during the last years, either higher amount of precipitation or desertification events. For example for Wales one of the main worries is the climatic change and threats to ecological status of freshwater ecosystems, particularly through diffuse pollution. Obviously these divergences can be significant to define problems affecting each area, and therefore to build up common strategies toward the development of the second phase of the project. Concerning the humid areas, in broad sense, the survey study revealed that hydrologic

ecosystems are mostly associated with the main rivers for the territories of RobinWood.

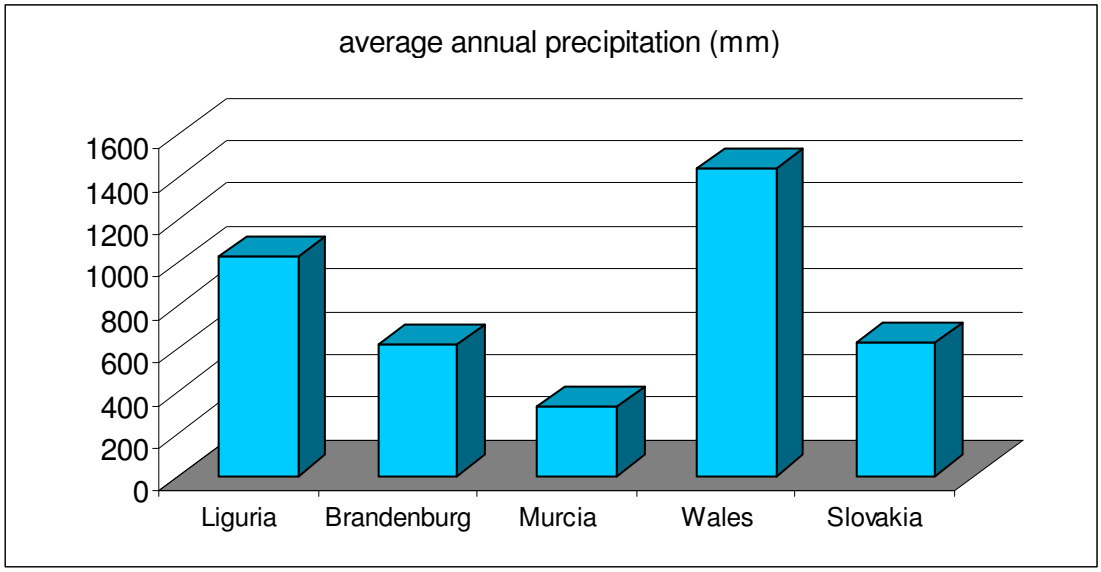

Figure 1 annual precipitation average, expressed as mm*year^{-1}, for the RobinWood countries.

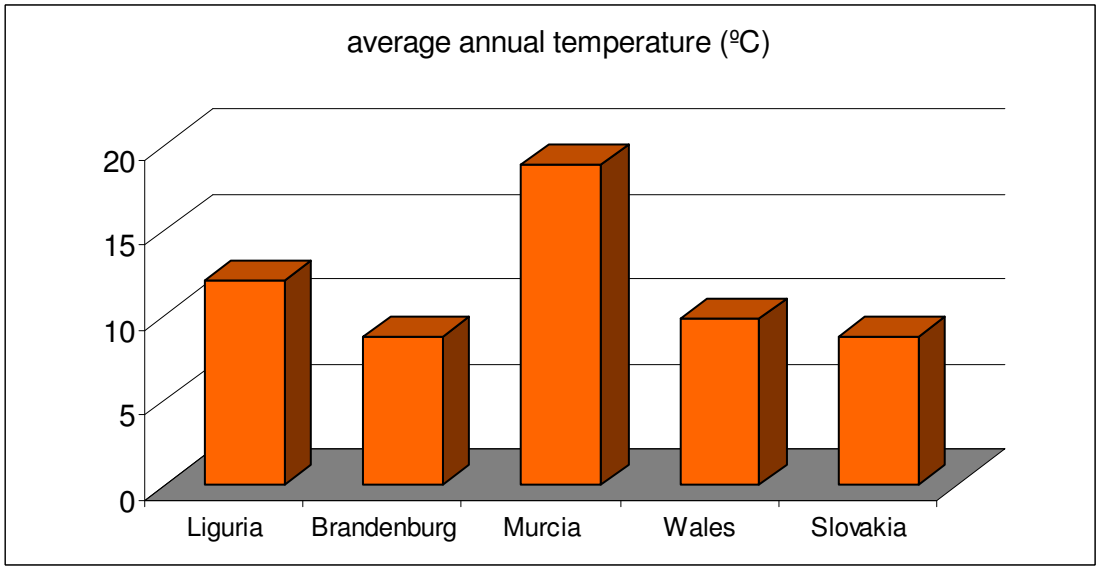

Figure 2 annual temperature average, express as T ºC, in the RobinWood countries.

These areas comprise: rivers, lakes, marsh, marsh grassland, bogs etc. On the other hand there are exceptional conditions such as the coastal lagoon of the Menor Sea, in Murcia. Some of these hydrologic systems are involved in protection plans at Regional, National or International level (Table 1) implying sometimes the existence of specific administration office for their management (Table 22 in the paragraph 0, page 46). The legislative agreements and plans of the protection level designed by authorities. can be overlapped with the international laws and figures of protection.

Country	Protection Types	Legislation
Liguria	Areas of national protection as Regional or National Park and international SIC (site of Community importance) and Special Protection Areas (SPA).	WFD 2000/60/EC; Dir. 1992/43/EC and D. 152/99; D 1705/2003.
Brandenburg	625 water protected areas that represent the 6.8% to the total areas of Brandenburg; those contain also Special Protection Areas (SPA) and Nature Reserve Areas.	WFD 2000/60/EC; Dir. 1992/43/EC
Murcia	Some of the 98 humid areas are included in locals or international management and protection plans, such as 30 international SIC (site of Community importance) and 40 Special Protection Areas (SPA) and Ramsar sites. Further 21 are totally included in ENP (natural protected area).	WFD 2000/60/EC; Dir. 1992/43/EC and D. 2/2004.
Slovakia	Aquatic habitants related with the freshwater system in some case considered as protected landscape areas (CHKO) and international SIC (site of Community importance) and Special Protection Areas (SPA) and Ramsar sites.	Act of the National Council of the SR 364/2004; Act of the National Council of the SR 543/2002; Dir. 1992/43/EC.
Wales	Different hydrologic ecosystems some of which included in five key types of designated areas for environmental protection: Site of Special Scientific Interest (SSSI); National Nature Reserves (NNR); and some of international importance Special Areas of Conservation (SAC); Special Protection Areas (SPA) and National parks (NP) and Ramsar sites.	WFD 2000/60/EC; Wildlife and Countryside Act 1981; Countryside and Right of Way Act 2000; Dir. 1992/43/EC.

Table 1. Protected habitats because of their hydrogeologic relevance in the RobinWood countries and related legislation.

Sometimes manmade drainage networks are pressing on the area, despite its protection, such as: reservoirs, channelization, and flood barriers that can cause territorial changes. However, the nets are generally designed and developed according to the soil use. On the regions of RobinWood the picture is really different on the basis of the territory requirements (Table 2). There are countries where the network consist in the natural drainage of the main rivers and others wherein the ground water table have to be lowered also with the human intervention. Grouping the survey results is possible to see that Wales and Brandenburg highlighted the existence of a complex drainage net correlated with the land use. From Liguria and Murcia inquiries emerge an absence of artificial drainage systems while Slovakia showed a specific situation.

Country	Manmade drainage	Description and needs.
Liguria	no	Natural drainage
Brandenburg	yes	In accordance with land use
Murcia	no	Natural drainage related with Segura River
Wales	yes	Extensive area (no of easy quantification) linked to agriculture and forestry land use. In some case there are problems in maintenance
Slovakia	yes	Strongly developed to avoid the water accumulation in the springtime

Table 2. scheme on the artificial drainage networks in the RobinWood territories and the local requirements related.

In Wales the artificial drainage is basically related to the agriculture and the forestry needs (e.g. grazing pastures areas were traditionally drained). The net is widely distributed but currently some of the agricultural drainage systems are deteriorated and there has been very limited new drainage works over the last years. Murcia, like Liguria, highlighted the inexistence of an artificial drainage net and the natural system is related with the main river basin, the Segura River and its affluents. If there have been some hydraulic works including drainage systems these have not been registered in the cartography. Opposite picture is provided from Eastern Slovakia where superfluous water had to be drained and the ground water table lowered cause of the climatic conditions. In springtime during the thaw out, and in the vicinity of streams where the ground water table is prone to increase, the drainage action is quite mandatory. Due to these necessities the systems are well developed and the networks are concentrated mainly in the lowland and near the main basin. The outcomes of this inquiry underlined differences among the countries involved in the project even if common characteristics are detectable among them, as we seen previously in the Figure 1, Figure 2 and in the Table 2. Moreover, the changes in water demands allowed define connections, or similarities, between the regions of RobinWood. For instance, in the Mediterranean areas an increase in the water demands was showed. Finally, also the flooding events, generally present in all the regions of the project, and their periodical distribution seem define a common line in the RobinWood countries (Table 3), although detailed information on these subjects are

described in the follow paragraphs (2.1.1 and 2.1.3, pages 15 and 23 respectively).

Country	Flooding events description
Liguria	Flooding events are seasonal and they mainly occurs in the autumn (September November) and rarely in the spring.
Brandenburg	Yearly flood events occur in the area. These episodes are frequently in the winter.
Murcia	Floods are random events due to the Mediterranean- semiarid regime that is irregular as intrinsic factor. Risks are present in the small watercourses in which floods may occur in spring and autumn or in the summer.
Wales	Flood risk is a major issue within Wales. With sea level rise and the increase in winter rainfall and hard weather predicted by the latest models of climate change, extreme floods are forecast to become more frequent.
Slovakia	A number of very high flash floods caused by extreme precipitations have occurred in recent years in Eastern Slovakia.

Table 3 flooding events in the RobinWood territories

2.1.1 HYDROGEOLOGICAL RISKS

Floodings are a common event even with differences in terms of recurrence, consequences and derivations in each area (Table 4 and Figure 3). For instance, in Murcia the main river basin are controlled whereas secondary freshwaters can be the focal points from which the floods set out. This is due to their torrential regime as well as to the human encroaches in their beds, that is, the hard urbanisation. However the climate change is one of the most serious problems for the future in each region.

Month	Liguria	Brandenburg	Murcia	Wales	Slovakia
January					
February					
March	X				X
April	X		X		X
May					
June					
July					X
August			X		X
September	X				
October		X	X	X	
November	X	X	X	X	
December					

Table 4 seasonal occurrence of flooding events in the RobinWood countries.

For instance in Wales current models predict that climate change will bring milder, wetter winters and hotter, probably drier, summers to the

UK, and extremes are expected to occur more frequently. While climate change will affect all aspects of the water environment there are still uncertainties about the precise impacts that will occur. For example, increased rainfall may dilute the pollutants present in water bodies but will also flush a greater concentration of compounds, such as nitrates in winter, into receiving waters or can cause more frequent sewer overflows in the summer, both resulting in deteriorating water quality.
The climate change seem to be the driving force for the flooding events increases as well as to other hydrologic problems highlighted by the regions involved.

As the Figure 4 displays, the strong runoff can be considered as the second major event that affect the territories studied. This hydrogeologic episode is the most frequent cause of the altitude zonality of the streams regime joined with snow precipitation increases in Eastern Slovakia. Nevertheless, an important impact is produced by soil erosion originated by several motives, such as torrential rain, grazing or slopes. Sheep grazing has been identified as a key factor in upland erosion in Wales. In this country the erosion from enclosed farmland and open moorland influence freshwaters particularly in terms of water clarity, deposition of fine sediment, loss of reservoir capacity and eutrophication. On the other hand the soil erosion in the Murcia region is linked principally with the climatic condition. The arid climate and the urbanisation are the basis of another problem that suffers the Spanish region: the desertification. The South-eastern part of the region of Spain represents the area with the major risk of desertification in Europe. Slope movements and landslides are the most serious geological factors threatening the environment in Slovakia and in Liguria. In Slovakia the total incidence of landslides detected in the framework of regional research affected about 3.9 % of the total

country's area. Concerning specific problems of the area studied, here indicated inside "others", Murcia designated the forestry fires whilst Wales identified as keys problems diffuse water pollution and acidification. Obviously the high incidence of fires in the Murcia Region is strictly interconnected with the hard climate conditions, and above all the frequent droughts. Anyhow, the preventive good practices lack on forestry management and it has an influence on the fire occurrence as well. Obviously for all partner the climate change is one of the most important problem and it is related with all the other problems. The countries are working on the diffusion of the information such as define that they will have been made drastic cuts in the emission and that the society as a whole will have taken account of, and be prepared for, the probable changes to the climate. These conditions may create events that affect the country from an economical, environmental and human point of view, such as the floods.

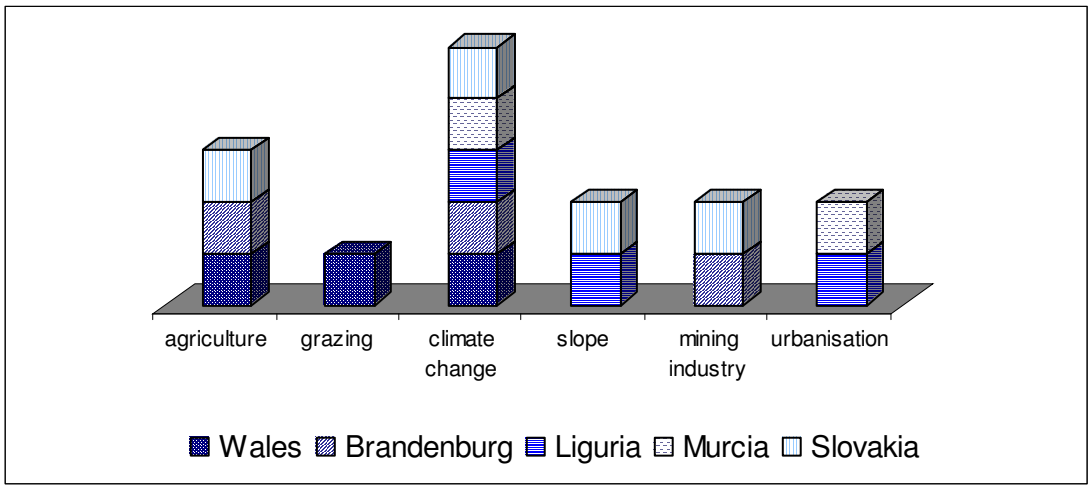

Figure 3 Summary of the main causes of hydrogeologic problems in the RobinWood countries.

Concerning Wales situation, the survey results underlined that large areas are vulnerable to acidification, especially the zones in which thin soils provide minimal buffering capacity to acidifying pollutants. Data provided from the Wales partners estimated that 34% of soils in Wales are affected by acidic deposition and that in these areas about 50% of the first to third order streams may have been damaged. Researches of Wales, focusing on nature conservation, estimated that more than 40% of the total areas of Sites of Special Scientific Interest (SSSIs) are potentially damaged by freshwater acidification. The diffuse water pollution in Wales affects rivers, lakes, coastal waters and groundwaters. In terms of vulnerability generally the ground waters are more sensitive because of the leaching of pollutants from the land surface and from areas of contaminated land, while surface waters are affected by run-off.

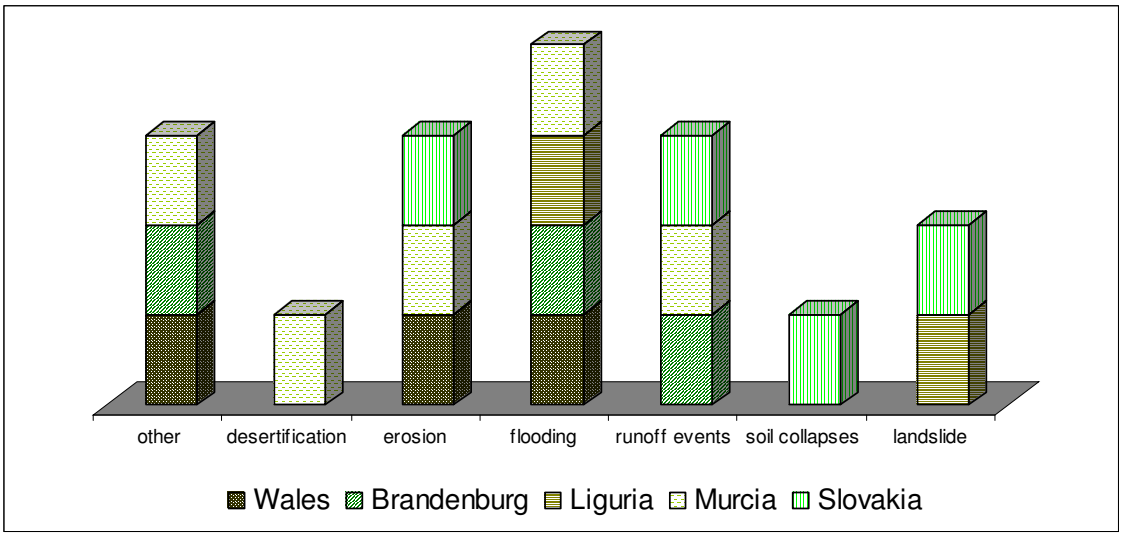

Figure 4. Schematic picture on the main hydrogeologic problems in the RobinWood countries.

In Wales the run-off rates have increased due to the intensification of agriculture and to the rise of urbanisation in which the human activity has degraded the natural permeability of the landscape and reduced its capacity to retain water via infiltration into the soil and underlying strata. The agriculture is considered as the principal cause of this important problem and although the sources may be restrained the impact induced as a whole to the environment can be strong. However, model predictions indicate an improvement over the next decade assuming that the Gothenburg Protocol is fully implemented.

Finally all the regions of the RobinWood project highlighted the evident influence of the climate change. In fact this was indicated directly as a main cause of the hydrogeologic problems (Figure 3). Each region provided in the survey a lot of data on what this problem mean in their territory. For instance, in the United Kingdom the climate is changing driven by increasing emissions of greenhouse gases. In Wales, for instance, the mean temperature and annual precipitation have increased by 0.3 °C and 3% respectively over the last century. Some impacts of climate change may have deep consequences for agriculture and forestry in Wales. However, each area presents a plan for preventing or controlling the hydrogeologic problems, or at least strong researches on these issues (Table 5). In Murcia a national plan is forecast to control and prevent the spread of the desertification, the most critical problem in the whole Peninsula.

Problem	Liguria	Brandenburg	Murcia	Wales	Slovakia
Landslide	X				
Strong run-off		X	X		X
Flooding	X	X	X	X	X
Erosion			X	X	
Desertification			X		

Others		X		X	

Table 5. Prevention plans developed in each region for specific problems.

2.1.2 RIVERS HEADWATERS AND FOREST SYSTEM

Many of the river headwaters, although affected by the human activities (mostly in terms of forest system), are included in protection, action or regulation plans, sometimes specific. These policies are encompassing rules to manage and define land uses and controlling tools for the the activities.

With regards to the data on the vegetation coverage, the vegetation appears generally altered by human activities, though with distinct degree of degradation (Table 6). For Wales there are no data on the riparian zones because the Welsh Assembly Woodland estates only account for 40% of the woodland in Wales. In fact the other areas are privately managed and quantitative as well as qualitative information is absent.

Vegetation situation	Liguria	Brandenburg	Murcia	Slovakia
Without cover vegetation		X		
With vegetation without tree		X	X	
With tree cover but very affected or degraded		X	X	X
With forest systems more or less degraded	X	X		
With developed complex well preserved		X		X

Table 6. Scheme of the vegetation in the river headwater in the RobinWood countries.

Varied pictures are provided in relation of the single area analysed, starting from Brandenburg that showed a wide range of possibilities. Merely few autochthonous riverine forest systems are persisting in Slovakia, in the lowland of Východoslovenská nížina, while the wetlands along the Latorica River are protected by CHKO Latorica. The remaining part pointed out degradation mostly due to the channelisation and manmade constructions. On the other hand Murcia is chiefly affected by sharp urbanisation that involve also basin of secondary rivers. Whereas, a slightly altered forest system is present in Liguria.

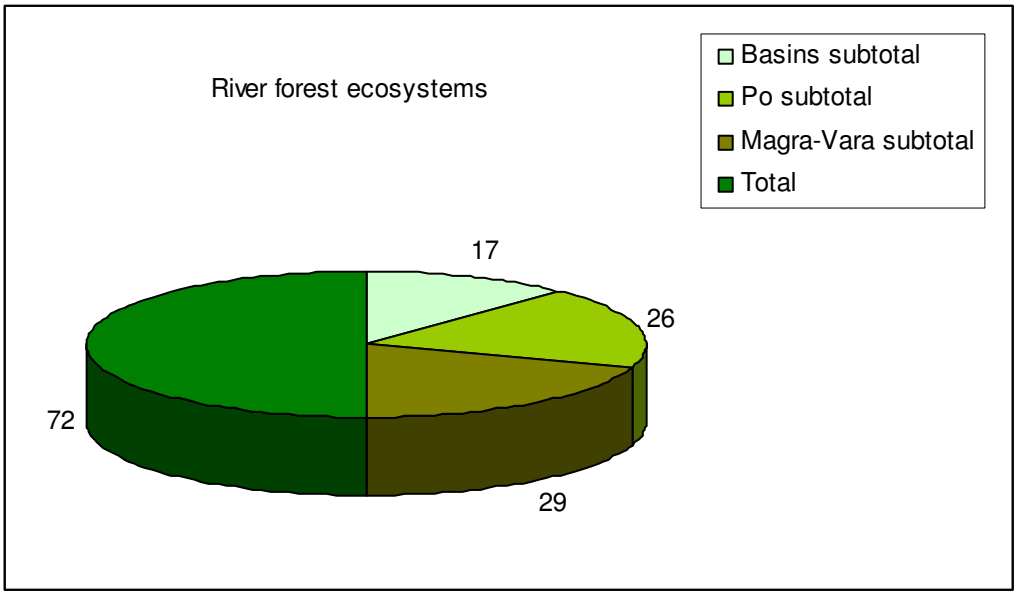

Figure 5 river vegetation coverage of Liguria express as Km^2.

In the Figure 5 it is possible to see that the total forest system of Liguria reaches out of 72 Km^2 of area. The most part of this area is represented by the Magra-Vara subtotal, that is an interregional protected zone, followed by the Po subtotal, that correspond to area covered by the affluents of the Po River passing through the Liguria region. Finally 17

Km^2 include the whole areas of the regional rivers normally affected by the urbanisation.

Notwithstanding by the degradation level of the forest system in the riparian zone and nearby the river headwaters, generally restoration plans are foreseen by all the regions (Figure 6), with exception of Liguria, where the improvement actions are associated to the local activities albeit those are included in the River Basin Plan.

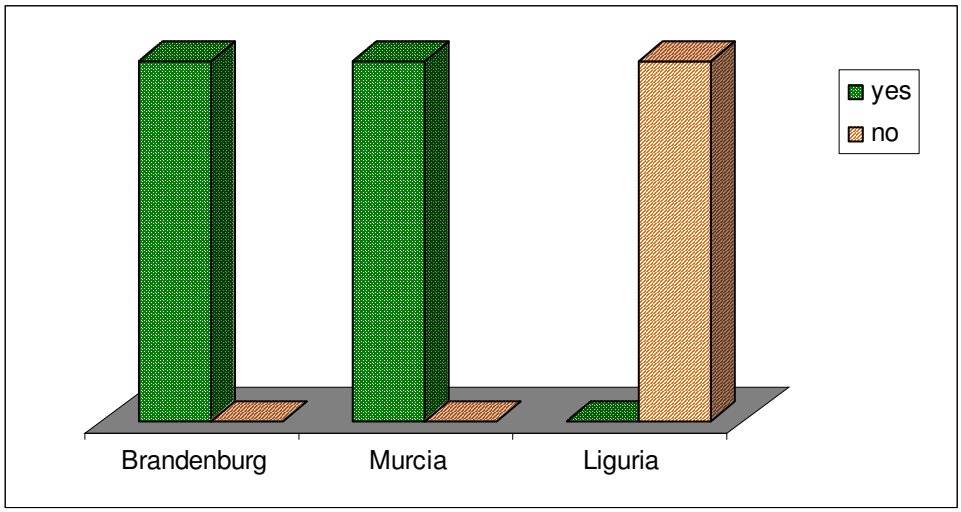

Figure 6. Presence or absence, express as yes/no respectively, of regional restoration plan in the forest systems close to the headwaters in some RobinWood countries.

2.1.3 HYDROGEOLOGICAL DEMANDS AND WATER USE

Regarding the water demand, as for the others punctual analysis on the hydrogeology, all the countries involved in the RobinWood project reflects very specific conditions (Table 7).

	Liguria	Brandenburg	Murcia	Wales	Slovakia
Trend in water demands	increase	no changes	increase	See Figure 7	decrease
Principal water use affected by the trend	D, T, I	-	D, T, A	D	D
Changes in land use (yes/no)	yes	no	yes	-	-
Existence of update data in water demands-use (yes/no)	yes	yes	yes	yes	yes
Existence of update data in the future water demands-use (yes/no)	yes (see Table 8)	no	yes (see Table 8)	yes (see Table 8)	-

Table 7. Summary of the trends in the water demands of the RobinWood regions. (Legend for the water uses: D domestic consumption for permanent population, A agriculture, T touristic activities, I industrial activities).

However some clustering can be realized. Liguria and Murcia highlighted, in the survey results, an increase in water demand, even when the progress in population growth showed different tendencies (Table 10).

Country	Studies on future water demand
Liguria	Plan of Water Improvement (1991)
Murcia	Data on the Segura River (Hydrographic Confederation of the Segura River)
Wales	Environment Agency data (some information are available on-line), Department for Environment, Food and Rural Affairs

Table 8 studies in some RobinWood rergions on the future water demand

In the Italian region the information, updated until the 1996, revealed a continuous augment in water demand started more or less 20 years ago. The main use that bear down on this increase are: domestic consumption by the permanent population (not seasonal), Tourist activities (including seasonal population, golf courses, recreational infrastructures, etc) both strongly present in the four provinces. Industrial activities present in three to the four (Savona, Genova and La Spezia) and finally agriculture deeply represented just in Imperia province. The rising request of water has been met in different way in the four provinces of the region (Table 9). The increment in the water demand affected the land use mostly in the agriculture and recreational activities.

	Liguria	Murcia
Desalinization	La Spezia	In implementation
Extraction of more groundwater	Genova and Imperia	More applied
Taking out from other use	Savona	Generally from agriculture to recreational use

Table 9 brief description on the methodologies applied to meet the increasing water demand in Liguria and Murcia.

Data on the Murcia region displayed a sharp increment in the water uptake strongly related with the population growth increase (Table 7 and Table 10). This change it happened in the last 10-20 years due to the sound increment of the housing, mostly as second home, that carried out an increase of 81% in the last 25 years. Data showed the uptakes as follow: Domestic 217 hm^3*year^{-1}, Industrial 23 hm^3*year^{-1}, Agriculture ranging from 1400 to 1662 hm^3*year^{-1}, on the basis of the Hydrologic Plan of Segura River. Currently the water consume for habitants is exceeding 50 hm^3 the annual availability, forcing to take water from other uses, generally agriculture (Table 9). The main activities that affected the water consumption are: agriculture and the touristic activity due to the increase of: seasonal population, recreational infrastructures, golf courses, etc. Although the domestic one, primary and second home, has developed rapidly in relation to the agriculture. Currently the domestic and touristic uses are the more impacting activities that have been driving to changes in the land use. Data on the future water demand estimated a continuous increase equal to 50 or 60 hm^3*year^{-1} in the long-term prevision,

However a further enhance is truly probable. Contrary trend respect to the two regions above quoted there is in Slovakia, where the water demand highlighted a decrease starting in the years 2000-2001. This tendency is correlated with the population growth trend and strictly related to a peculiar economic condition (Table 7 and Table 10). On the other hand, the Eastern Slovakia area is considered as deficient in terms of water demands due to a irregular distribution of groundwater resources, just the 17% of the total amount occurs in Eastern Slovakia. However, since 1991 the gradual decrease of water consumption is well documented (in 1989-2000 loss of 36% in Slovakia), due to economy transformation (cutback in production, increase of water tariff), which lasts till this time. Decrease of water consumption was noticed in case of surface water sources too (in 1989-2000 loss of 57% in Slovakia). In the Welsh territory, as showed the Figure 7, the prospect reflects a sort of steady state, with slight decrease until the 2004. Studies on the future demand draw attention to an increase. The data are available, in the Environment Agency, on the Water Situation Report published for each calendar month dating back to 1999 and is supplemented by a weekly update during dry periods, as well as in different report of the same institution.

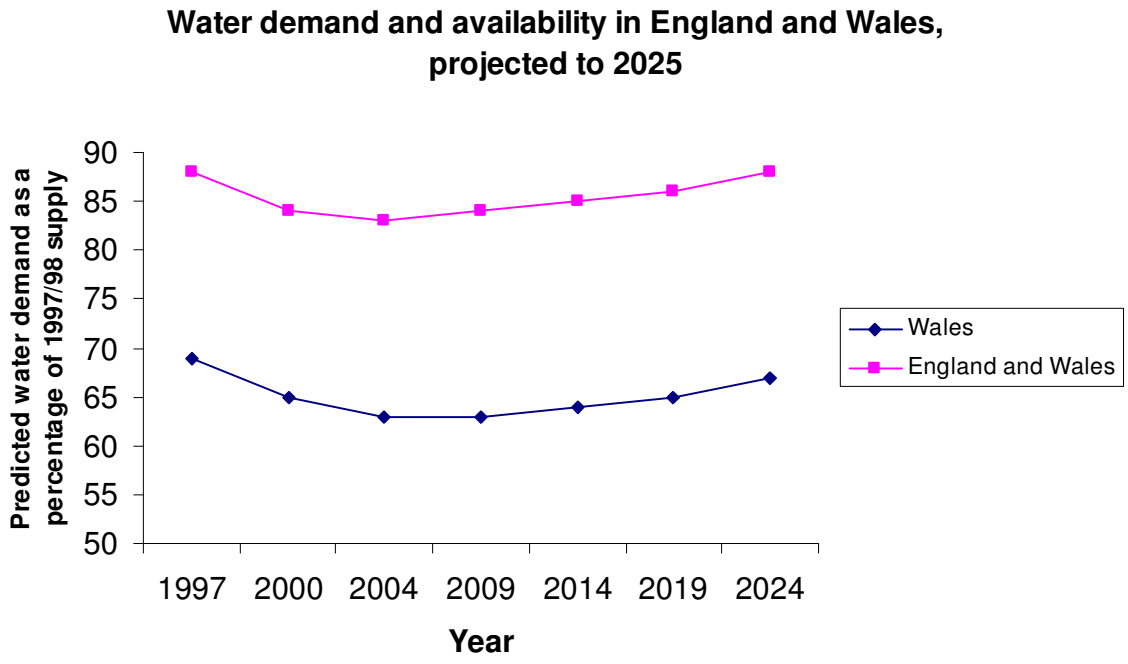

Figure 7. Water demand tendency for Wales and UK. Source: Environment Agency.

Actually there is limited information available about the future demands of water in UK. A dataset on future water demand for three river basin districts, located wholly or partially in Wales, is defined as part of the characterisation phase for Article 5 of the Water Framework Directive. As those data explain the future expectation are as follow:

- Welsh industry in currently experiencing growth, mainly in new business parks around urban areas.
- Housing growth has become a significant issue in Wales, and across the UK. Population growth accounts for 57% of this growth, with the remainder due to changing household patterns. There are now more smaller and one-person households. Since smaller households tend to have higher per capita water use, this trend may increase overall water consumption.

Country	Population trends
Liguria	The Ligurian population is decreasing. During the years 1982-2003 decreased about 12 per cent. In details the decrease for the four Provinces of the region is (from West to East): Imperia –6.62%, Savona –6.0%, Genova –15.8%, La Spezia –9.07%.
Brandenburg	The local population no increased whilst it changed its distribution
Murcia	The population is increasing mostly due to the immigration related with enhance in workforce demands mainly for the agriculture and for construction. Furthermore a change in the population distribution occurred with an augment in the coastal areas density in respect to the internal zones.
Wales	The population is growing with a rate 2-4%/year. This leads to an average increase of over 11,500 houses per annum. Much of this increase will be around major urban areas such as Cardiff and Swansea. The inflow of migrants to Wales has grown considerably in recent years, from around 45,000 in 1981 to 64,000 in 2002. The reason for the net inflow of people into Wales is that its rural areas provide an attractive location for retirement.
Slovakia	Long lasted increase of population has been finished in the last years. The emigration searching new job opportunities is a new phenomenon in Slovakia. Contrary to the great migration before 1960, when only rural areas were being unpeopled, great towns are presently unpeopled too. Currently only vicinity of greatest towns show increase on population.

Table 10 Schematic descriptions of the population trends in the RobinWood countries.

2.1.3.1 STATE OF THE AQUIFERS

Many differences are detected in the countries studied that ranged from overexploitation to a balanced condition of the aquifers (Table 11).

Country	Aquifers condition
Liguria	The problem of the overexploitation does not exist, therefore there are no data on the matter.
Brandenburg	The aquifers resulted overexploited, about a 5% of the total areas is suffering this heavy use (1500 Km2). The changes in groundwaters depth caused by this misuse achieved a mean value of about. –2 cm/year of deficit in the aquifers (time series 1976 – 2000).
Murcia	Aquifer overexploited: about 45% of the Hydrographic units are in deficit (the outflow are greater than the inflow). The water debit express the overexploitation.
Wales	Wales contains many aquifers with different characteristics. The aquifers are grouped into categories based on how groundwater flows within them and how much water is available for abstraction. However the overexploitation it is not a real problem.
Slovakia	The aquifers in all hydrogeologic regions of Eastern Slovakia can be considered in balance state. The SHMÚ performs an annual analysis of groundwater exploitation in Slovak hydrogeologic regions, by comparison of documented exploitable amounts and actually withdrawed amounts.

Table 11 schematic description of the state of the aquifers in the countries of RobinWood.

Generally Murcia is the region where the problem of the exploitation, or better the overexploitation, of the waters is stronger. The scenario in Slovakia is very peculiar, no changes in the groundwaters depth were detected and the aquifers state is balanced. This condition is related to the considerable decreases of groundwater demand in the last years,

due to a critical economic scenario as well as to the use limitations of water sources resulting from contamination. In Slovakia there are two degrees of limitations, regarding contamination, to the use of underground and surface water:

- Very heavy contamination avoids the use of water for drinking or even as utility water (groundwater of anthropogenically affected aquifers and some sections of rivers mainly in lowland areas).
- Heavy contamination avoids the use of water for drinking (groundwater of anthropogenically affected aquifers and some sections of rivers in fluvial plain areas).

These limitations obviously affects the consume of water. The Welsh waters, as indicated yet (Table 11), are geologically diverse and therefore the aquifer revealed different characteristics. The classification of the groundwater is based on their flow and productivity. They range from low productivity uplands to low-lying, highly productive karstic limestones and sandstone basins. The Environment Agency have identified 46 Groundwater bodies in Wales by dividing aquifers into 'aquifer types' according to hydrostratigraphic boundaries and then dividing these up on the basis Catchment Abstraction Management Strategy (CAMS) catchment hydrological boundaries. The groundwater abstractions are also an important source of water for agriculture and industry and provide water to people or businesses that cannot use water from the public mains in Wales. Groundwater levels, in early 2004, were at the long-term average, although the height is depending on the weather and the waters demands. In the Murcia region the overexploitation is a real problem and most of the aquifers showed a deficit (Figure 8) that express the amount over–utilized. This situation is going worse because of the increasing water demand together with the

extensive drought. Now the overexploitation of the groundwater is strongly present in the Northeast of the region in which the drop in the water level achieve about the 0.6-0.8 m*years^{-1}, with some exceptional case of 2-3 m*years^{-1}. Currently the outcome of this problem are perceptible as fount dryness effect, for instance in the Fuentes del Marqués, where the flow fell down from 500 l*s^{-1} to 250 l*s^{-1}.

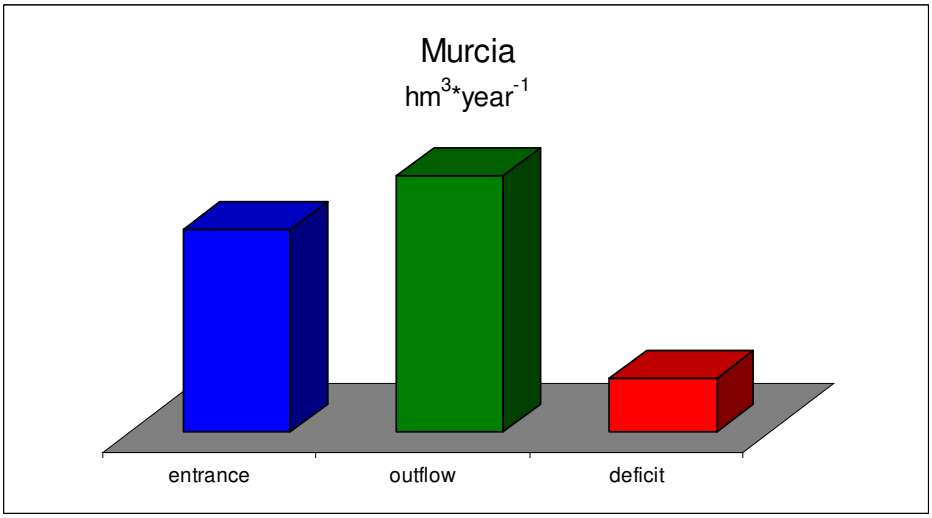

Figure 8 data on the water exploitation for the 1995 in the Murcia Region. Total water amount in entrance (rivers, rain, etc.), total outflow (pumping, rivers, etc.) and the deficit recorded for the year (express as hm^3*year^{-1}), data provided by the Hydrographic Confederation of the Segura River.

In the zones of Yecla and Jumilla this critical circumstance is marked, in fact the aquifers suffered a drop down in the water level about of 2.5-5 metres for year. Remarkable consequence of this overexploitation in the Murcia region can be as follow: loss of water level, salinization of the water resource and/or the gas release, like it is happened in the Valle del Guadalentín in which there is a liberation of carbonic gas contained into the aquifer.

2.1.4 PROTECTED AREAS: HYDROGEOLOGY AND FORESTRY

For each region involved in the RobinWood project tables or figures representing a scheme related to the protected areas of the territory are provided (see below Liguria: Table 12 and Table 13; Slovakia: Table 14; Brandenburg: Table 15; Murcia: Figure 9 and Table 16; Wales: Figure 10 and Figure 11). In general Natura 2000 areas are present in each region with different extension and quantities. In Liguria (Table 12 and Table 13) there are SPAs (3.62% to the total area), and SIC terrestrial and marine (the 25% of regional territory is interested by terrestrial SIC). In Brandenburg (Table 15) the total area designed as Natura 2000, that includes FFH- and SPA-Areas, represents the 26.38 % to the total. In the Murcia region the SIC (terrestrial and marine) covered a 14% to the total area and the Special Protection Areas For Birds represented the 18.1 % (Figure 9, Table 16). The distribution of the hydrological ecosystems of international importance through the EU Habitats and Birds Directives in Wales are summarized in the Figure 11. There are 90 Special Areas of Conservation (SAC), of which about 95% have water dependent Habitats and species, including extensive wetland areas (approximately 52.8 Km^2 in total), rivers, lakes and coastal waters, and 20 Special Protection Areas (SPA), of which only 4 are freshwater reserves. On the other hand a list of 11 Special Protection Areas For Birds is proposed in the Eastern Slovakia, overlapping the two Ramsar Convention sites (Table 14). Regarding the protected areas, the data on the national and regional protected areas are reported in the figure and table above quoted, and differs among the RobinWood regions in relation to the local legislation framework (see paragraph 2.1.4.2). For instance (Figure 10), the most part of the Welsh protected territory are SSSI (Sites of Special Scientific Interest). Those SSSIs cover over 10 per cent of the land area of Wales and range from small fens, bogs and riverside meadows to sand dunes, woodlands and vast tracts of

uplands. Most of them are in private hands, although some are owned and managed by local wildlife trusts, or other voluntary conservation bodies. Many of these territories are further ordered as National Nature Reserves (NNR), currently there are 76 NNR. There are also three National Parks: Brecon Beacons, Snowdonia and the Pembrokeshire Coast. The designation of a Welsh National parks can include substantial settlements and land uses (e.g. commercial forestry, grazing agriculture, extractive industries) which are often integral parts of the landscape, and land within a national park remains largely in private ownership. While in Slovakia the National park are controlled by the Govern and exist different level of protections (Table 14). In some of the territories polled there are Ramsar Convention Sites such as: Latorica, and Senné – rybníky in Slovakia; Mar Menor in Murcia (the bigger european coastal lagoon, 14,933 ha). In Wales 10 Ramsar sites are classified (those areas are also SSSI and SPAs).

Acronym	Description	Protection level	Number	List
SPAs	Special Protection Areas	European level	7	See Table 13
SIC terrestrial	Site of Community Interest	European level	98	
SIC marine	Site of Community Interest	European level	26	
NP	National park	National	1	National Park of 5 Terre
RP	Regional park	Regional	6	Regional Park of Montemarcello Regional Park of Vara-Magra Regional Park of Aveto Regional Park of Antola Regiona Park of Beigua Piana Crixia

Table 12 protected areas in Liguria for which is provided the denomination and the protection level.

N°	Natura 2000 Code	Name	Area HA	Ambito
1	IT1315380	TESTA D' ALPE - ALTO	1544.69	2
2	IT1314679	TORAGGIO - GERBONTE	2484.43	2; 4
3	IT1314677	SACCARELLO - GARLENDA	986.46	4;9
4	IT1315481	CEPPO - TOMENA	2071.06	2;4
5	IT1313776	PIANCAVALLO	1108.62	PO
6	IT1314678	SCIORELLA	1472.84	4;9
7	IT1331578	BEIGUA - TURCHINO	9960.27	11;12;PO

Table 13 list of SPAs in Liguria for which is provided the denomination, extension and administrative location (Ambito).

Acronym	Description	Protection level	Number	List
RAMSAR	Ramsar Convention Sites	International level	2	Latorica, Senné – rybníky
SPAs	Special Protection Areas	European level	11	proposed
CHKO	Protected landscape areas	National second level	4	Slovenský kras, Latorica, Vihorlat, Východné karpaty
NP	National park	National third level	5	TANAP, Nízke Tatry, Slovenský raj, Pieniny, Poloniny
		National fourth –fifth level	289	protected areas, natural reserves, national natural reserves, natural monuments, and national natural monuments

Table 14 protected areas in Slovakia for which is provided the denomination, the protection level, number and list.

Acronym	Description	Protection level	Percentage
FFH	it provides for Special Areas of Conservation (SACs) extended to other groups of species and types of habitats. Special Areas of Conservation and Special Protection Areas form together the NATURA 2000 network	European	11.23
SPAs	Special Protection Areas	European	21.88
NSG	Nature Reserve Areas	National	8
LSG	Landscape Protection Areas	National	33

Table 15 protected areas in Brandenburg for which the denomination and the protection level and spatial extension expressed as a percentage of the total area is provided.

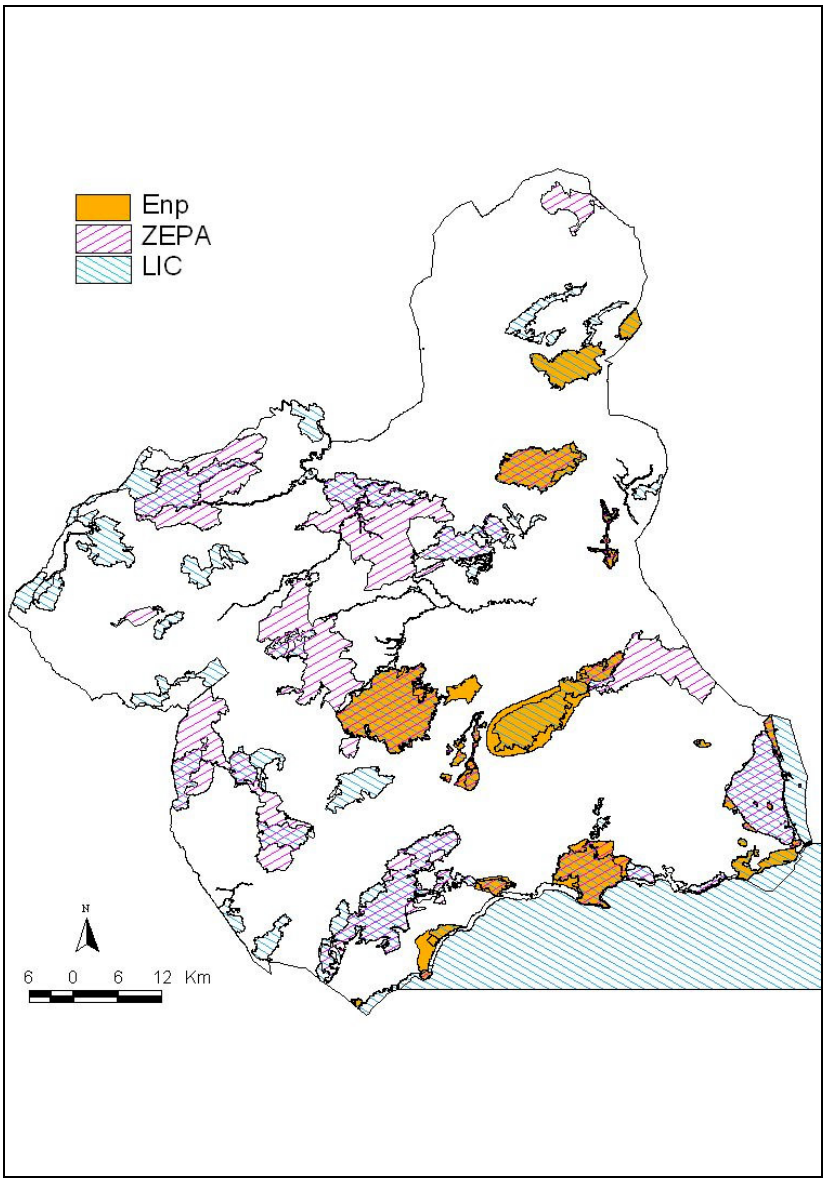

Figure 9 maps of protected areas in Murcia Region (the legend is in Spanish therefore: ZEPA correspond to Special Protection Areas for Birds, LIC correspond to the Site of Community Interest and Enp Natural Protected Areas).

Special Protection Areas for Birds	Main Species
Sierra Espuña	*Aquila chrysaetos, Bubo bubo*
Sierra de la Pila	*Pyrrhocorax pyrrhocorax*
Sierra de La Fausilla	*Rhodopechys githaginea*
Sierra de Ricote y La Navela	*Falco peregrinus, Bubo bubo*
Sierra de Mojantes	*Gyps fulvus*
Sierra de Almerana, Moreras y Cabo Cope	*Hieraaetus fasciatus, Bubo bubo, Rhodopechys githaginea*
Sierra del Gigante-Pericay, Lomas del Buitre-río Luchena y Sierra de la Torrecilla	*Circaetus gallicus, Falco peregrinus, Bubo bubo*
Sierra de la Muela-Cabo Tiñoso	*Falco peregrinus, Bubo bubo*
Sierra de Moratalla	*Falco peregrinus, Bubo bubo, Pyrrhocorax pyrrhocorax*
Sierras de Burete. Lavia Y Cambrón	*Pyrrhocorax pyrrhocorax, Circaetus gallicus, Bubo bubo, Hieraaetus pennatus*
Monte de El Valle y Sierras de Altahona y Escalona	*Bubo bubo, Hieraaetus fasciatus*
Salinas y arenales de San Pedro del Pinatar	*Himantopus himantopus, Sterna albifrons, Sterna nilotica, Recurvirostra avosetta*
Humedal de Ajauque y Rambla Salada	*Himantopus himantopus*
Estepas de Yecla	*Otis tarda*
Mar Menor	*Himantopus himantopus Egretta Garzetta, Calandrella rufescens*
Llano de las Cabras	*Chersophilus duponti*
Saladares del Gudalentín	*Himantopus himantopus*
Sierra del Molino, Embalse del Quípar y Llanos del Cagitán	*Bubo bubo, Falco peregrinus, Himantopus himantopus, Pyrrhocorax pyrrhocorax,* Burhinus oedicnemus
Isla Grosa	*Larus audouinii*
Isla Hormigas	*Hydrobates pelagicus*
Islote de Cueva Lobos	*Hydrobates pelagicus*
Isla de Las Palomas	*Hydrobates pelagicus*, *Calonectris diomedea*

Table 16 list of protected areas in Murcia Region: Special Protection Areas for Birds and related species.

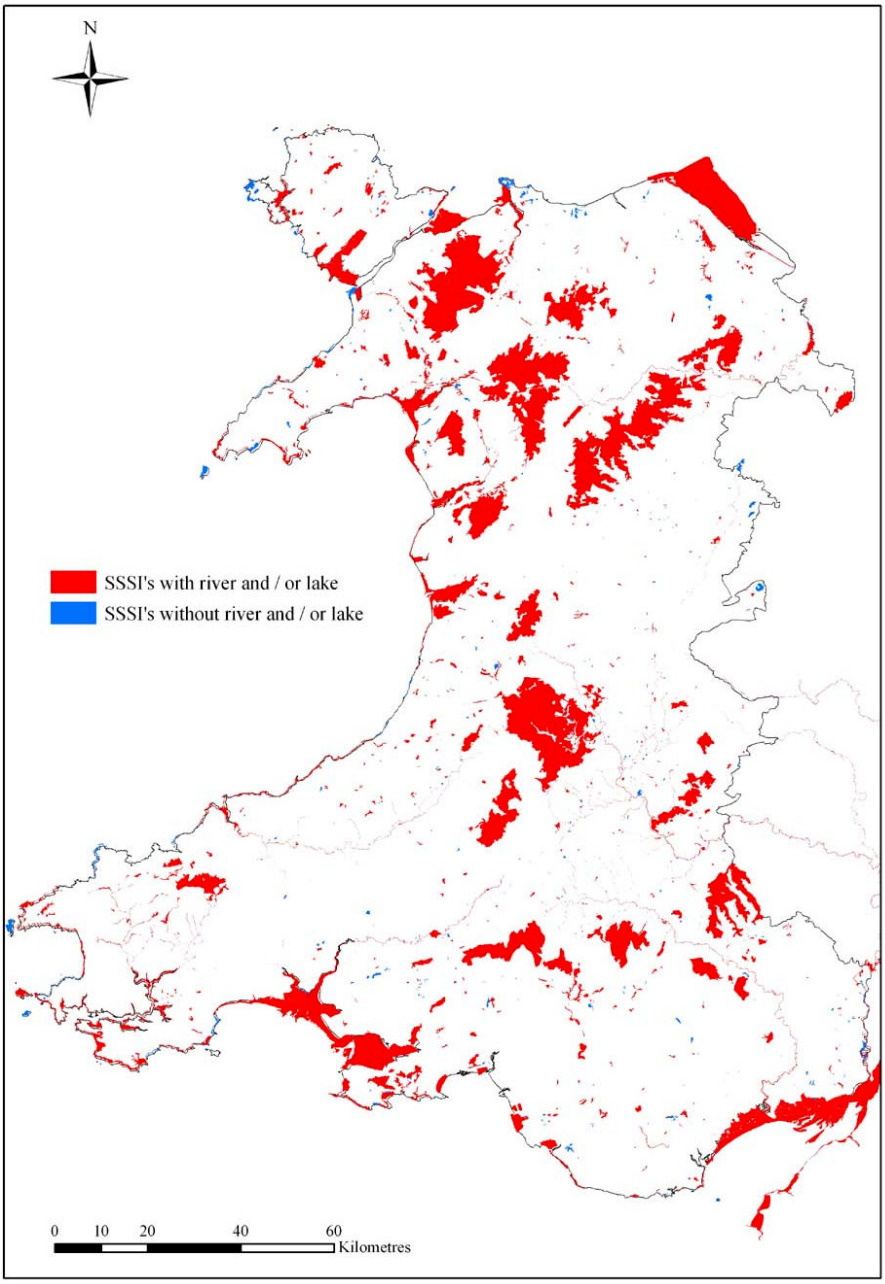

Figure 10 map of protected areas SSSIs (Sites of Special Scientific Interest) in Wales with (red) and without (blue) a water component (Kindly provided by the Wales partners).

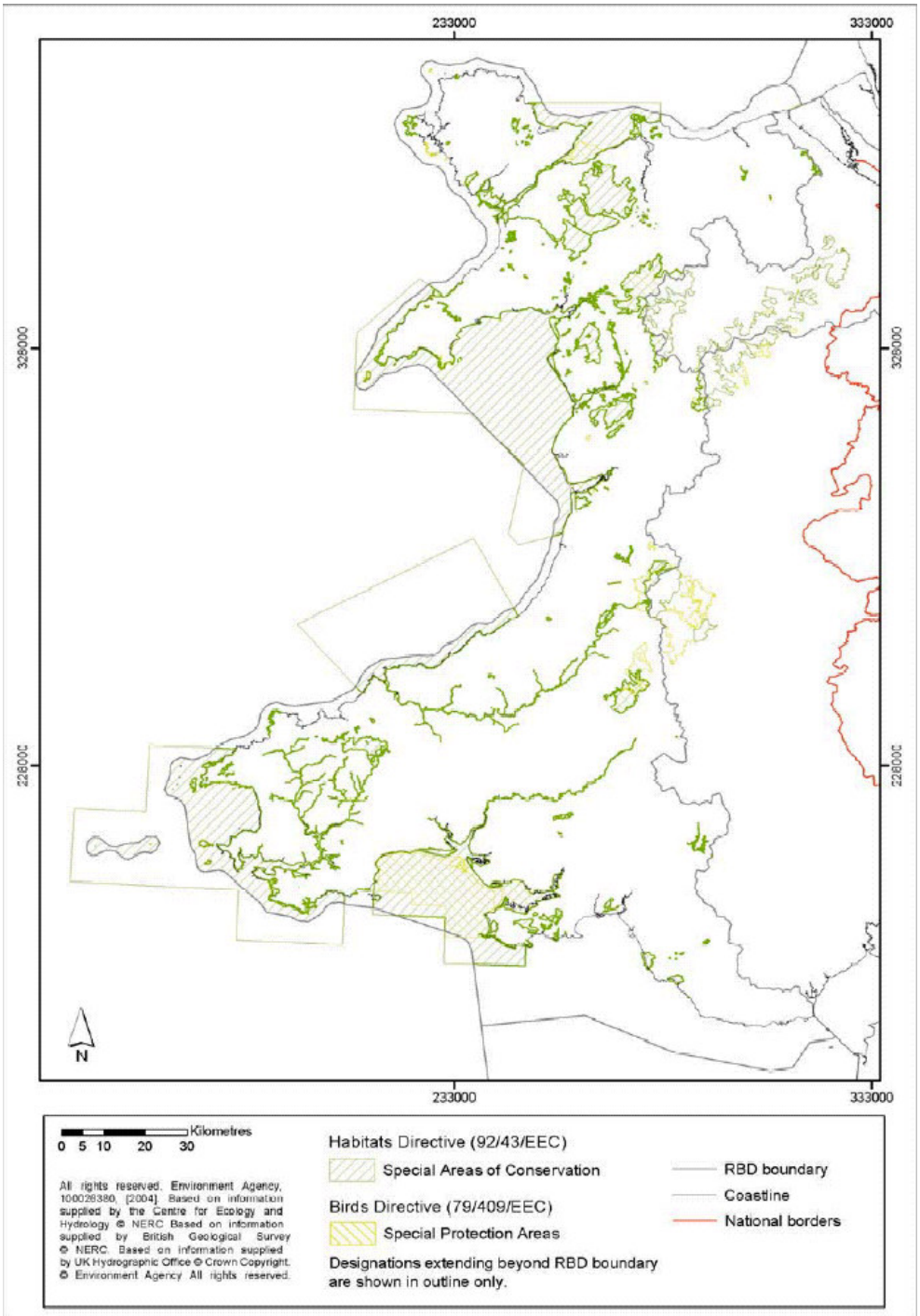

Figure 11 Water dependent conservation areas (Kindly provided by the Wales partners, source: Environment Agency. Copyright Environment Agency).

2.1.4.1 PROTECTION OF HYDROGEOLOGICAL RESOURCES

The protection of the hydrogeological resources is related to the European and national legislations. Generally the Water Framework Directive (2000/60/EC, Table 17 and Figure 12) has been adopted in every country even if it is definitive application is still in progress. However in all the countries the studies to reach the steps requested are ongoing. In the Table 18 and Table 19 a schematic picture of the regulations that are in force at local level in the region of the project is provided.

WFD Water Framework Directive (2000/60/EC)
All Member States of the European Union have to take action to maintain the ecological status of water and to improve it to achieve the standard. The legislation provides a set of guidelines to reach the water quality. The Directive requires that all surface waters should be classified using ecological methods in addition to chemical measures of quality. key aims of the Directive: • expanding the scope of water protection to all waters, surface waters and groundwater • achieving "good status" for all waters by a set deadline • water management based on river basins • "combined approach" of emission limit values and quality standards • getting the prices right • getting the citizen involved more closely • streamlining legislation

Table 17 European Directive on the water quality (source: http://europa.eu.int).

Year	Issue	Reference
2000	Directive entered into force	Art. 25
2003	Transposition in national legislation Identification of River Basin Districts and Authorities	Art. 23 Art. 3
2004	Characterisation of river basin: pressures, impacts and economic analysis	Art. 5
2006	Establishment of monitoring network Start public consultation (at the latest)	Art. 8 Art. 14
2008	Present draft river basin management plan	Art. 13
2009	Finalise river basin management plan including programme of measures	Art. 13 & 11
2010	Introduce pricing policies	Art. 9
2012	Make operational programmes of measures	Art. 11
2015	Meet environmental objectives	Art. 4
2021	First management cycle ends	Art. 4 & 13
2027	Second management cycle ends, final deadline for meeting objectives	Art. 4 & 13

Figure 12 Timetable for implementation (source: **http://europa.eu.int**).

Country	Hydrogeologic resources regulations
Liguria	Plan river basin: includes restriction and controlling tools to activities and use of resources.
Brandenburg	Regulation about the hydro-geological resources focusing on ownership, priority of uses, control structures
Murcia	At national level: National Hydrologic Plan (Law 11/2005); Law on Water 2/2004 it defined the basis into hydraulic and hydrogeologic subjects, use, control and checking of the activities of the Hydrographic Confederation. Autonomic Law: 1/1995 of the Environment.
Slovakia	A complex series of regulations on the protection of surface and underground waters is present (see Table 19)
Wales	River Basin Management Plans (RBMP) are produced for each defined River Basin Districts (RBD). Wales has three RBDs, one of which is wholly in Wales (the West Wales district) and the other two are shared with England (the Dee and the Severn). The EA is in the process of developing the initial RBMPs (which are due to be completed by 2009). They will be prepared, implemented and reviewed on a six year cycle. The Environment Agency has prepared guidance on the Regulations on water protection that require Environmental Impact Assessment (EIA) for water management projects for agriculture, including irrigation, where it is deemed that the effects of the project on the environment are likely to be significant and where planning permission is not required.

Table 18 scheme of some of the regulations on hydrogeologic resources protection in some RobinWood countries.

Acronym	Description	Protection level	List
OP	Protective zones	National: three degrees. The first degree protects the spring area; the second degree protects the accumulation area, and the third degree protects the infiltration area of hydrogeological structure	The natural medicinal sources and natural mineral table water sources.
	Streams important for water management	National	water streams or their sections established for diverse purposes streams important for water economy
	Drinking water supply streams	National	
PHO	Hygienic protection zones	National	exploited surface and underground water sources – they are identified with the purpose of protecting the yield, quality and hygienic security
CHVO	Protected water management areas	National	exploited surface and underground water sources – they are identified with the purpose of protecting the yield, quality and hygienic security

Table 19 protection of hydrogeologic resources in Slovakia for which is provided the denomination, the protection level and list.

2.1.4.2 MAMAGEMENT FRAMEWORK FOR PROTECTED AREAS

Management plans for the protections areas are present in all the regions, but not for all the protection figures. Like it is reported in the Table 20, the picture for the polled regions is showing that for Brandenburg, Liguria and Murcia some regulations and framework are still ongoing, while a more completed scenario is present in Slovakia and Wales. Regarding Wales, details of the Welsh condition are given in the Table 21.

Country	Regulations on protected areas
Liguria	The management plan of protected areas (Parks, SIC and SPAs) comprehends indications also about hydrologic and forest activities. The Plan of Park regulates and programmes all activities in each one. The management plan of SIC and SPAs are going to be ready soon.
Brandenburg	The management plan for the environmentally protected areas is defined but no for all areas. Where they already exist include indications also about hydrologic and forest activities.
Murcia	Regulations for the protected areas are present but no for all the sites. At now the management plan (PORN: Plan de ordenación de los recursos naturales-natural resources management plan) are ongoing. These plans contemplated controls and activities in the use of the resources but no strictly on the hydrogeology and forestry issues.
Wales	A subtle series of regulations are designated for each protected area typology (see Table 21), although the Wildlife and Countryside Act 1981 (amended 1985) forms the statutory bedrock for protecting land.
Slovakia	In the Slovakian territory the protection is provided by two acts, six governmental regulations, which designate the national parks (NP), 24 decrees, which designate the protected landscape areas (CHKO) and regulate the details concerning protection, designate the protected plant and animal species, minerals and fossils and finally the generally binding decrees of regional offices, which designate the protected territories and trees. Pursuing the Act of the National Council of the SR No. 287/1994 of Coll. on nature and landscape protection, conservation of the natural assets of Slovakia is based on territorial system of ecological stability.

Table 20 scheme related with the action plans for the protected areas in the RobinWood regions.

Protected area	Regulations description
SSSIs	SSSIs provide the basic 'building blocks' of nature conservation legislation, and most other legal natural/geological conservation designations are based upon them. The management of a SSSI is based on partnerships between the Countryside Council for Wales (CCW) and the owners and occupiers.
NP	The National parks, although they have a peculiar framework, are managed by National Parks authorities. In Wales the designation as a national park can include substantial settlements and land uses (e.g. commercial forestry, grazing agriculture, extractive industries) which are often integral parts of the landscape, and land within a national park remains largely in private ownership.
NNR	All nature reserves are also SSSIs and are protected under the same legislation and they are managed by CCW. Many SACs and SPAs are found within NNRs.
Natura 2000	SACs are strictly protected sites designated by the EU Habitats Di rective. Their management is normally achieved through SSSI management agreements and plans. Special Protection Areas (SPA) are a designation under the European Commission Directive on the Conservation of Wild Birds (79/409/EEC).

Table 21 general situation on the protected areas regulations in Wales

On the other hand the differences in the frameworks in each region implies also differences in the administration centres authorized to manage the protected areas (Table 22).

Wales	Liguria	Brandenburg	Murcia	Slovakia
Countryside Council for Wales (CCW) and the landowners (for the national park)	Liguria Region	Brandenburg State Office for the Environment	Regional administration	Ministry of Environment

Table 22. administrative office or legal figures involved in the protected ecosystems management.

2.1.4.3 MAMAGEMENT FRAMEWORK FOR HYDROGEOLOGY AND FORESTRY ISSUES

As a survey result a composite picture of the competent authority for the hydrogeological and forest components was found in the RW regions. Details of the administrative offices involved in the management of the above-mentioned compartments for each territory are reported in the Table 23. As it is possible to see in some cases the authorities at different level such as: Government, Region, Council or District, are merging the hydrogeologic and the forestry competences in the same government office. However the regions showed mainly a separation in the bodies in charge of manage of the hydrogeological or forestry component. Nevertheless there are some centres involved in the government are liaising in terms of policy strategy and there are examples of a strictly cooperation. Particularly it is the Liguria Region case in which two different administrative offices are sharing out the functional and the jurisdictional authorities for both the components: hydrogeology and forestry.

Administration dependence	Country	Institutions list
Hydrogeology and Forestry components depend on **same** government institutions but with different roles.	Liguria	**Hydrogeology** and **Forestry**: Liguria Region manages programs, plans and controls. Province and Mountain Communities are jurisdictional bodies.
Hydrogeology and Forestry components depend on the **same** government institutions.	Brandenburg	**Hydrogeology** and **Forestry**: Ministry for Agriculture, Environment and Spatial planning; Brandenburg State Office for Environment; District administrations; Regional Forest offices.
Hydrogeology and Forestry components depend on **different** government institutions.	Murcia	**Hydrogeology:** Segura River Hydrographical Confederation and Taibilla channels associated institution of provinces and municipalities. **Forestry:** General Direction of the Natural Environment
Hydrogeology and Forestry components depend on **different** government institutions.	Wales	**Hydrogeology**: Environment Agency-Wales. **Forestry**: Forestry Commission Wales. **Other inst.:** Environment, Planning and Countryside Department of the Welsh Assembly Government, Countryside Council for Wales.
Hydrogeology and Forestry components depend by **different** government institutions.	Slovakia	**Hydrogeology:** Ministry of Living Environment. **Forestry**: Ministry of Agriculture, Regional forest offices.

Table 23. administrative offices list for the hydrogeological and forestry component to each country.

2.2 GEOGRAPHIC INFORMATION SYSTEMS (GIS)

A survey purpose was gathered information to develop GIS maps based on the hydrogeological issue to each target country. The inquiry was addressed to achieve information ranging from GIS data sets current state to the availability and accessibility of those. The material collected related to the RobinWood countries are presented in the tables below (Table 24, Table 25, Table 26). Broadly there are a number of GIS data sets in the countries (e.g. hydrology, protected areas, soil erosion, geomorphology, etc.) unfortunately with a heterogeneous distribution. Furthermore the chief concern pointed out from the survey was the sharp differences among the partners regarding available information. As it is possible to see in the Table 24, some territories showed a cartography system in progress, therefore accessible mostly to the people involved in its realization. In other case the centres that manage the maps don't provide a service to the usability outside the institution. Those problems can affect the development to attain the common approach on GIS maps requested by the project.

GIS Information	Liguria	Brandenburg	Murcia	Wales	Slovakia
Cartography presence	yes	yes	yes	yes	yes
Availability	Digital topographic map available. GIS maps in progress.	GIS maps available in the most of the cases.	GIS maps available in relation to the centre.	GIS maps available.	GIS maps in progress.

Table 24. picture on the GIS information in the RobinWood countries.

Country	GIS maps list
Liguria	Carta Bionaturalistica a complete map on humid areas.
Brandenburg	Several GIS maps.
Murcia	Several GIS maps such as: land use (agriculture, forestry, waters, etc) ; Principal Basins; Segura River hydrographic basin; Secondary rivers; Urban areas; Aquifers, forest regions.
Wales	Land Cover Map 2000 (LCM2000) a complete map of the land cover of Great Britain; National Water Archive (NWA); UK Governments National River Flow and Groundwater Level archives; Countryside Survey 2000 (CS2000) information on the habitats, plants, landscape features and land types of Great Britain; Countryside Information System (CIS) a package which allows users to map and analyse spatial information about the UK countryside
Slovakia	. Digital topographic map (scale 1:50000). GIS on hydrogeology, pedology and geodynamics in progress.

Table 25. GIS maps list related to the hydrogeological issue.

Country	Centre
Liguria	Liguria Region, Environment Agency. (at the moment the cartography is accessible by people involved in its realization).
Brandenburg	Several public administrations
Murcia	Several public administrations such as: IGME (Institute of geology and mineral extraction) and CIMA (Industry and Environment Ministry of Autonomic Region).
Wales	Centre of Ecology and Hydrology. (CEH); National Soil Resource Institute (NSRI); Forestry Commission-Wales; Environment Agency-Wales.
Slovakia	Geological Survey of Slovak Republic

Table 26. public and/or private centers that realize and/or manage the cartography system in the RobinWood territories.

3 SWOT ANALYSIS

The data obtained by the SWOT analysis are summarized in the follow points. The major problems as well as the driving forces of the project, in relation with the hydrogeologic thematic and the relationship with forests, has been detailed.

Aim of this part of the report is the definition of common and peculiar characteristic to highlight the work that all partners have to be done to the correct realization of the future steps of RW project.

The report is divided in a common part descriptions (paragraph 3.1), and a second part that it include peculiar problems and driving forces for each country expressed as potential hydrologic studies (paragraph 3.2). Both the paragraphs are derived by information of the SWOT analysis collected and therefore the specific points: WEAKNESS, THREATS, STRENGTHS and OPPORTUNITIES have been elaborated and redefined. From the development of the points above quote has been possible build up strategies and define how addressed the project by the hydrogeologic point of view.

3.1 COMMON TECHNICAL OVERVIEW

In the paragraphs below (paragraph 3.1.1and 3.1.2) are presented the SWOT analysis results, they are focused on the for the common part analysis. The countries of RobinWood have been provided a lists of common problems to the realization of the project as well as general forces, both centred on the hydrogeologic theme.

3.1.1 MAIN PROBLEMS

From the SWOT analysis has been highlighted problems to the realization of the project in terms of hydrogeologic and forestry context. Beside of difficulties related to administrative actions and data collection, it has been underlined by countries obstacles in the realisation of the project considering the hydrogeologic component or issues associated with.

Problems
Studies on the predictions of future water cycles and future waters demands are poor.
Studies on climate change effects have to be included in the regional projects but there are some difficulties mostly in the predictive studies.
Water shortage problems and increase in water demand.
Difference in the hydrogeologic characteristics in the RobinWood countries.
Difference in hydrologic needs in the RobinWood countries.
Difference in the administrative organization for the hydrogeologic resources in each RW country.
Difference in the management framework for the protected areas involving hydrogeologic and forestry resources in each country.
Difficulties understanding hydrologic effects associated to the mosaics of land uses.
Difficulties in unifying data within regions and between regions.

Table 27 list of the principal difficulties, found in the project, focus on the hydrogeologic issues for each RobinWood partners.

Crucial problems, detailed in the table above, to the development of the hydrogeologic part of the project are focus on the heterogeneity present in the territories involved in RobinWood. However as hydrologic

problems, in terms of risk, the main worries for all countries involved in RobinWood is the flood event, as is possible to see in the Figure 4 in the paragraph 2.1.1., although the runoff appears to be another important impact, mostly in Slovakia. Whereas related with the socio-economic part of the project, and therefore with the water demand, it is possible to say that water shortage is an increasing problem. It must be taken seriously mostly in those sites in which there is and increase of water demand due to the increase in the domestic use, housing and second home.

In addition to the problematic above quoted RobinWood partners have been underlined the common vulnerabilities of the project strictly related with the hydrogeologic component (Table 28). This part came out from the threats listed in the SWOT analysis. Hence they are not real problems these can express concerns and create possible arrests, or short term complications, in the RobinWood progress.

Vulnerability
Forest not seen as linked to water issues by many stakeholders. And lack of confidence in forestry to provide long term benefits for management of hydrogeologic problems.
Limited research on large scale effects of forestry on hydrological cycles.
Lack of common actions between hydrogeological and forest administration.
Difficulty in providing cost/benefit analysis for hydrogeological effects.

Table 28 scheme of the principal vulnerability in the development of the RobinWood project.

3.1.2 DRIVING FORCES

In addition to the data on main problems to the realization of the project the SWOT analysis allowed to us the definition of the driving forces to the project. Moreover to the strengths derived by the opportunity of a work-together between different European countries, there are several motivations to get on the project by the hydrogeologic point of view. The data on the positive thrusts, highlighted by the partners, to the realisation of future steps of RobinWood, in terms of the hydrogeologic component or issues associated with, are presented in the Table 29.

Motive Power
Forestry is recognised as an extensive land use that generally protects the freshwater environment.
The EU Water Framework Directive (WFD) focuses on integrated catchment management and land use solutions to hydrogeological problems.
Potential to provide recommendations to policy makers.

Table 29 main forces that promote and stimulate the countries partners in the RobinWood project progression.

It seems clear that the potential outputs for the river basin management and forestry administration are the principal strengths of RobinWood project, to get across the strictly correlation between forest and freshwater environments and going on with studies and/or with the collection of the data related.

Other advantages of the project, in the SWOT analysis expressed as opportunities, are listed in the Table 30 below. As outcomes of the SWOT analysis it is stressed the opportunity to develop the rural areas socio-economic picture with the reinforcing the hydrogeologic and

forestry management. Furthermore a severely connection with the steps for the future application of the EU Water Framework Directive (WFD) is underlined by the countries involved in the RobinWood project.

Advantages
Highlight the protective role woodlands with stakeholders and the general public.
Achieve sustainable and wise alternatives for rural population in terms of agricultural use. Forestry has multi purpose benefits for rural communities.
Opportunity to define guidelines to manage and plane the territorial management about the hydrogeological assessment.
Achieve dataset comparable and standardised on the hydrogeologic issues and forestry related system.
Assist in the delivery of the EU Water Framework Directive (WFD). Forestry could make significant contribution in achieving the EU WFD objectives.

Table 30 list of the advantages or opportunities related with RobinWood project.

3.2 REGIONAL TECHNICAL OVERVIEW

Other than common negative and positive faces of the hydrogeologic component in the RobinWood project, in the paragraphs below are presented data on the SWOT analysis results for the regional part. The countries of RobinWood have been provided peculiar problematic and forces related to the realization of the project.

3.2.1 MAIN PROBLEMS

In the follow tables (Table 31 and Table 32) the specific characteristics related to potential and real problems affecting the different region regarding the hydrogeological issue are presented.

Liguria	Problems
Studies on the relationship between forest system and water cycle are very poor.	
Problems in the data collection. Sometimes they are fragmentary, unorganised and unupdated.	
Difficulties on the river management since are torrential watercourses.	
Brandenburg	**Problems**
Effects of sinking water tables on oak tree forests.	
Future water demand and future water extraction scenario not available.	
Cultivation of tree species and their impact on the groundwater regeneration and the vitality of forest systems. High percentage of manmade pine forest stands have a negative effect on groundwater tables.	
Impact of forest conversion and deforestation on fens.	
Murcia	**Problems**
Overexploitation of the aquifers and problem to meet the request.	
Problems in the data collection. Sometimes they are fragmentary, unorganised and unupdated.	
Wales	**Problems**
Lack of confidence in land use methods (soft engineering) being able to alleviate flood events.	
Limited evidence available to show benefits of forestry for flood alleviation and mitigating diffuse pollution.	
Some forestry practices if managed wrongly can increase soil erosion.	
Improving agricultural practice may provide more improvement than forestry in terms of flooding, soil erosion and diffuse pollution.	
Slovakia	**Problems**
Problems in the data collection. Sometimes they are fragmentary, unorganised and unupdated.	

Table 31 critical problems highlighted by each region of the RobinWood project. The table is divided in five sub-tables each one describing efforts exposed by each single country.

Liguria	Vulnerabilities
Morphological factors (e.g. slope), fire events, intense rainfall are considered threats together with the territorial characteristics.	
There is an elevated risk of floods, mostly in the rivers' mouths. Due to the high urbanisation of the area.	
Increase of vulnerability of territory with respect to the past.	
Brandenburg	**Vulnerabilities**
Abandonment of agriculture or changes in land use may have strong negative effects on groundwater level and water balance as a whole.	
Water as the limiting factors strongly affects ecological, economical and social development (e.g. through drought stress and floods).	
Ecosystems of humid areas are at risk.	
Conflicts on water issues may increase in number and intensity between different stakeholders (e.g. farmers and nature conservationists).	
Murcia	**Vulnerabilities**
The increasing urbanisation processes and occupation of rural areas can interfere with the planning and management processes.	
Political conflicts on the water issues and land use.	
Wales	**Vulnerabilities**
Increased risk of flood events and soil erosion predicted by climate change specialist.	
Blockage of watercourses by " woody debris" could cause flooding and could also trigger slope failure.	
Lack of forest management due to poor timber prices could cause slope failure and increased sediment flow.	
Detrimental effects on ecosystems through changing land use practices e.g. tree planting near stream edges reducing vegetation.	
Slovakia	**Vulnerabilities**
The inner migration of Slovakian' population can interfere with the planning and management processes.	

Table 32 potential characteristic problems that can affect each region of the RobinWood project.

3.2.2 DRIVING FORCES

In the follow tables (Table 33 and Table 34) are presented the specific descriptions related to the driving forces that push on the regions in the development of hydrogeological issue of the RobinWood project. All partners have broad experience in European projects, therefore in the table forces related with hydrologic and forestry issues have been stressed.

Liguria	Motive Power
Deep knowledge of the territory and availability a lot of data. (e.g. land register of landslide in most part of Liguria. Updated at 2003).	
Increasing activities of territorial management for restoration and promotion.	
The Plan of Water balance is ongoing. It will be ready in the present year (2006).	
Exist planning of basin area for all rivers of Liguria with the objective to improve the territorial management and to prevent several risk, such as landslide, floods, runoff, erosion, etc.	
Broad experience in management of follow issues: erosion, landslide, river flood, and hydrological restoration.	
Liguria has charged IPLA (Istituto per le Piante da Legno e l'Ambiente-Torino) to study te role of ligurian soils and woods in terms of protection by territorial ruin.	
Brandenburg	**Motive Power**
Legal and planning framework are well developed.	
Experience with different hydrological modelling.	
Knowledge on water balance of pine stands.	
Strategies for sustainable land and water management are existing.	
Good technical equipment for a system ecological approach (Forest-Water)	
Murcia	**Motive Power**
Knowledge of the study area, mostly on aquifers, and availability of dataset on.	
Current increase in restoration and promotion of river bank activities.	
Broad experience in forest and hydrological restoration.	
Broad experience about the management of associated issues (erosion, desertification, aquifers aver-exploitation and contamination, decrease in water table levels).	

continue

Wales	Motive Power
Forestry and flood plain woodland are know to increase flood storage and slow down flood flow.	
Floodplain and riparian woodland can remove diffuse pollutants from runoff.	
Knowledge and experience in hydrological systems and modelling.	
Slovakia	**Motive Power**
Deep knowledge and a lot of documentation available about the hydrogeology (regional hydrogeological conditions, aquifers exploitations), pedology (pedology (soil conditions and contamination) and geodynamic phenomenon (landslide, erosion).	
Broad experience about the management of associated issues (drinking water supply, state hydrologic monitoring system, water protection, floods).	
Current activities in research of hydrogeological geodynamic and pedological aspects of the floods.	

Table 33 lists of the driving forces of each region of RobinWood for the project development.

Liguria	Advantages
The regional administration is aroused to the importance of accurate environmental management (soil, water, etc.)	
At the moment exist national and regional acts to improve and increase the knowledge of territory.	
The studies on the forestry and hydrogeological ecosystems relationship can be useful.	
Brandenburg	**Advantages**
The "water issue" could be more public due to a sensitisation of people.	
Better understanding of water balance. Increase knowledge on forest composition and its influence on water tables.	
The role of fens in context with water balance is better understood.	
Continuous groundwater supply under fast rowing tree plantations. Develop more appreciation for these kind of agricultural use.	
Murcia	**Advantages**
Great tradition and experience in issues related to managing water.	
There exist national plans and regulations closely connected to aims of the RobinWood project.	
Wales	**Advantages**
Changing management practices in forests and expansion of forests could reduce runoff.	
Flood plain woodland could increase flood storage and reduce down stream flooding.	
Strategic planting of trees on sites prone to erosion and landslip risk could protect these sites.	
Floodplain and riparian woodlands can collect sediment and filter runoff.	
Planting of trees can be used to buffer pollutants draining from the land into the streams.	
Slovakia	**Advantages**
Experience in the water managing.	
There exist national plans and regulations closely connected to aims of the RobinWood project.	
The administration is aroused to the importance of demonstrate that there is an accurate water management.	

Table 34 list of the advantages or opportunities at regional level for the RobinWood Partners.

3.3 STRATEGIES

Form the SWOT analysis results, in terms of strengths, weaknesses, threats and opportunities, at global and regional level, it is possible to build up strategies using a matrix (Figure 13).

The strategies are defined crossing the four terms in the follow way:

1. Strengths-Opportunities: strategies pursue opportunities that are a good fit to the strengths.
2. Weaknesses-Opportunities: strategies overcome weaknesses to pursue opportunities.
3. Strengths-Threats: strategies identify ways that the firm can use its strengths to reduce its vulnerability to external threats.
4. Weaknesses-Threats: strategies establish a defensive plan to prevent the firm's weaknesses from making it highly susceptible to external threats

	STRENGTHS	WEAKNESSES
OPPORTUNITIES	Strengths-opportunities strategies (Re-positioning)	Weaknesses-opportunities strategies (Offensive)
THREATS	Strengths-threats strategies (survival)	Weaknesses-threats strategies (defensive)

Figure 13 matrix of the strategies that must be developed by the four point of the SWOT analysis (Strengths, Weaknesses, Opportunities and Threats).

Liguria	Repositioning
Acts and knowledge of territory: It will be possible to improve again the territorial management using the existing acts to environmental protection, the data from different sources, the achieved results as regards the territorial planning and mitigation of hydrogeological risk.	
Sensitivity by Regional administration: The regional administration is aroused to the importance of responsible territory use and will improve them with application of existing planning instruments (Plan of basin area, Plan of water balance, Register of landslides).	
Integrated approach: The integrated approach between forestry system and hydrogeological system allows to develop the knowledge about the protection of vegetation in respect of the erosion and the stability of slope..	
Brandenburg	**Repositioning**
Use the knowledge of the groups in order to increase the understanding of hydrological vulnerable ecosystems.	
Use the great deal of specific information and let it be easy accessible.	
Take the concrete examples of modelling and regional scenarios that already exist and make the public more aware of the problem.	
Use this joint action to fill gaps in missing information.	
Use the expertise to develop a powerful network of experts and make it public through the internet.	
Murcia	**Repositioning**
To use the different scopes of Work of our groups to make known the objectives and results from the project to diverse groups, with the object of obtaining supports and help. To identify those groups that can be our target and send them regular information about the project.	
To compile information about all the projects with related subjects (erosion, desertification, forestation, hydrological management...) in each region, in a systematic way (perhaps with a template) and to dedicate time specifically to its knowledge by the rest of the groups.	
To point out the approach of environmental protection of this project and its European scope as to his results and the development of regulation. To emphasize that this is a very good opportunity to participate in the construction of specific regulations.	
To participate in different forums and events in each region to make known the project and to obtain support. The good knowledge of each area can allow us to display concrete examples and demonstrative cases in each region. That practical information has to be integrated in the results and can be a very valuable output.	
To give priority in the communication strategy to the capacity of the project to put under recommendations and future obligations to the administrations. It can be used as a tool to obtain more interest from the people we want to involve in the project. To prepare an explanatory document on the project.	

continue

Wales	Repositioning
Partners have different skills and there is potential to share knowledge and experience between partners	
Forestry is generally recognised as protecting the freshwater environment and so forestry can play an important role in achieving EU WFD objectives	
Opportunity to provide recommendations to policy makers especially as both the regional government and the general public has an increased interest in environmental matters	
Forestry and flood plain woodlands have the potential to reduce flood flow by planting strategically positioned woodland under specifically developed grant schemes	
Use existing knowledge of Hydrology and modelling to demonstrate the effects of woodland and woodland management and raise awareness amongst stakeholders	
Woodland has the potential to mitigate diffuse pollution from agriculture and there is a need to develop integrated agri-environmental schemes	
Slovakia	**Repositioning**
To use the different scopes of Work of our groups to make known the objectives and results from the project to diverse groups, with the object of obtaining supports and help. To identify those groups that can be our target and send them regular information about the project.	
To compile information about all the projects with related subjects (erosion, desertification, forestation, hydrological management...) in each region, in a systematic way (perhaps with a template) and to dedicate time specifically to its knowledge by the rest of the groups.	
To point out the approach of environmental protection of this project and its European scope as to his results and the development of regulation. To emphasize that this is a very good opportunity to participate in the construction of specific regulations.	
To participate in different forums and events in each region to make known the project and to obtain support. The good knowledge of each area can allow us to display concrete examples and demonstrative cases in each region. That practical information has to be integrated in the results and can be a very valuable output.	
To give priority in the communication strategy to the capacity of the project to put under recommendations and future obligations to the administrations. It can be used as a tool to obtain more interest from the people we want to involve in the project. To prepare an explanatory document on the project.	

Table 35 scheme of the Strengths-Opportunities strategies.

Liguria	Offensive
Interaction between region and public subjects: The regional administration and all the public subjects linked with the territorial management will act with an integrated and shared approach to improve the re-organization of data and the territorial knowledge.	
Integrated approach: Development of a new approach integrated in order to increase the studies about the relationships between forestal ecosystem and hydrogeological system.	
Brandenburg	**Offensive**
Homogenize and expand data-sets for all partners.	
Include rural population in the process of finding economical alternatives.	
Stay focused on the main project targets to be cost-effective and successful.	
Include hydrological modelling systems in forthcoming projects.	
Murcia	**Offensive**
To program a schedule for communication activities among the groups. A constant and decided action from the coordinators is needed. It would be useful to set a timing and tools for periodic communication (as short reports of activities made and problems faced) It would be necessary too to send a list of web pages with information about each area to the rest of the groups.	
To use the EU regulations to find the common place to work and so surpass the problem of the different administrative organization.	
To develop GIS maps in those regions where it is not developed yet..	
Wales	**Offensive**
Hydrological effects are complex and research knowledge is limited to small-scale catchments. However it may be possible to persuade regional governments to undertake research on a landscape scale.	
There is limited communication between regions in the EU and there is an opportunity to increase communication in this field.	
There is potential to develop protocols so that data can be unified between regions.	
Hydrology affects are usually limited to single land use and there is a need to develop models to work at a landscape scale for multiple uses.	
There is poor understanding of climate change affects and a need to develop models to understand the implications.	
Slovakia	**Offensive**
To program a schedule for communication activities among the groups. A constant and decided action from the coordinators is needed. It would be useful to set a timing and tools for periodic communication (as short reports of activities made and problems faced) It would be necessary too to send a list of web pages with information about each area to the rest of the groups.	
To develop GIS maps in those regions where it is not developed yet.	
To use the EU regulations to find the common place to work and so surpass the problem of the different administrative organization.	

Table 36 scheme of the Weaknesses-Opportunities strategies

Liguria	Survival
Improvement of knowledge: It will can be mitigate the frailty of territory with a better use of the present knowledge of territory and the present and future experience obtained by the integrated environmental management (hydrological and territorial restoration…).	
Brandenburg	**Survival**
To overcome water shortage by means of adapted land-uses, taking into account future developments of water demands and climate change.	
Adapted water and forest management in endangered humid areas.	
Use many information paths to inform people about the importance of protected areas (e.g. humid areas).	
Murcia	**Survival**
It is necessary to be very careful with the assessment of the problem, using data and experiences as support, in order to avoid being identified with any political view of the problem.	
Whenever it is possible, to base on the data, already standardized, of the European Union, adding to them the precise knowledge that we have of the particular circumstances of our regions and real examples. That will be the added value of our project and one of the main arguments in which to support the recommendations and conclusions of the project.	
Try to show to local stakeholders that the results of the Project Hill create obligations to the administrations, and then its participation in the activities of the project would be very profitable for them and that their interests would be listened.	
Wales	**Survival**
Although it is recognised that forestry generally protects the freshwater environment there is a lack of confidence in using forestry to provide long-term benefits for managing flooding, diffuse pollution and erosion – more awareness and research.	
Potential to provide recommendations to policy makers but there is a difficulty in providing cost/benefit analysis for hydro geological effects.	
There is benefit to be gained from specialists networking across EU regions, however issues and site factors vary between regions and their is a need to provide clear messages	
Forestry can provide multiple benefits but a lack of forest management (due to poor timber prices for example) can cause hydro geological problems so forest management grants will be hended.	
Slovakia	**Survival**
It is necessary to be very careful with the assessment of the problem, using data and experiences as support, in order to avoid being identified with any political view of the problem.	
Whenever it is possible, to base on the data, already standardized, of the European Union, adding to them the precise knowledge that we have of the particular circumstances of our regions and real examples. That will be the added value of our project and one of the main arguments in which to support the recommendations and conclusions of the project.	
Try to show to local stakeholders that the results of the Project Hill create obligations to the administrations, and then its participation in the activities of the project would be very profitable for them and that their interests would be listened.	

Table 37 scheme of the Strengths-Threats strategies.

Liguria	Defensive
Increasing activities of territorial management: It will have to reduced the frailty of territory and the lack of organization about data management, with the use of new methodologies development to study problems linked with the integrated territorial management linked with the opportunities that Robinwood offer with respect to Activation of local sub-projects.	
Brandenburg	**Defensive**
Need to bring all partners to the same level of data-availability (GIS, long time series, etc.).	
Include the aspect of climate change in forthcoming projects.	
Enable rural areas to find a cost-effective sustainable way of agriculture (e.g. fast growing plantations)	
Murcia	**Defensive**
Need to establish a fluent communication with the administration offices (at different levels) to convince them about the advantages of this project and to eliminate mistrust. It is necessary, regarding this, to make a specific work at the beginning of the Project, and not only make it when we need to contact with the administration.	
To provide detailed information about each area and its administrative organization, helping of schemes and looking for analogies that make easier to compare.	
In order to create the water cycle model and the assessment of past, present and future demands, it is necessary to set objectives that can be achieved with the available information and that they don't require an effort too high.	
To set a collection data plan and its later integration, keeping in mind which data are critical, essential, desirable and rescindable.	
To show cohesion to present an image of qualification and multiparty work to the different administrations. It would be useful to carry out simultaneous actions in the administrations and to respect the calendar set	
Wales	**Defensive**
Limited communication across the EU, different site factors and issues between regions show that there is a need to develop good communication and protocols.	
Poor predictions of water cycles and climate change plus the need to provide cost/benefit analysis to government clearly demonstrates the need for concerted data gathering.	
Poor forest management practices may increase erosion and specific flood flow – this demonstrates the need for good management practices (through certification) and a supporting grant structure.	
Detrimental effects on ecosystems from changing land use practices can be avoided by good management practice and working on a landscape scale.	

continue

Slovakia	Defensive
Need to establish a fluent communication with the administration offices (at different levels) to convince them about the advantages of this project and to eliminate mistrust. It is necessary, regarding this, to make a specific work at the beginning of the Project, and not only make it when we need to contact with the administration.	
To provide detailed information about each area and its administrative organization, helping of schemes and looking for analogies that make easier to compare. In order to create the water cycle model and the assessment of past, present and future demands, it is necessary to set objectives that can be achieved with the available information and that they don't require an effort too high.	
To set a collection data plan and its later integration, keeping in mind which data are critical, essential, desirable and rescindable..	
To show cohesion to present an image of qualification and multiparty work to the different administrations. It would be useful to carry out simultaneous actions in the administrations and to respect the calendar set	

Table 38 scheme of the Weaknesses-Threats strategies.

4 HEAD TOWARD THE ROBINWOON DEVELOPMENT IN TERMS OF COMPONENT 2

The outputs derived from the analysis above described are reported in this chapter in which the whole dataset has been elaborated to define the work that each country of the RobinWood project have to done. Starting from the mains problems, in terms of hydrogeology, concrete features have been developed. They have to be further investigated to head toward the future steps of the project. These actions can be useful to establish strategic plans based on the strengths and the opportunities as well as to reduce and prevent external threats and internal weaknesses that can affect the progress of the project. In the following tables the problem descriptions, regarding the hydrogeologic component, here defined as criticism, to apply a generalization (that can include all problematic typology and designation of the work that have to be done for each territory) are presented. The previous table is related with the worktogether, problems that affect all the territories of the project and therefore that have to be studied from all partners jointly. On the other hand the follow tables: Table 42,

Criticism	Work to do
Changes in the land use	Describe in detail the changes in land use and its relation with the water demands. Precise temporal scale, driving forces and if there is territory management regarding this and if there is any forecast about the future.
Changes in land use have been reported associated with the water demand.	
Criticism	**Work to do**
Headwaters	Describe precisely the headwaters protection.
The river headwaters are protected by specific regulation.	Describe if there are restorations plans foreseen or any other management action.
Criticism	**Work to do**
Landslide	Describe precisely where happened these events and when (area affected of the region, frequency -yearly, seasonal and randomly- and months affected).
	Describe if the population is influenced by this risk: in the past (when and where) and currently.
	Provide GIS information of the areas affected.

The events have been pointed out as one of the mains problems in the area.	

Table 41,

Criticism	Work to do
Changes in the land use	Describe in detail the changes in land use and its relation with the water demands. Precise temporal scale, driving forces and if there is territory management regarding this and if there is any forecast about the future.
Changes in land use have been reported associated with the water demand.	
Criticism	**Work to do**
Soil Erosion	Describe precisely the extent of the problem and if there have been circumstances that have changed this extent (specially related to territorial management). Also describe area affected of the region. Actions and interventions foreseen. Provide GIS information of the areas affected.
Event strongly due to the climatic action more than to the human impact.	
Criticism	**Work to do**
Desertification	Describe precisely the extent of the problem and if there have been circumstances that have changed this extent (specially related to territorial management). Also describe where happened these events and when (area affected of the region, freshwater involved and their regime, frequency -yearly, seasonal or randomly- and months affected). Describe how the population is influenced by this risk. Provide GIS information of the areas affected.
The area of the south eastern part of the region of Spain represents the areas with the major risk of desertification in Europe.	

Table 43,

Criticism	Work to do
Drainage	Describe in detail the manmade drainage net (its accordance with land use, where and how this affect the territory).
Channelization, and construction of flood barriers have caused most of the change in riverine and floodplain habitat. Drainage networks are concentrated mainly in the Východoslovenská nižina Lowland and the Košická kotlina basin.	
Criticism	**Work to do**
Soil Collapses	Describe precisely the typology of slope collapses and the extent of the problem and if there have been circumstances that have changed this extent (specially related to territorial management). Also describe the area affected in the region. Describe if the population is influenced by this risk: in the past (when and where) and currently.

Movements of slopes are the most serious geological factors threatening the environment in Slovakia.	
Criticism	**Work to do**
Runoff events	Describe precisely the extent of the problem and if there have been circumstances that have changed this extent (specially related to territorial management). Also describe where happened these events and when (area affected of the region, freshwater involved and their regime, frequency -yearly, seasonal or randomly- and months affected). Describe if the population is influenced by this risk: in the past (when and where) and currently. Provide GIS information of the areas affected.
Strong problems due to the altitude and zonality of the streams regime and the higher snow precipitations.	

Table 45 and Table 44 are related to regional critical points and relative effort to diminish the problems. It is necessary to point out that all the information required in GIS must be included in the GIS map that each partner has to provide.

All partners	
GIS	**Maps list**
On the basis of the availability of the GIS information for each country (detailed in the paragraph 2.2, page 49) GIS maps are needed for the correct development and progress of the hydrogeologic component of RobinWood.	• Freshwaters courses map. • Lakes, marshes, bogs, fen, maps. • Humid areas map. • Vegetation map. • Protected areas map. • Climatic map.

Table 39 GIS information required to all RobinWood partners.

All partners	
Criticism	**Work to do**
Flooding	Describe precisely the extent of the problem and if there have been circumstances that have changed this extent (specially related to territorial management). Also describe precisely where these events happensand when (area affected of the region, freshwater involved and their regime, frequency -yearly, seasonal and randomly- and months affected). Describe if the population is influenced by this risk: in the past (when and where) and currently. Provide GIS information of the areas affected. Include references (literature, web pages) regarding this problem in your area.
As reported in the Table 3 (page 14) and in the paragraph 2.1.1 (page 15) the floods events affect all the countries involved in the project even if difference in terms of recurrences, consequences and derivations. Extreme floods are forecast to become more frequent due to the climate change.	
Criticism	**Work to do**
Prevention plans	Describe in detail the prevention plans (which hydrogeologic problem they consider how and where they are applied).
From the data emerged that each area presents a plan for preventing or controlling the hydrogeologic problems, or at least strong researches on these issues (Table 5).	

Table 40 scheme of the information needed to the accomplishment of the hydrogeologic issue.

Liguria	
Criticism	**Work to do**
Changes in the land use	Describe in detail the changes in land use and its relation with the water demands. Precise temporal scale, driving forces and if there is territory management regarding this and if there is any forecast about the future.
Changes in land use have been reported associated with the water demand.	
Criticism	**Work to do**
Headwaters	Describe precisely the headwaters protection. Describe if there are restorations plans foreseen or any other management action.
The river headwaters are protected by specific regulation.	
Criticism	**Work to do**
Landslide	Describe precisely where happened these events and when (area affected of the region, frequency -yearly, seasonal and randomly- and months affected). Describe if the population is influenced by this risk: in the past (when and where) and currently. Provide GIS information of the areas affected.
The events have been pointed out as one of the mains problems in the area.	

Table 41 scheme of the information needed from Liguria and action needed for to the accomplishment of the hydrogeologic issue.

Brandenburg	
Criticism	**Work to do**
Drainage	Describe in detail the manmade drainage net (its accordance with land use, where and how this affects the territory).
From the data has been highlighted that an artificial drainage is well developed however in accordance with land use.	
Criticism	**Work to do**
Headwaters vegetation cover	Describe precisely what means headwaters without vegetation covered and the area affected, freshwater involved and possible causes of the vegetation absence. Describe if there are restorations plans foreseen or any other management action.
All range of the vegetation covers are present, from any presence to developed and complex structure.	
Criticism	**Work to do**
Runoff events	Describe precisely the extent of the problem and if there have been circumstances that have changed this extent (specially related to territorial management). Also describe where happened these events and when (area affected of the region, freshwater involved and their regime, frequency -yearly, seasonal or randomly- and months affected). Describe if the population is influenced by this risk: in the past (when and where) and currently. Provide GIS information of the areas affected.
Presence of strong events has been underlined in the data provided (e.g. in the Stepenitz river)	

Table 42 scheme of the information needed from Brandenburg and action needed for the accomplishment of the hydrogeologic issue.

Murcia	
Criticism	**Work to do**
Changes in the land use	Describe in detail the changes in land use and its relation with the water demands. Precise temporal scale, driving forces and if there is territory management regarding this and if there is any forecast about the future.
Changes in land use have been reported associated with the water demand.	
Criticism	**Work to do**
Soil Erosion	Describe precisely the extent of the problem and if there have been circumstances that have changed this extent (specially related to territorial management). Also describe area affected of the region. Actions and interventions foreseen. Provide GIS information of the areas affected.
Event strongly due to the climatic action more than to the human impact.	
Criticism	**Work to do**
Desertification	Describe precisely the extent of the problem and if there have been circumstances that have changed this extent (specially related to territorial management). Also describe where happened these events and when (area affected of the region, freshwater involved and their regime, frequency -yearly, seasonal or randomly- and months affected). Describe how the population is influenced by this risk. Provide GIS information of the areas affected.
The area of the south eastern part of the region of Spain represents the areas with the major risk of desertification in Europe.	

Table 43 scheme of the information needed from Murcia and action needed for the accomplishment of the hydrogeologic issue.

Wales	
Criticism	**Work to do**
Drainage	
Manmade drainage basically falls into two categories in Wales; drainage for agriculture and forestry drainage.	Describe in detail the manmade drainage net (its accordance with land use, where and how this affect the territory).
Criticism	**Work to do**
Soil Erosion	
Soil erosion from enclosed farmland and open moorland is important for impacts in off-site aquatic systems, particularly in terms of water clarity, deposition of fine sediment in spawning beds, loss of reservoir capacity and the eutrophication of freshwater ecosystems where nutrients are bound to the sediment particles.	Describe precisely the extent of the problem and if there have been circumstances that have changed this extent (specially related to territorial management). Also describe area affected of the region. Actions and interventions foreseen. Provide GIS information of the areas affected.
Criticism	**Work to do**
Acidification	
Large areas of Wales are vulnerable to acidification, especially the uplands, as the bedrock is slow weathering and the base-poor, thin soils provide minimal buffering capacity to acidifying pollutants.	Describe precisely the extent of the problem and if there have been circumstances that have changed this extent (specially related to territorial management). Also describe area affected of the region. Actions and interventions foreseen. Provide GIS information of the areas affected.

Table 44 scheme of the information needed from Wales and actions needed for the accomplishment of the hydrogeologic issue.

Slovakia	
Criticism	**Work to do**
Drainage	Describe in detail the manmade drainage net (its accordance with land use, where and how this affect the territory).
Channelization, and construction of flood barriers have caused most of the change in riverine and floodplain habitat. Drainage networks are concentrated mainly in the Východoslovenská nižina Lowland and the Košická kotlina basin.	
Criticism	**Work to do**
Soil Collapses	Describe precisely the typology of slope collapses and the extent of the problem and if there have been circumstances that have changed this extent (specially related to territorial management). Also describe the area affected in the region. Describe if the population is influenced by this risk: in the past (when and where) and currently. Provide GIS information of the areas affected.
Movements of slopes are the most serious geological factors threatening the environment in Slovakia.	
Criticism	**Work to do**
Runoff events	Describe precisely the extent of the problem and if there have been circumstances that have changed this extent (specially related to territorial management). Also describe where happened these events and when (area affected of the region, freshwater involved and their regime, frequency -yearly, seasonal or randomly- and months affected). Describe if the population is influenced by this risk: in the past (when and where) and currently. Provide GIS information of the areas affected.
Strong problems due to the altitude and zonality of the streams regime and the higher snow precipitations.	

Table 45 scheme of the information needed from Slovakia and action needed for the accomplishment of the hydrogeologic issue.

5 TABLES AND FIGURES INDEX