



# **ROBINWOOD PROJECT**

## **COMPONENT 2: HYDROGEOLOGY**

### **SURVEY: THE HYDRO-GEOLOGIC SYSTEMS AND THEIR RELATIONSHIP WITH FORESTS**



## INTRODUCTION

This survey has been developed by the Murcia Region within component 2 of the Robinwood project: "Hydrogeology". The aim is to obtain data on the present state of the territory in terms of hydro-geologic ecosystems and their relationship with forests, assessing the availability of information in each area involved. With the collected data an overall diagnosis of the situation and the necessities will be developed, being this report compulsory for the following stages of the project. The aspects included in the survey are:

- Inclusion of the present state of the territory in terms of:
  - Hydro-geologic ecosystems,
  - Hydro-forest systems,
  - Drainage networks,
  - Humid areas,
  - Regulation infrastructures and systems,
  - Problems related to hydro-geologic issues: collapses, changes in groundwater depth...
- To pay special attention to protected areas
- To analyze the environmental situation in terms of the present, past and future demands of water
- The collection of statistical data with GIS
- To study the territorial context, that is to say, the legal regulations, plans and the ecological necessities of the protected zones.

Please note that the term "region" is used as a general name for the administrative organization in each area.

The deadline for the survey is April the 30<sup>th</sup>. Although the survey has already been discussed (in the last meeting in Brussels) you can send contributions or suggestions to the survey until the 30<sup>th</sup> of March.

Please any doubt, explanation needed, comment, etc. write to **ROBINWOOD.MURCIA@AMBIENTAL-SL.ES**



## 0 PRELIMINARY DATA

The next information is necessary to make an initial framework of each area. Every data asked is relatively easy to get except, perhaps, rainfall seasonality. In the annex, at the end of the document, some ways of measuring are explained. It can be also possible just to explain briefly (two-three lines) if rainfall seasonality is a common event in the area, that is, if rainfall is concentrated regularly on specific seasons, and if the distribution of rainfall (amount of precipitation in each event) is irregular or not. This information is specially relevant in Mediterranean areas but it will be also useful for Mediterranean areas to know better the climatic conditions and characteristics of the other areas.

<b>PRELIMINARY DATA OF EACH AREA:</b>	
<b>AREA (Km<sup>2</sup>)</b>	
<b>POPULATION</b>	
<b>AVERAGE ANNUAL TEMPERATURE</b>	
<b>PRECIPITATION</b>	
<b>EVAPOTRANSPIRATION</b>	
<b>ANNUAL SUNSHINE (hours/year)</b>	
<b>RAINFALL SEASONALITY INDEX</b> <b>(or a brief explanation about the rainfall dynamic)</b>	



**1 ASSESSMENT OF THE PRESENT STATE OF THE AREA IN TERMS OF HYDRO-  
GEOLOGICAL ECOSYSTEMS.**

**(QUESTIONS 1-5)**

**1.1 Do exist in the area ecosystems or habitats protected because of their hydro-geologic relevance, like humid areas or aquifers considered “strategic”?**

**NO (go to 1.2)**

**YES**

**1.1a Could you indicate the name and the area of those ecosystems?**

**1.2 Are there specific regulations (legislation) about the protection of those ecosystems?**

**NO**

**YES**

**1.3 Is there a specific administrative office for those ecosystems?**

**YES (go to 1.4)**

**NO**

**1.3a Then, who manages those ecosystems?**



#### 1.4 Is it an artificial drainage network developed?

NO (go to 1.5)

YES

##### 1.4a Those drainage networks are designed and developed according to the soil use (industrial, agriculture, residential...)?

NO

YES

#### 1.5 Do flooding events occur in the area?

NO (go to 1.6)

YES

##### 1.5a Those flooding, are seasonal or random events?

Seasonal (indicate, if possible, the frequency of the event)

Random events



**2 GIS IMPLEMENTATION OF THE DATA.**

**(QUESTION 6)**

**2.1 Do Exist GIS cartography in the areas of interest of this Project?**

**NO (go to part 3)**

**YES**

**2.1a Do exist GIS cartography about the hydro-geologic resources?**

**NO (go to part 3)**

**YES**

**2.1b Is this cartography easily accessible and usable?**

**NO**

**YES**



**3 ANALYSIS OF THE ENVIRONMENTAL SITUATION IN TERMS OF THE PRESENT, PAST AND FUTURE DEMANDS OF WATER**

***(QUESTIONS 7-12)***

**3.1 Are available precise and updated data about the water demands in the region, for the different uses (agricultural, industrial, domestic consumption)?**

**NO**

**YES**

**3.2 Have water demands increased greatly in the last years?**

**NO (go to 3.3)**

**YES**

**3.2a How long have been this increase in the demands been like this?**

**Since less than 5 years ago**

**Since 5 to 10 years ago**

**Since 10 to 20 years ago**

**Since more than 20 years ago**

**3.2b Please, indicate the activities that have increased the use in a greater extent (multi choice):**

**Domestic consumption by the permanent population (not seasonal)**

**Tourist activities (including seasonal population, golf courses, recreational infrastructures...)**

**Industrial activities**

**Agriculture**

**Others (list them)**



### 3.2c How are these increases on the demand of water met?

**Without using new resources**

**Using new resources (select which one/s)**

- Desalination**
- Extracting more groundwater**
- Taking them out from other uses**
- (Agriculture, industry...) (list them)**
- Any other way (list them)**

### 3.2d have happened, together with the increase in water demands, land use changes?

**NO (go to 3.3)**

**YES**

- **New activities (list them)**
  
- **Enlargement of already present activities:**
  - Agricultural activities**
  - Industrial activities**
  - Recreational activities**
  - Others (list them)**





**3.3 Has the local population increased or changed its distribution to a significant extent in the last years?**

NO

YES

**3.4 It is reported the present state of the aquifers (if they are overexploited)?**

NO (go to 3.5)

YES

**3.4a Which is the percentage of aquifers that are considered as overexploited?**

**3.5 About the changes made in the groundwater depth in the last years, Have they been reported?**

NO (go to 3.6)

YES

**3.5a Can you specify the amount? (X meters/ Y years)**

**3.6 Are there studies about future water demands and how to meet them?**

NO

YES



**4 ANALYSIS OF THE TERRITORIAL CONTEXT, THE LEGAL REGULATIONS, PLANS AND THE ECOLOGICAL NECESSITIES OF THE PROTECTED AREAS**

**(QUESTIONS 13-21)**

**4.1 Is there in the area any plan for the territorial development?**

**NO (go to 4.2)**

**YES**

**4.1a In those plans, are included population and economic activities forecast?**

**NO**

**YES**

**4.2 Which is the percentage (or the total area) of the region that is under an environmental protection that include restriction of uses and tools for controlling the activities and the use of resources?**

**4.3 Is there any management plan for the environmentally protected areas?**

**NO (go to 4.4)**

**NOT FOR ALL THE AREAS**

**YES**

**4.3a Are included, in these plans, hydrologic and forest activities or initiatives?**

**NO**

**YES**



**4.4 About the hydro-geological management and the forest management, do they depend on the same administrative office?**

NO

YES

**4.5 Please list the name of the administrative office that is on charge of the hydro-geological management and the forest management (be they the same or different) and point out if they are regional or state bodies (or any other level or organization).**

**4.6 Is there any specific regulation about the hydro-geological resources (ownership, priority of uses, control structures...)?**

NO

YES

**4.7 Are there protected humid areas?**

NO

YES

**4.8 Are there SPAs in the protected humid areas?**

NO

YES



**4.9 Are there “sites of community interest” or any other European regulation in the protected humid areas?**

**NO**

**YES**



## **5 WATER CYCLE MODELS AND ITS RELATIONSHIP WITH THE FOREST SYSTEMS**

**(QUESTIONS 22 TO 26)**

**5.1 Is there any developed model for the water cycle in the area (that include eater volumes and times of stay in each stage)**

**NO (go to 5.2)**

**YES**

**5.1a Please list the data that are included in this model**

**5.2 Is there any tool to follow the movements of the water inside the cycle?**

**NO**

**YES**

**5.3 Is there any study about the relationship between the forest system and the water cycle?**

**NO**

**YES**

**5.4 How are the upper watercourses in terms of the banks vegetation?**

- Well preserved**
- With some alterations**
- Totally degrade or altered**



**5.5 Regarding the regulation systems (dams, channels, other infrastructures...), is there any plan for new regulation infrastructures?**

**NO**

**YES**



## 6 DETECTION OF GEOMORPHOLOGIC AND GEOLOGIC RISKS

(QUESTIONS 27 TO 35)

### 6.1 Is there any map of geomorphologic risks?

NO

YES

### 6.2 Is there any erosion risks map?

NO

YES

### 6.3 Point out the main problems in your region:

- Landslides
- Soil collapses
- Strong runoff events
- Flooding
- Erosion
- Desertification
- Others (list them)



#### 6.4 Is there any plan for preventing or controlling the following problems?

	NO	YES
• Landslides	<input type="checkbox"/>	<input type="checkbox"/>
• Soil collapses	<input type="checkbox"/>	<input type="checkbox"/>
• Strong runoff events	<input type="checkbox"/>	<input type="checkbox"/>
• Flooding	<input type="checkbox"/>	<input type="checkbox"/>
• Erosion	<input type="checkbox"/>	<input type="checkbox"/>
• Desertification	<input type="checkbox"/>	<input type="checkbox"/>
• Others (list them)	<input type="checkbox"/>	<input type="checkbox"/>

#### 6.5 Which are the activities that are considered to have more negative effects on the soil, hydro-geologic or forest resources?

• Agriculture	<input type="checkbox"/>
• Forestry	<input type="checkbox"/>
• Mining	<input type="checkbox"/>
• Urban development	<input type="checkbox"/>
• Industrial development	<input type="checkbox"/>
• Tourism	<input type="checkbox"/>
• Others (list them)	<input type="checkbox"/>

#### 6.6 How are the river headwaters in terms of forest systems?

• Without any vegetation cover	<input type="checkbox"/>
• With vegetation but not tree-covered	<input type="checkbox"/>
• With tree-cover but very affected or degraded	<input type="checkbox"/>
• With forest systems (tree-covered) more or less affected or degraded	<input type="checkbox"/>
• With developed complex, well preserved	<input type="checkbox"/>
• Others (list them )	<input type="checkbox"/>





**6.7 are they affected by human activities?**

**NO**

**YES**

**Very affected**

**Not very affected**

**6.8 Are the river headwaters protected by any specific regulation?**

**NO**

**YES**

**6.9 Is there any hydrologic and forest restoration plan in the river headwaters?**

**NO**

**YES**



## ANNEX: RAINFALL SEASONALITY

Rainfall seasonality can be defined as the irregular distribution of rainfall during a normal year. This irregular distribution means that most of the rainfall occurs in specific months (that can be identified with specific seasons). This phenomenon is quite usual in Mediterranean areas, where most of the rainfall happens in the autumn and in the spring. Normally this seasonality comes with irregular distribution of the amount of rainfall in each episode. Most of the rainfall quantity is accounted in few violent episodes.

Two different simple range of values can be used:

Season rainfall/total rainfall (%) From 0 to 100%. The statistical theoretic “normal” value for each season is 25%

Monthly rainfall/total rainfall (%). An equal distribution would assign ≈8% to each month. The bigger difference the more seasonality

In case of using an index there are other ranges of value:

**Seasonality Index (Si)**, derived by Walsh and Lawler (1981):

The next transformation is needed:

$$S_i = \frac{\sum_{n=1}^{12} |X_n - R_i|}{12R_i}$$

Where  $R_i$  is the total annual precipitation for the particular year under study and  $X_n$  is the actual monthly precipitation for month  $n$ . Higher index values indicate a great overall departure from an equal distribution of precipitation through the year, with near zero values indicating that there is little or no seasonal variation in precipitation. It is important to know that although we can calculate this index using long-term average monthly precipitation data directly this is not a good option since the resulting index possesses a lower magnitude, since the process of averaging smoothes year-to-year “noise” in the monthly precipitation values. Instead of that, it is much more suitable to do it year by year and then calculate the mean value for the calculated period.

Sii	Precipitation regime
<0.19	Precipitation spread throughout the year
0.20-0.39	P. spread throughout the year, but with a definite wetter season
0.40-0.59	Rather seasonal with a short drier season
0.60-0.79	Seasonal
0.80-0.99	Marked seasonal with a long dry season
1.00-1.19	Most precipitation in <3 months
>1.20	Extreme seasonality, with almost all precipitation in 1-2 months



The problem with that index is that it doesn't indicate when or how wetter periods are distributed through the year. To overcome this difficulty we can use a "replicability index" to indicate whether or not the wettest period occurs over a small range of months or whether it may occur in any month during the year. Higher values of replicability index indicate that the wettest month of the year generally occurs in only the same few months every year. Lower values show a more spread distribution in different months.

### The Markham technique

This can be used to know which are the months with more rainfall seasonality and it is necessary to use the smoothed percentages index. In this index the median monthly precipitation is expressed as a percentage of the monthly rainfalls. The monthly percentages,  $P\%$ , are then subjected to a weighted smoothing by considering the months before and after the one selected:

$$P\%_i = \frac{1}{4} (P\%_{i-1} + 2P\%_i + P\%_{i+1})$$

Where  $i = \text{months}(1 \dots 12)$

When  $P\%_i > 8\%$  a concentration of precipitation is taking place in month  $i$

When  $P\%_i > 8\%$  a concentration of precipitation is taking place in month  $i$ , where  $i = \text{months}(1 \dots 12)$