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**A sustainable and symbiotic relationship
between human occupation and a natural
waterscape. The Afife case study, from the
XIIth to the XXth century.**

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A sustainable and symbiotic relationship between human occupation and a natural waterscape. The Afife case study, from the XIIth to the XXth century.

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Abstract

The waterscape defined by the Afife creek (Portugal) is a hotspot of time and cultural cross-references. In the 1200s, the presence of Benedictine monks, in the Convent of S. João de Cabanas, suggest the existence of a Catholic agrarian landscape. Benedictine monks ought to provide shelter, food, wool for blankets, and products for religious sacred services to pilgrims. Therefore, wheat, hay or barley, vineyards and olive trees would be cultivated. As such, the landscape should reveal the cultivation of cereals, olive trees, vineyards, and grazing lands, and mills to mow the cereals, produce olive oil, and saw the wood.

The design of the former landscape on cereals, wine, olive trees, sheep, goats and sawing industry in the area, under the Benedictine convent of S. João de Cabanas, together with its architectural structure, is strongly related to the XVIth century. In particular, the cross of S. Tiago de Compostela (Spain), indicating a route of pilgrimage, and the concentration of seven water mills in a 100 meters upstream distance to the convent, reveal a great presence of permanent water power.

The present irregular distribution of the remaining pine-trees, oaks, eucalyptus and acacias indicate changes in the agrarian exploitation throughout the XIX^h and XXth centuries. The *Eucalyptus*, original from Australia and New-Zeeland, was introduced in Portugal in the 1800s, while the Acacia was introduced in the 1900s, to sustain moving sands. Their expansion in the slopes of the Afife creek suggests very recent farming abandonment (after 1940s).

This paper proposes to discuss agro-forest sustainable adjustments to changing cultural-economic drivers in the long run, through a case study. The case study is the Afife waterscape transformation, located in the village of Afife in the North of Portugal. The analyses will adopt an interdisciplinary approach crossing diverse sources of information and methodologies.

I. Introduction

Cultural landscapes, as the result of the interaction of man and nature, are important sources of historical information, since traces of this co-evolution tend to remain present for long periods of time (Agnoletti, 2006a; Palang et al., 2000; Antrop, 1998). Waterscapes, focusing on a very particular natural resource, the river, are a special case.

Since ancient times, rivers have been the providers of a variety of services for all species. Their existence and characteristics tend to determine the economic, social and cultural activities developed in the vicinity, influencing the services that the river provides to the surrounding ecosystem.

Case study

Afife is the name of a parish and of a river located in the district of Viana do Castelo in the north of Portugal. The river has, until today, signs of a very intensive activity of water mills, suggesting the existence of large areas of cereals and forest. Existing mills were designed to saw wood or to grain cereals. However, the analysis of the present landscape suggests that the agricultural area in the parish is too small for such a large number mills, indicating a transformation of the landscape through time. In addition, the steep slopes that characterize the area would have required terraces for agricultural production. Nevertheless, there are presently no signs of the existence of terraces in the past. In addition, the irregular distribution of pine-trees, oaks, eucalyptus and acacias, suggest a transformation of the landscape in the 1900s. In sum, the reading of Afife waterscape suggested the following hypotheses: (i) Afife's population provided grinding and sawing services to nearby parishes; (ii) Afife's mills belonged to residents from other parishes; (iii) the mills were used for grinding cereal and sawing trees cultivated in the parish and sold to other villages; (iv) more than one hypothesis is verified depending on the time period.

The analysis of the four hypotheses requires the use of historical data on the characteristics of the Afife river basin, the population, and also on economic and social activities. This paper is organized as follows: description of the case study area, with a special focus on the river basin; the study of economic and social activities using historical and oral history sources; analysis of the implications regarding each

hypotheses, based on the collected information. The paper concludes with some reflexions for future research.

II. Methodology

The analysis of cultural landscapes is a transdisciplinary process, where “one of the hardest things is to combine different approaches, choosing the right combination of methods, to put into evidence the complexities that landscape resources always represent” (Agnoletti, 2006b, pp1). The approach adopted in this study comprises the review of historical documents, archaeological structures, other written sources and oral testimonies from local residents and experts, following a very simplified version of the methodology proposed in Agnoletti (2006b). In a sense, we propose to develop a landscape history of a particular space (Marcucci, 2000) characterizing its natural and cultural elements.

Yet, we propose to go even further in this methodology using the landscape itself as a information source, a document that provides information for long run analyses (Melo, 2015). Indeed, the formulation of the hypotheses derived from the observation of the landscape, while their validation is based on written sources and interviews.

The spatial distribution of land and water uses, as the chronology of natural, exotic and *in-situ* built elements, displayed across the water basin of the river Afife, express both landscape changes as continuity of soil occupation and design in the long run. Built structures from ditches to mills, monastery, churches, fencing walls, bridges, railways, roads, cottages, and buildings provide additional information to identify and date significant stages of the biocultural change. Moreover, the observed geo-morphology and hydrology, the tree species distribution, and the land occupation indicate different stages and historical contexts in the landscape design. The changing patterns of the landscape depend on the role that cultural and natural factors have in driving the development of cultural and economic activities. More importantly, it suggests the co-evolution of natural and cultural forces, in enriching or deteriorating, the biological diversity in the surrounding slopes, prairies and the seashore. It is evident in the present landscape that the abandonment of this area by the population has decreased the biocultural diversity.

The patchwork of pieces left in the landscape, and what was erased or transformed, provides indicators of the chronology of land occupation and water resource uses. The Landscape transformation analysis, in different themes, constitutes an operative tool to understand the evolution of the area, its people and its resources.

The crossing of these elements with written sources describe an overview of the continuity of water resources uses and soil occupation in the long run in the Afife creek basin until the late 1800s and early 1900s.

Therefore, having performed heuristic and hermeneutic analyses of the landscape, the information collection proceeded in a sequential mode. In a first stage, a thorough search on primary and secondary bibliography was carried out in the Portuguese National Library. Secondly, the analyses of historical documents were undertaken in the Portuguese National Library, in the Archive of the Ministry of Public Works, Commerce and Industry (nowadays lodged in the Ministry of Economy) and the District archives of Braga and Viana do Castelo.

In order to characterize the productive activities of Afife in the Medieval and Modern Ages, series of taxes paid to the municipality of Viana do Castelo and the cathedral of Valença, were depicted from secondary bibliography. In addition, the series of taxes paid from Afife to the institution of royal assistance of Viana do Castelo (Misericórdia) and the Cathedral of Valença were analysed (XVIth and XVIIIth centuries). Judicial sources on complaints from Afife peasants against the Cathedral of Valença claiming tax reduction on cereal production (1584) were also observed.

For the XIXth century, the books of the Minutes of the Parish of Afife, in the archive of Viana do Castelo, were analysed for the period 1793-1918. These books contain information about the public local jurisdiction on:

- Public inland and sea waters, common inland waters, uses and distribution of streams following consuetudinary law on private division of water flows;
- Forest acts, uses and management: hunting, fishing, gathering wood, felling trees, felling logs and their transport;
- The plantation use of the Parish commons between 1878 and 1910; in 1910, a decision from the District of Viana do Castelo imposed the plantation of pine trees in the common land;

- Cereals, after the implementation of the new political regime, the Republic, and in the aftermath of cereal crises and civil tension, in 1913, the government strongly ordered the civil Governors to supply seeds for cereal production. In Afife, as for all over the country, the President of the Parish committee was strongly advised and remembered to buy *painço* (Corn seeds) from the Civil Governor in Viana do Castelo and plant them.
- Licences for pastures use; sheep, goats and pigs; Prohibition of horses grazing in the commons of the parish;
- Licenses for extraction and use of rocks and stones: queries exploitation and gathering stones from the river bed; building in rubble stone in river margins, river bed or river walling; in addition it contains information on the management of complaints against water streams deviation to water farming land, cereals, and pastures or meadows;
- Licenses for constructions: construction, demolition and functioning of mills dams, ditches, banks, and bridges;
- Licenses for construction and maintenance of public buildings such as: churches, cemeteries, primary schools, railway stations, public roads;
- Decisions for cleaning the public river bed, fountains and aqueducts;
- Decisions when both private landowners and the Board of the parish had to clean the road borders (this data provides information about the division of private property with fences of brambles and “trees”).

In the Archive of The Ministry of Public Works, in Lisbon, the nucleus of each District of Roads building and the industrial survey of 1890 provided very accurate, although partial, information on the spatial location of resources.

In the archive of Viana do Castelo, other documental nucleus were scrutinized for this period

- Processes from the General Direction of Hydraulic works provided information on fines collected from private owners and landlords for illicit water courses deviation in order to irrigate pastures, vegetables, and other “fields” (cereals-most likely wheat and corn);
- Licences to rebuild mills and walls destroyed by floods (1892-1920);
- The cadastre of mills (for flour) 1940s and 1960s;

In the late XIXth century and early 1900s, the data encourages a more consistent pattern of property regime and land use occupation, geo-referenced, in a forthcoming future. The scale of maps and detailed information, with the inclusion of nearby national and local roads will allow, nonetheless, a partial representation of landscape patchwork and evolution since the 1890s to the 1950s, when these soils and ecological maps were published. The historical information collected for the XIXth, XXth, and XXIth century was however insufficient to test the hypotheses under investigation in more recent periods, thus a series of semi-structured interviews were developed.

These interviews are a methodology most used to collect qualitative information from pre-selected respondents (Diefenbach, 2009). The interviewees were selected by two criteria: (i) having used or owned a water mill in Afife; (ii) being available and willing to answer. The interviews were on the following topics:

- Characteristics of the interviewee: age, time lived in Afife, family history.
- Perception of natural elements across time:
 - o River: how abundant was the water, how frequent and serious were the floods;
 - o Water mills: property or use, number, location, name, how they were managed;
 - o Forest management and composition.
- Production activities:
 - o Cereals: which cereals were cultivated; cereals for the mills were from own fields or bought;
 - o Forest products: changes in forest coverage, type of trees and extension, other products.
- Landscape changes: if it changed, when and how.
- Some clarifications on terms found in archives.

Interviews were audio-recorded and transcribed for content analysis.

III. Afife

The river

The River Afife basin has 13.35 Km². Its main stretch, *Ribeira de Cabanas*, has its spring at an altitude of 523m and flows to the sea, after 7102m. The river has 22

tributaries, the most important are the creeks: Ribeira de Pedreira, Ribeira de Agrichousa, Ribeira de Fojo, Ribeira de Ereira and Fonte Pedrinha. The average slope is 9%, varying between 15% and 2% (Faria, 2007). There is some registry of floods in the river (Meira, 1945); archives in Viana do Castelo refer the existence of licenses to reconstruct mills because of floods 1892-1920.

Figure 1: Afife river basin
Source: Faria (2007)



- 1 – Azenha de Camilo
- 2 – Azenha de Formiga
- 3 – Moinho do Lamas
- 4 – Engenho de Formiga
- 5 – Moinho de Formiga ou da Agrichousa
- 6 a 12 – Moinhos de Cabanas (7)
- 13 – Moinho da Ponte de Cabanas
- 14 – Moinho da Quinta de Cabanas
- 15 – Moinho das Eras
- 16 a 17 – Moinhos do Loureiro (2)
- 18 – Moinho das Ferreiras
- 19 – Moinho da Torre
- 20 – Moinho da Oliveira
- 21 – Moinho da Margarida
- 22 – Moinho do Amial
- 23 – Moinho e engenho do Rio
- 24 – Moinho de Gateira
- 25 – Azenha, moinho e engenho do Pião
- 26 – Moinho da Ponte
- 27 – Moinho de Além do Rio
- 28 – Moinho de Entre Moinhos
- 29 – Engenho do Xisto
- 30 – Moinho de Porto do Rio
- 31 – Engenho do Pinto
- 32 – Moinho do Bichôco
- 33 – Moinho do Fial
- 34 – Ruínas do moinho Velho do Fial
- 35 – Ruínas de moinho

Figure 2: Ribeira ed Cabanas watermills location

Source: Faria (2007)

Based on the two nearby meteorological stations of Nogueira, in Viana do Castelo (from 1978/79 to 2014/15), and Caminha (from 1979/80 to 2014/15), Figure 3 depicts the average monthly precipitation for the existing data. The precipitation data shows that there is a difference on the average monthly rain depth for the two stations, but a similar variation through the year: there are nine months with high precipitation in both stations and three months with small precipitation height.

The power needed by the mills depends on both flow and relative waterfall height. Since the characteristics of river Afife does not allow regularization, all the mills are in a cascade system. A simple analogy with the precipitation patterns shown in Figure 4 indicate that there would be considerable flow in 75% of the year, which could be in accordance with the mills' needs. Furthermore, the high slopes characteristic of this river arise with the ideal conditions for waterfall heights that correspond to enough power in a short longitudinal distance. This fact makes it possible to install the high number of mills in such a short river.

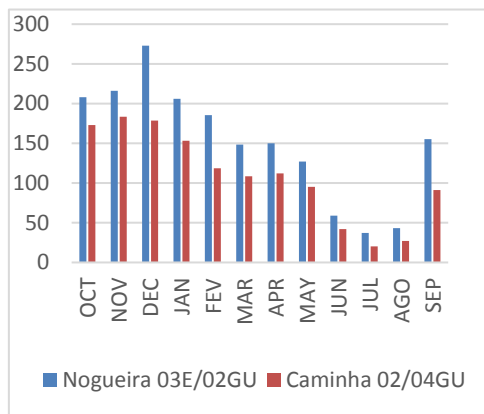


Figura 3 – Average monthly rainfall (mm) in the meteorological stations of Nogueira and Caminha (1979/80 to 2014/2015).

Although we cannot date the appearance of water mills in Afife, they are known to exist in Portugal since the Roman Period. Moreover, findings from excavations of roman settlements in this area indicate the presence of utensils for planting and grinding cereals from the roman age. According to Horácio Faria's interview, the first mill in Afife that is documented dates from 1527. In 1758, in a survey carried out through all parishes in Portugal, Afife was described as having thirty-three devices of grinding (flour).

Later, in 1940, the National Public Service ordered the inventory of all mill units to produce flour or cut timber and wood. In this record, thirty three mills were identified in the Hydraulic Service of Viana do Castelo, on river Afife and its tributaries, one of which had been demolished remaining only the ruins (Figure 4). In the catalogue that followed, the mills registered along the river Afife in the records of the District hydraulic services within 1960 and 1969, had an engine of one or two horse-power. However, only five mills were in operating conditions at that time. It is not possible to

know if the other mills kept working on self-water power or if their use was discontinued.

Left Document (1940-43):
 DIREÇÃO HIDRÁULICA DO DOURO
 Comunicação N.º 22
 Ao Ex.º Sr. Chefe da
Cadastro das Moagens de Rama
 (Moinhas ou azenhas accionadas por água das correntes públicas com ou sem lezíria)
 Levo ao conhecimento de V. Ex.ª, para os devidos efeitos, que na margem direita (direita ou esquerda) do rio (rio ou ribeiro) de afife (nome), no sítio de Cabanas, freguesia de afife, concelho de Viana do Castelo, existe um moinho (moinho ou azenha) com 1 (número) mós, pertencente ao Sr. Henrique de Afife, residente no lugar de Gaterra, freguesia de afife, concelho de Viana do Castelo.
 O guarda-rios do cantão com sede em Cabanas
Henrique de Afife

Right Document (1960-69):
 P. D. 900/943
 P. S. 2809/41
 P. L. 340/61
 P. S. 853/62
 MINISTÉRIO DAS OBRAS PÚBLICAS
 Direcção Geral dos Serviços Hidráulicos
 DIRECÇÃO DOS SERVIÇOS FLUVIAIS
 Em 18 de Janeiro de 1962 N.º 461
CADASTRO DE MOAGENS
 NOTA DE SERVIÇO
 N.º _____ CONCELHO de VIANA DO CASTELO
 Pro.ª Dir.ª N.º _____ FREGUESIA de APIFE
 Pro.ª Sec.ª N.º _____ LUGAR de CABANAS OU GATEIRA
 CORRENTE RIO DE APIFE
 MARGEM ESQUERDA
 Tipo de aproveitamento (*) MOINHO
 Número de mós UM Potência 1,5 C.V.
 Proprietário AUGUSTO ALBUQUERQUE NOGUEIRA
 Residência GATEIRA - APIFE - VIANA DO CASTELO
 Observações e averbamentos Ofício de Ização de legalização nº 2411 de 20/8/943.
 O CHEFE DA SECÇÃO
Henrique de Afife
 Mod. 21 DHD: REGISTO DE ENTREGA

.* Secção	/	/	/	/
.* Lago	/	/	/	/
.* Canaleta	/	/	/	/
.* Lagoa	/	/	/	/
.* Secção	/	/	/	/

 NOTA: Texto no verso, informações em baixo e no verso.
 Mod. 106/Cat. 1956 (*) Moinho, azenha, lago ou lábica. Ponte

Source: Cadaster of mills (1940-43)

Source: Cadaster of mills (1960-69)

Figure 4: Register of a mill in the site of Cabanas

Nevertheless, with a uniform distribution of water mills in this stretch, the average distance between mills would be 200 meters. In Âncora (to the north), the river has 19.000m and 62 mills, rising this average distance to 300 meters. In Carreço (to the south), there are very few windmills, according to Horácio Faria's interview. It is thus clear that Afife had a significantly higher hydropower relative to its neighbouring parishes.

The products

Information on tax and other payments made to the governing bodies may, in addition to landscape, provide complementary data on products, activities and uses of the territory, in general.

Cereals

The information collected indicates the existence of several important productions and resources. Historical registries show the presence of wheat since the XIIth century, rye since the XVth, and corn since the XVIIth century. Later in the XIXth century, there is reference to barley. However, in recent times, corn is the most abundant crop. Historical records show for the Middle and Modern Ages that seigniorial, church, municipal and state payments were done in wheat, corn and wine.

In the case of wine, although it is a default production of any catholic environment, the mention of vineyards is quite rare in the archives.

Forest

Forest in Afife is composed of eucalyptus, pines, and Acacias in the commons and abandoned farming land nearby the convent of S. João de Cabanas, and in the slopes and the summit of the hill. Acacias were introduced in the north Coast of Portugal and in Serra do Gerês in 1903-1905. Acacias are characterized as a very harsh invasive species very fond of water. It is thus possible that the abandonment of wide areas of farming in Afife water basin, that resulted from the end of the grinding mills in the 1960s, when there was an intensive flux of Migration from the Minho Province, provided the conditions for this species to spread, decreasing the biological and cultural diversity in the area. In the XIXth century the Civil Governor required the delivery of Parish's Pine trees Logs, suggesting that Afife could supply Viana yards/building industry from the parish public forest.

There is also a reference to the existence of few oaks and cork trees in the XIXth century. Forest was a productive resource, one important forest product was wild bushes, which constituted the basis for animal beds, and source of many disputes, according to oral testimonies.

The amazing absence of records (especially in the convent inventory of properties) of olive trees and olive oil milling was noticed, while there is a mention to the “flying cattle” (bees), honey and wax production. Possibly, like the vineyards, it was so obvious that recording would be useless. Further research is required to understand who supplied the community with olive oil, the most characteristic product of the Mediterranean diet. According to oral testimonies, oil mills were located in other parishes.

Sea and river products

The sea provided additional important resources for the local economy. Fishing was mainly done in *pesqueiras* –a round rubble stone bay constructed in the sea creeks or up in the river of Afife, at the highest level where the migrating species would climb.

There are records of these ponds for fisheries as for *cistus* (wrack) extraction in Afife since the middle ages, throughout all the Modern Ages (XVth-XVIIIth centuries). These ponds belonged either to the church, seigniorial landlords or the municipality. After the abolishment of the seigniorial rights, in 1832, the Parish Afife kept administrating those little ponds and dams in the River Afife, in the mouth and along the Afife coast (“Afife sea”), following customary law, at least since 1836 until 1918, according to the records on the book of the Parish minutes, and the Industrial Inquiry of 1890. Even after the beginning of the Republic in 1910, that practice remained in the exact same way: the parish would auction the rent of the fisheries and the income would be casted off by the higher price and paid to the Parish.

In addition, wrack (*sargaço*) was fundamental for feeding pigs, soil fertilization and also trade.

Management practices

The Management of resources, natural or cultural, also contributed to shape the landscape. At least since the 1800s to 1911, in Afife, the commons of the parish were auctioned every nine years among the families of the parish. After 9 years, a new auction was performed, and the former parcel could not be attributed to the prior users. The lands included, soil, water and infrastructures. Each parcel was delivered to more than one family in each period. During that period, several families used the same mill to produce flour with no spark of conflict; they also used water from the creeks and streams to irrigate their lands. Yet, if milling caused no conflict, the irrigation of farming lands did. The rules for water distribution had been established in a precise rule earlier than 1878. Those resources were ditched from the commons to the farmed lands. Often, the users in the higher land would retain the water for self-consumption, provoking huge rows and legal action between both the owners of the parcels as of their neighbours.

Water mills were, according to historical records (since 1830) and oral data collected during the interviews, either property of one family house, or of a group of families. Common mills were most frequently from residents in Carreço (a parish just south of Afife) and Gateira. Each mill had a monthly calendar where each *consorte* (family) registered the days they would use the mill. It could be 24 hours (*rolda*) or 12 hours (*meia rolda*) per week. Interviewing residents in Carreço, it was found that the cereal was carried by donkeys, through the “donkey way”. Interestingly, there is no registry of conflicts regarding mills’ water management. On the contrary, irrigation water was a source of countless conflicts since the 1830s. Most conflicts regarded the illicit deviation of water by the landowners, modifying the schedule of water supply to water pasture, cereals or the cattle. According to oral testimonies, the monastery had the right to 24 hours per day of water from the end of June to the end of September. During this period, the mills could not be used, as all water was permanently diverted to the monastery fields.

The cereal used in the mills was mostly corn, although sometimes wheat and rye was used. Usually the cereal was left there and the flour was collected the next day. Mills produced three types of flour: a very fine one used for infants and very weak people; regular flour used to bake the bread, and a third type used for animals. According to oral testimonies, Maria Lua, was the only grinder in the mills. Cereal owners would often ask her to take care of the mill during the night, namely when heavy river flows were expected. Several interviewees mentioned Maria Lua. There is no history of disputes in the use of water mills, self-regulation was sufficient for the management of the resource. Some mills had two grindstones, one for corn and another (softer) for rye and wheat. Some interviewees stated that only two people in Afife knew how to prepare a grindstone properly. In an interview with the granddaughter of the first bakery in Afife, we found the family that used to sell bread to Viana do Castelo and Âncora (two locations to the north of Afife). The bread was cooked in an oven heated by pine needles and horses were used for the transport.

Opposite to the use of common water mills, where there is no story of conflicts, the management of forests is characterized by constant and sometimes violent conflicts, according to oral testimonies and Faria (2008). The bushes in the forest were divided in parcels, one for each family house in Afife. Bushes were used for making the bed for the animals and after sometime to fertilize the agricultural land as manure. This manure,

together with wrack, was possibly the reason for the extraordinary fertility of the land. Quite interestingly, soil erosion was already an issue 200 years ago. There are registries prohibiting cutting wild bushes with grubbers (which extracted the roots also). The bushes had to be cut with a reaping hook, preserving the roots and thus preventing soil erosion. It is an example of an environmental and economically sustainable management of the forest shaping the landscape (Agnoletti, 2013).

The sea, source of wracks and fish, also represented a source of conflicts. Wracks were used to feed the animals (pigs) and as fertilizers. More recently, a trade on wracks outside the parish was also developed. The collection of wracks was, since at least the XVIth century regulated: the activity was only allowed between end of July and March, being prohibited on Sundays and holy days. In the XVIIIth century, the development of the agriculture and the scarcity of bushes to fertilize the agricultural land raised conflicts over this resource and consequently more demanding regulation was created (Faria 2008).

Human settlements/urbanization

According to population census, the number of Afife residents has varied very little, from 1332 inhabitants in 1864, to 1632 in 2011 (Figure 5).

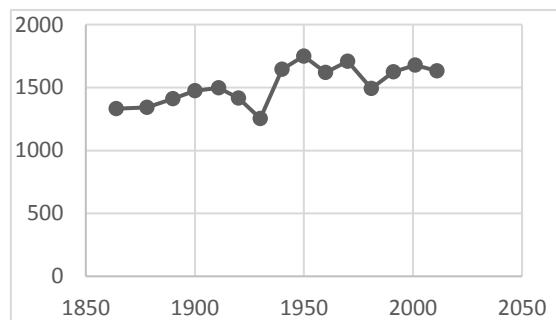


Figure 5: Resident population in Afife

Oral testimonies have also revealed a perception of very little change in the landscape. Interviewees mentioned the presence of more eucalyptus in the forest and more second houses in the village (between quota 20 and 60).

The collected information provides clear evidence that the use and management of the natural resources varied overtime:(i) the water mills in Afife were not exclusively owned by residents in Afife, instead, the water mills were property of residents in Afife and in Carreço (Âncora to the north has a river and watermills). Regarding hypothesis

(iii) there is evidence of trade in wood in the XIXth century, but no evidence was found of trade in cereals.

IV: Conclusions and directions for future research

Observation of the waterscape in Afife raised the curiosity about the relationship between a natural resource (the river) and the human occupation of the territory. The waterscape denotes an intricate evolution of the river, its margins and its insertion in the macro-environment. The understanding of this relationship required the extension of the study area outside the river basin.

Regardless of the diversity of sources analysed, the data collected for the period before the XXth century, has only allowed to establish a partial inventory, maybe just a list, of natural resources and built structures which had been spread across the river basin of Afife, between the XIIth and the XVIIIth centuries. However, the traces in the landscape such as forested summits, water mills and sawing mills, and rubble stone fish ponds described in sources since medieval times to nowadays, archaeological proofs, together with the persistence of taxes on production and trade in some goods, allowed to infer that the sawing industry and flour production would be just for subsistence consumption while the algae and stone extraction, as sand, would have been explored to be traded outside the village, at least to the middle of the XXth century.

The persistence of economic practices and resources extraction for long periods of time until nowadays could also be confirmed, however, it was not possible to define a cadastre of rocks, trees, cereals, cattle, fish, and algae distribution or any other soil and water occupation before the 1950s, given the available information.

The hypotheses raised from the research found in historical sources lead to the development of interviews to local elderly residents in Afife and Carreço with knowledge of the activities developed in the Afife river basin. In addition, there was an opportunity to interview local experts. The reunion of all the data provides clear evidence to reject two of the four hypotheses. In particular, residents in Afife did not exclusively own water mills; and the mills did not provide grinding paid services. On the contrary, there are strong evidences in favour of the hypothesis that the Afife river was the main source of hydropower of two parishes, Afife and Carreço.

This evidence also suggests the adoption of different management models for the commons across time. In particular, it reveals an interesting property arrangement as most watermills that were property of a single family belonged to Afife residents, while those that were common property belonged to residents from nearby Carreço.

Moreover, the management of forest resources was completely different from the management of water for mills, as the intervention of the governmental agents was required to manage the resource. Likewise, the management of the wracks was also intensively regulated to manage conflicts. It should however be stressed that the regulation of water for irrigation was across time a source of intensive and numerous conflicts.

One possible explanation for the adoption of different models is the imbalance between the demand for resource uses and the capacity of the existing resources. In the case of river Afife, its unique characteristics allowed non-binding constraints relative to the demand with respect to hydropower supplied to watermills; however, in the case of the forest bushes, sea wracks, and water for irrigation the available quantity of the resource was limited when compared to the demand. Consequently, conflicts emerged and regulation (monitoring and penalties) were defined to prevent the use of their scarce resource form populations in the vicinity.

In sum, more abundant commons were managed on a self-regulatory framework, while less abundant commons were managed by local authorities that issued provisions for the use and also to monitor and penalise noncompliance.

Future research on the negotiation mechanisms that sustained this organization across time is fundamental to understand the factors behind the choice of different management models for different types of commons.

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- 1897, 2ª circunscrição hidráulica , 1ª secção, processo 59, processo 59, queixa que fazem diversos proprietários da freguesia de afife, contra francisco barbosa pinheiro, proprietário na mesma freguesia, Cota atual 2.38.3.7-1

- 1ª secção, 1896, processo nº 18, licença para reconstruir um açude no leito do ribeiro de Afife, no sítio de loureiro, da freguesia de afife, concelho de viana do castelo, a António Ramos ferreira de carvalhom, Viana do Castelo, Cota atual 2.38.3.3-62

- 1ª secção, 1896, processo nº 20, licença para reconstruir um açude no rio de afife, sítio do Ameal, na freguesia de afife, concelho de viana do castelo, Cota atual 2.38.3.3-64

- 1ª secção, 1896, processo nº 26, licença para reconstruir um açude no sítio do Gasparelho, margem esquerda do rio de afife concedida a Manuel Afonso do rio, de Afife, do concelho de viana do castelo, Cota atual 2.38.3.3-70

- 1ª secção, 1896, processo nº 27, licença para reconstruir um açude no sítio da formiga e bem assim um caminho e passadiço na margem esquerda do rio de afife, concedida a António Pinto Meira, concelho de Viana do Castelo, Cota atual 2.38.3.3-71
- 1ª secção, 1896, processo nº 61, Licença pedida por José António Gomes Moreira, para reconstruir dois açudes e uma casa, no ribeiro de afife , Viana do Castelo, Cota atual 2.38.3.4-12
- Direcção das obras públicas de Vianado Castelo , 2ª secção participação. Manuel Francisco Pires participa que João Bento dos Reis, da freguesia de Portela Suzã, deste concelho, mudou o leito do ribeiro de cabanas causando grande transtorno ao suplicante e a outros, processo nº 72, cota atual 2.38.5.2-5
- Embargo, a Serafina Afonso e outros da freguesia de afife, deste julgado, Embargado, Rafael Lourenço Manço e mulher da mesma freguesia, 22-04.1842, Cota atual 8.16.1.6-3
- Licença para a reconstrução de um açude, concedida a João Ennes Ramos, Cota atual 2.38.3.4-15
- Licença para reconstruir um açude de uma fábrica de moagem e serragem no sítio do porto do rio, na margem esquerda do rio de Afife, concelho de viana do castelo, concedida a António José Gomes Moreira, cota atual 2.38.3.3-72
- Licença para reconstruir um açude no sítio do Gasparelho, margem esquerda do rio de afife concedida a Manuel Afonso do rio, de afife, do concelho de Viana do castelo
- Licença requerida pela junta de paróquia de afife, para a reconstrução da ponte do Fial e caminhos marginais do rio de afife, Cota atual 2.38.3.3-82
- O presidente da junta de paróquia, da freguesia de afife, reitor João Luís Barge, pede providências a fim de se dar curso às águas do ribeiro de afife, próximo ao local da sua foz, Cota atual 2.38.6.1-7
- 1ª secção, 1896, licença para a reconstrução de um açude e um muro pedida por Jacinto Afonso Simões, viana do castelo, cota atua 2.38.3.3-76
- 1ª secção, 1896, processo nº 21, licença concedida a António Alves Pinto para reconstruir parte de um açude a muros no rio de Afife, no sítio da ponte, - 1ª secção, 1896, processo nº 2 Viana do Castelo, Cota atual 2.38.3.3-65
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- Licença requerida por Francisco Alves Moreira de Viana do Castelo, Cota atual 2.38.3.7-40
- Primeira secção, 1896 processo nº 28, licença para reconstruir um açude de uma fabrica de moagem e serragem no sitio do porto do rio, na margem esquerda do rio de Affife, concelho de viana do castelo concedida a Antonio Jose Gomes Pereira. Viana do Castelo, cota atual 8.22.5.2-7
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