

FITTING THE RIVER TORMES AND THE CURRENT ASPECTS OF MAINTAINING THE DRAINAGE SYSTEM

Duină C. Valeria Simona

University of Craiova, Geography Department
Craiova, Romania, dvaleriasimona@yahoo.com

Abstract

The water represents the blue soul of this planet, the fight to recover and maintain the health of the rivers, lakes, swamps, seas and oceans, the fight for the living and the ones that are going to live on Earth. Unfortunately, over many decades the industrial and the consumer society understood the aquatic ecosystems as simple water channels or reservoirs whose essential utility was served as a productive factor. Mass development of hydraulic infrastructure with public subsidy and systematic contamination of rivers and groundwater have led us to a critical point of insensitivity and insecurity. Tormes River, a tributary on the left side of the river Duero, springs from the Sierra de Gredos, near of Hoyos Del Espino, then crosses the provinces of Avila and Salamanca, and after 247 km flows into the River Duero (administratively within the locality Villarino de los Aires). Due to its characteristics this river does not ensure the water supply of human settlements in the summer, a fact that determined at the end of 1960 the construction of Santa Teresa dam with a capacity of 496 m³, which provides and secures the water supply in summer and prevent floods in winter. The lack of rainfall, combined in some sectors with the electric production through hydroelectric micro powers, have left the bed of the river Tormes to record minimal values of leakage, the most representative being in town Puente Del Congosto, where in February 2012 recorded 3.62 m³ and in the same period of 2011, there were more than 15m³. This study aims to present variations of level and flow of the Tormes River at different times of year for a period of five years, at 5 stations located along it, from source to river mouth. The target objectives implies the projects achieved and the ones involved ongoing the arrangement of Tormes River, but also the ones of the maintenance of drainage regime, given the situation presented above. Conservation and recovery is a constant struggle of human societies that live along this river, which starts to react more and more against the negative effects that have come to destroy nature.

Keywords: flow, SHP, drainage system, improvement, projects, conservation, river Tormes.

1. INTRODUCTION

“Water is a limited natural resource essential for life and for the greater performance of most economic activities, it’s irreplaceable, not expandable by the simple will of man, it has an irregular shape both in time and space, it’s easily vulnerable and sensitive after successive uses. (Water Law 29/1985, August 2 Spain)”.

The Iberian Peninsula, because of its geography and climate, is presented as a plaque on which are reproduced, on a small scale, the global water conflicts. The increased consumption, availability differentiated according to river basin water, increasing salinization of groundwater ,pollution and some of the pieces that make up the mosaic generated around water issues in Spain, similar to other areas of the world.

This causes the water to represent the origin of conflicts between regions, economic sectors and social sectors. Tormes River, a tributary on the left side of the Duero river , springs from the Sierra de Gredos, near of Hoyos Del Espino, then crosses the provinces of Avila and Salamanca, and after 247 km flows into the Duero river (administratively within the locality Villarino de los Aires). This river due to its water supply does not ensure human settlements in the summer, prompting the end of 1960 Santa Teresa dam construction, with a capacity of 496 m³, which provides and regulates the water supply in summer and flood in winter.

1.1 Data and methods

This study aims to present variations of the level and flow of the river Tormes at different periods of the year for a period of five years, at the 5 stations located along it, from source to river mouth.

Target objectives achieved and the projects involve ongoing arrangement corresponding Tormes river and drainage maintenance regime, given the situation presented above. Conservation and recovery is a constant environmental struggle human society that lives along this river, which starts to react more against the negative effects that started already to destroy the nature.

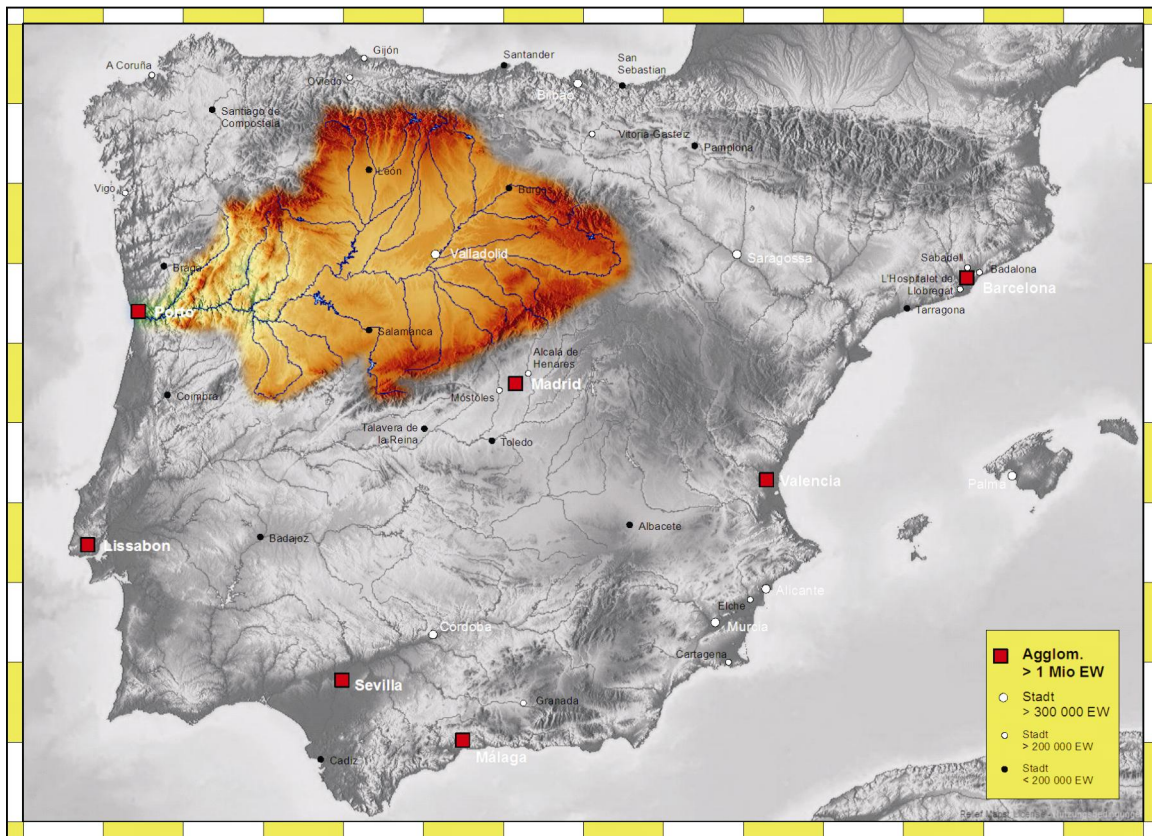


Figure.1 The location of the Tormes catchment area in Spain (Source: Confederation of the Duero Basin, Spain)

2. DRAINAGE SYSTEM

2.1 Variations in flow drainage system

This study refers to Tormes river flow variations from October 2004 to September 2010, over the five stations. Since 2004, five of the most important points of the river Tormes data collection were made public. These stations are: Hoyos Del Espino, in the source, Puente Del Congosto, Encinas de Arriba, Salamanca y Contienda, and this last station is owned by a private company (Fig. 2).

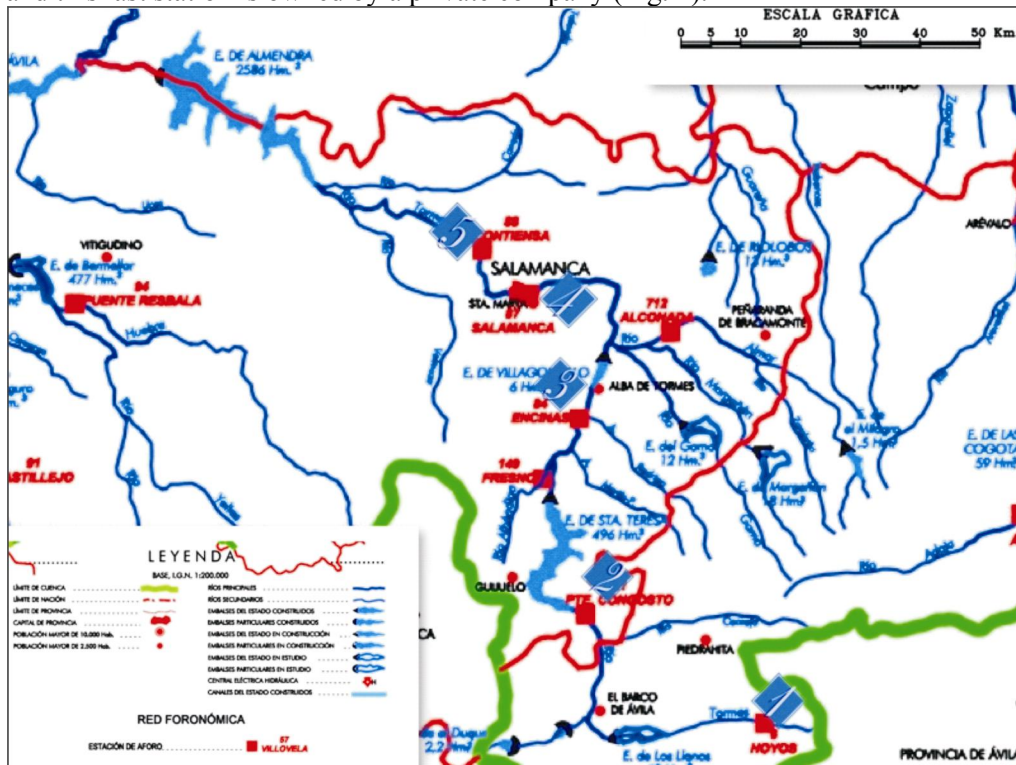


Figure 2. Location of the five stations in the drainage basin Tormes (Source: Annual measurements CHD, Spain)

The following figure shows variations in the flow of Tormes's river, five hydrometric stations in different periods of the year.

It can be seen, flow variation along Tormes's river from October 2004 to September 2005. The lowest values recorded in the source station, Hoyos Del Espino, are from 0.086 m³/s to 2.08 m³/s. As maximum values, we can see that Puente Del Congosto station, in October 2004 recorded a maximum flow of 45.2 m³/s, and the same station recorded the minimum value in 2004-2005 and the value was 0,005 m³/s.

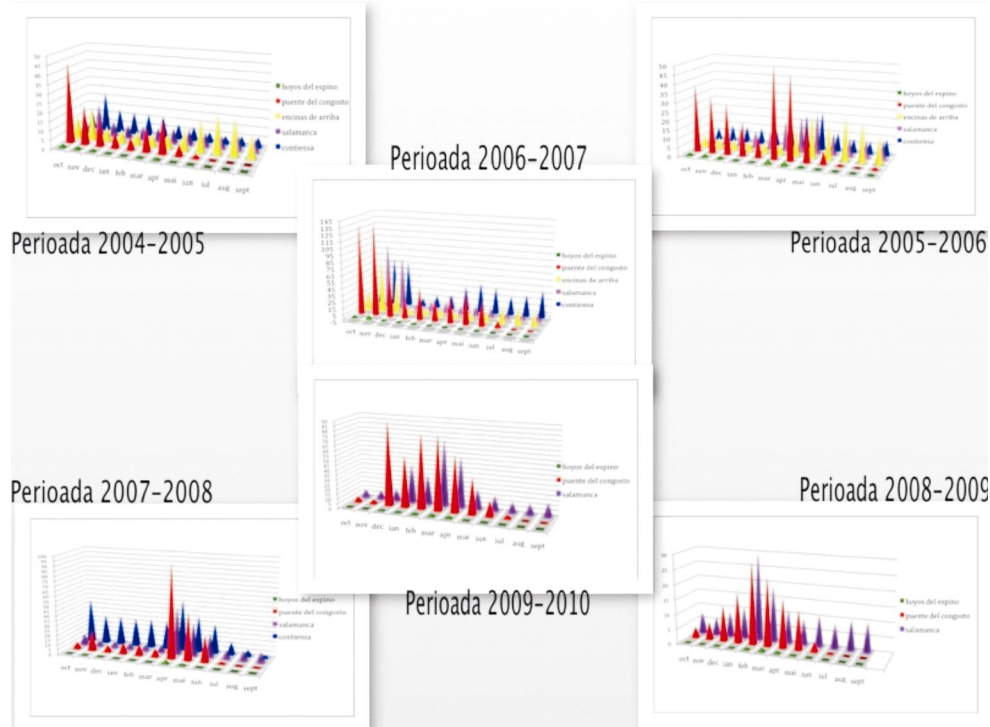


Figure 3. Variation of Tormes's river flow at the five hydrometric stations

In 2005 and 2006, Puente Del Congosto's station became famous because recorded the lowest and the highest values: the minimum value was 0.159 m³/s, and the maximum value was 51.6 m³/s. During the same period Encinas de Arriba station recorded a maximum value of 24.2 m³/s.

Like before, the station Puente Del Congosto recorded the maximum value of 143 m³/s or 138 m³/s. Hoyos Del Espino is distinguished having minimum value of 0.125 m³/s. Other maximum recordings were in Salamanca station of 102 m³/s and Encinas de Arriba station of 79.5 m³/s.

In 2007-2008 is remarkable maximum value of 96.3 m³/s in Puente Del Congosto and 52.1 m³/s in Contiensa. That minimum values were 0.19 m³/s and 0.237 m³/s in Hoyos Del Espino. From this period Encinas de Arriba station stop in to take over data on river Tormes, due to its proximity to the Santa Teresa station and dam Salamanca.

With the beginning of the period 2008-2009, private station Contiensa ceased to provide data on the River Tormes. Because of low rainfall that began to affect Spain, Tormes's river flow began to record the maximum of only 29.6 m³/s in Salamanca and 28.2 m³/s in Puente Del Congosto. Minimum values were lowered to 0.004 m³/s in Puente Del Congosto in August and September.

Puente Del Congosto remained with remarkable values and during the last period studied, 2009-2010, the values were of 89.4 m³/s and 79.2 m³/s, followed by Salamanca with 70.1 m³/s. And the minimum values were of 0.250 m³/s in Puente Del Congosto and 0.266 m³/s in Hoyos Del Espino.

Thanks to a minimum flow of a river has been created the concept of "ecological debt". Because of irregular rainfalls, ecological flow varies and it's difficult to find a common definition.

2.2 Important levels in maintaining the drainage system

Regime of the river or drainage system is under a year variations in flow and river water level. During the study, presented various water level variations, most notably those of Puente del Congosto stations, the lowest being 1.06 m in 2004-2005 and the biggest was 1602 m in 2006-2007, and Salamanca, where the lowest recorded value occurred in the period 2004-2005 of 0.36 m and the maximum was reached in 2009-2010 with a value of 0.629 m.

Encinas de Arriba and Contiensa stations were constant, with slight differences from one period to another. Hoyos Del Espino station had almost identical values and the values changed in 2008-2009 when there was a minimum of 0.369 m.

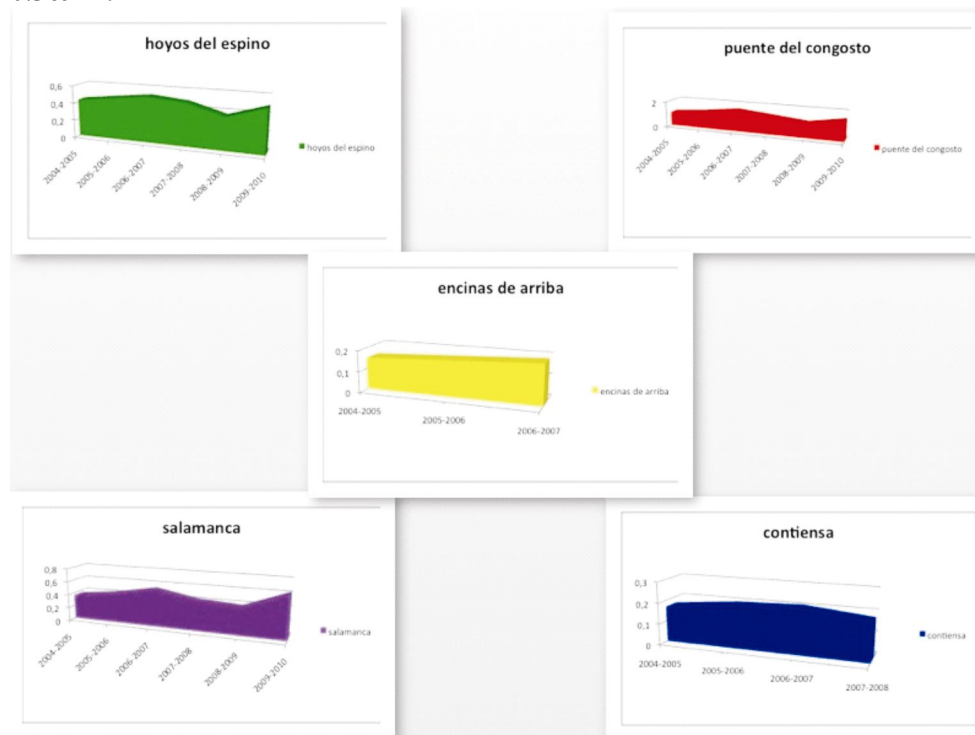


Figure 4. Variations in water level at the five stations along the study period.

3. ARRANING TORMES`S RIVER AND CURRENT ASPECTS OF MAINTAINING THE DRAINAGE SYSTEM

3.1 Projects

For arranging Tormes`s river, they made a lot of different projects with different funding sources. Among the completed projects I want to mention some of the most important:

- * "Recovering and preserving Tormes`s river, over passing through Salamanca." This project had a budget of Euro 3.1 million, money needed for different procedures in a section of the Tormes s river bed of approximately 13.000m long and 32.8 hectares in the two banks, and islands. The objective of the project target is to promote recreational areas along the river, fishing and improve the appearance of the river. It also wanted to promote indigenous flora, fauna and restore the geometry and dynamic of the channel.
- * "The maintenance and development of El Soto island, property of Santa Marta's de Tormes municipality". The necessary investments for developing this project have reached the value of 1.300.000 euro. This project has tasks like: shrubs care, conservation of various species of trees, places made especially for fishing, etc.
- * "The recovery of the forest along the center of the River Tormes, in drawing the latter through Juzbado". The objective of this project was correct and to recover indigenous forest located along the borders of the River Tormes, a declared site of Community Importance (SCI) \"the River Tormes and Beds of the tributaries" in Nature 2000. The project has cost an estimated 600,000 Euros, money being invested in the planting of over 3.000 species of native trees, forestry treatments, building and maintaining four spaces for the gaze and observation of birds.
- * "Recovering the ambient environment in the area of the River Tormes Sieteiglesias de Tormes". With a budget of 500,000 Euros, this project has been invested in environmental protection, recovery of ambient and the emergence of new spaces for leisure and recreation.

3.2 Projects in the course of development

The II century Plan of Riverbeds (2009-2015), has as its objective the ambient environment regeneration and reservoir riverbeds, flood defenses against these riparian zones and recovery, taking into

account the natural value, how to use and exploit them, by the citizens, by integrating River in everyday life to urban centers. Among the projects proposed, as these are important:

- * “Ambient environmental actions along the River Tormes, in drawing the latter through Villamayor”. Planned actions have as its main objective the recovery of the ambient environment 4,7km on the right bank of the River Tormes, the river passes through the city in Villamayor. Environmental recovery center will pass through a series of actions, such as riparian forest treatments on vegetation, planting native species and protection of riverbanks, structuring and implementation of a complex of temporary pools. In addition, as part of communication will create a network of walking trails and bike lanes along the a 7,4 km and creating views, and installing observatory for wild fauna. The project, the value of 2.600.000 Euros in, is financed by the ERDF.



Figure 5. The River Tormes in Salamanca.



Figure 6. The River Tormes in Villamayor.

- * “Recovering the ambient environment of the River Tormes, in drawing the latter through Huerta”. This action aims to strengthen the public utilities along the center of the River Tormes, in its passage through the city Huerta, making him compatible with the conservation of natural values they hold. For this purpose, is preparing a portion of evil with a utility of 2800m and an average width of 1,5m, and the creation of recreational areas in public areas for millennia. It is also made of native species plantations and representative for the various ecosystems of the channel, Mediterranean, alpine and Atlantic in an area of 4,2 hectares. In addition, it has started installation of elements of interpretation to promote public knowledge of this environment. The project, in the value of approximately 570.000 euro, is financed by the ERDF.

The biggest challenge faced by Spain is planning to implement in accordance with hydrologic new social demands on the environment, looking for ambient best technologies that reduce the demand for water, and avoid the large works which may have an important impact on the ambient environment. Conservation of natural resources cannot remain just as challenging, but should be the transpose of the territory. If water is a limited resource, then it must be protected in any form.

CONCLUSIONS

Due to problems with the climate that Spain began to grapple, aquatic systems are those that are largely affected. Lack of rainfall or low weight, as well as their distribution map of irregular have resulted in significant variations in the flow in the River Tormes and other rivers in Spain..

All these projects are a new chance in the hope to a stabilisation of the flow of the River. Ambient environmental protection along the river basin protection, supposedly because the forests are ecosystems able to maintain water, avoiding in this way an evaporating mass. Although it is a river with a small surface, basin represents a source of Tormes, important that the area where the rainfall is irregular.

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