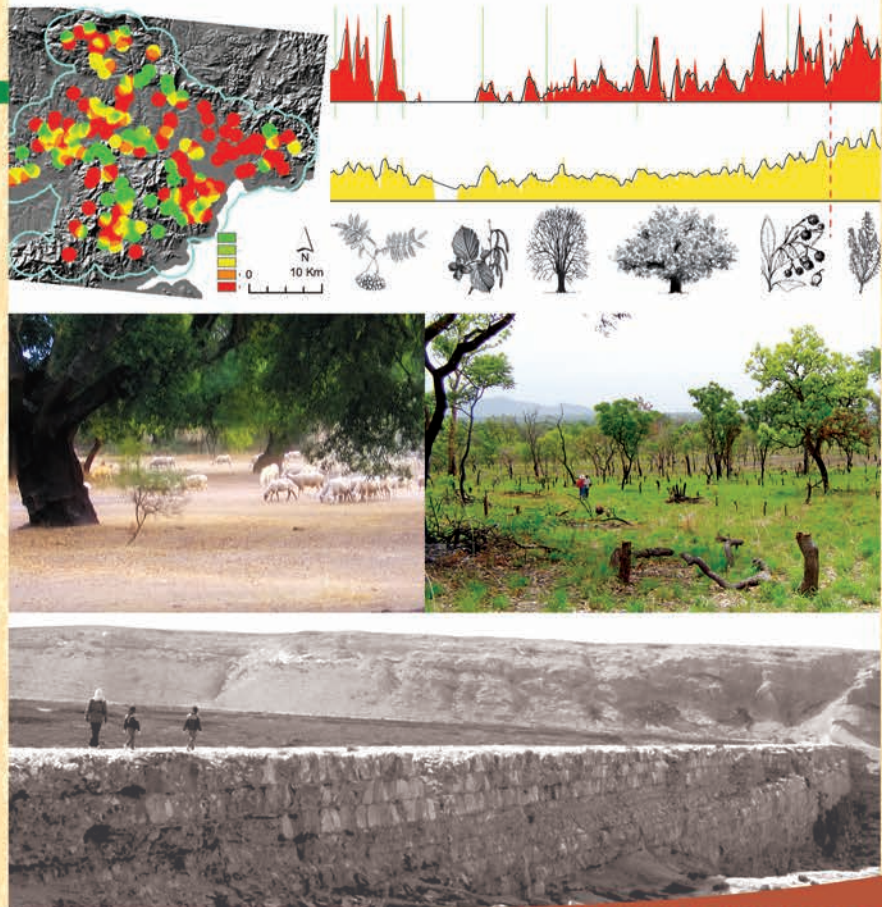


# VARIABILITÉS ENVIRONNEMENTALES, MUTATIONS SOCIALES

*Nature, intensités, échelles  
et temporalités des changements*

*Sous la direction de  
Frédérique Bertoncello et Frank Braemer*





*Variabilités environnementales, mutations sociales*  
*Nature, intensités, échelles et temporalités des changements*

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# Islamic society in a new environment: adaptation or transformation. The south of the Iberian Peninsula in the Middle Ages

Luca MATTEI<sup>a</sup>, Luis MARTÍNEZ VÁZQUEZ<sup>a</sup>, Sonia VILLAR MAÑAS<sup>a</sup>

## Abstract

The arrival of Islamic populations and their installation in the Iberian Peninsula resulted in a new relationship between this society and an environment different to its own. Our aim is to evaluate the nature of this relationship, in other words, the impact that both society and the environment had on each other. We analyze, among other things, irrigation, dry lands and livestock, focusing on the territory of Granada in the Middle Ages, especially from the work we are carrying out in different areas of the region.

**Keywords:** Middle Ages, irrigation, agriculture, dryland farming, Granada.

## Résumé

L'arrivée des populations islamiques dans la péninsule Ibérique et leur installation ultérieure représente une nouvelle relation entre cette société et un environnement différent de celui qu'elle connaissait. Le but de cette communication est d'évaluer quelle est la nature de cette relation, c'est-à-dire quel est l'impact de la société sur le milieu et vice versa. Nous discutons, entre autres sujets, la mise en place de l'irrigation et la survie de l'agriculture pluviale, en nous concentrant en particulier sur le territoire de Grenade au Moyen Âge à partir du travail conduit dans différentes zones de cette région.

**Mots clés:** Moyen Âge, irrigation, agriculture, culture sèche, Granada.

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a. Grupo de Investigación THARG (HUM 169), Universidad de Granada, Becarios FPU del Dpto. de Historia Medieval y Ciencias y Técnicas Historiográficas, Facultad de Filosofía y Letras, Campus universitario de Cartuja s/N, 18071 Granada (Spain).

## Introduction

Our study focuses on an area in the southeast of the Iberian Peninsula, in the region around today's town of Granada, measuring some 2 407 km<sup>2</sup>. This area includes Granada itself and three rural *comarcas* (counties) which roughly match three historical areas: *Los Montes*, the *Vega* plain and the *Quempe* (fig. 1). The three *comarcas* (counties) do not only have certain distinct geographical and environmental features, there are also differences in the settlement patterns and production systems.

Springs abound in the hilly area of *Los Montes*. The terrain is made of steep, rocky hills and low ridges. This, together with the climate and the soil, makes this area highly suitable for dry land farming. In addition, a fair amount of holm oak trees and mediterranean scrub provides ideal conditions for livestock breeding.

An entirely different setting is the *Vega*, a wide plain surrounded by mountains. The land, drained by the river Genil and its tributaries, is extremely fertile, and it is the most appropriate area for the installation of irrigation systems.

The *Quempe* consists mainly in a plain dryland, where the water resources are much more scarce. The soil is arid, irrigation is difficult to set up and thus available production options are limited to livestock and salt works.

## Production and Land use

The migrations that took place during the 8<sup>th</sup> century, with new populations coming mainly from northern Africa, caused major changes in the environment. In particular, the landscape was shaped by the construction of an irrigation system that reached its highest level of development by the Late Middle Ages.

However, the use of resources and production systems depend on natural conditions, including climate, water sources, soil and vegetation. As a result, irrigation was much more densely spread in the plain than in the mountains or in the drylands.

The location of water sources plays an essential role in the creation of any settlement. In this particular case, colonisation may not have its origin in the existence of abundant fresh surface water, as the inhabitants set up a complex hydraulic network. This system allowed the irrigation of new areas and the introduction of new crop varieties. While the facilities used were essentially the same everywhere (particularly canals, fields and mills), their number varied with the possibilities of each area. Where only limited irrigation was possible, the economy was mainly based on animal husbandry and dryland farming.

Other cases show that settlements were not always chosen for the presence of fresh water. This is the case of the *Malaha*. It is located in a dry and arid land, which results in low-quality soil. Moreover, the main water sources are either thermal or with a high content in sodium chloride, and therefore unsuitable for irrigation. In any case, there were indeed some human settlements in this area and not only did they create an irrigated area large enough to supply the town (TRILLO SAN JOSÉ, 1996), but they also exploited the salt water to produce salt

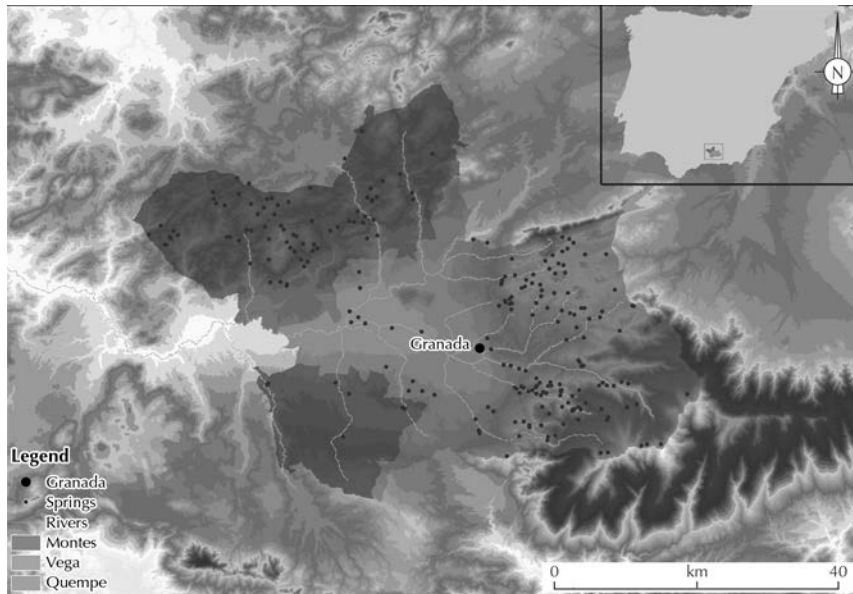


Fig. 1. Study area showing the three regions, rivers, springs and the city of Granada.

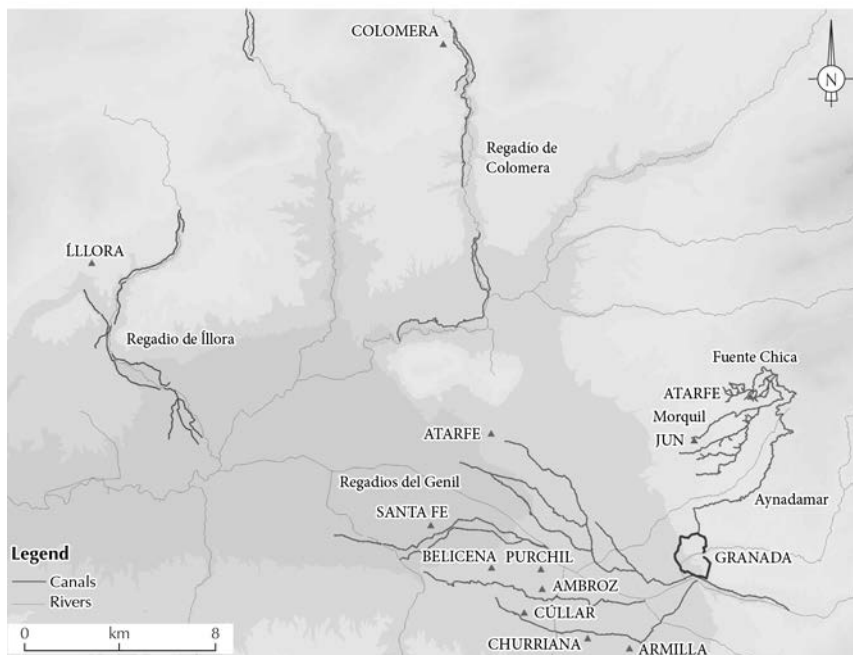


Fig. 2. Main canals of Los Montes area mentioned in this paper and main settlements attached to the irrigation systems.

on a consistent basis. It is likely that aspects like the high salt concentration, the proximity to the capital Granada and the direct path to Málaga played an essential role in deciding the establishment of new settlements.

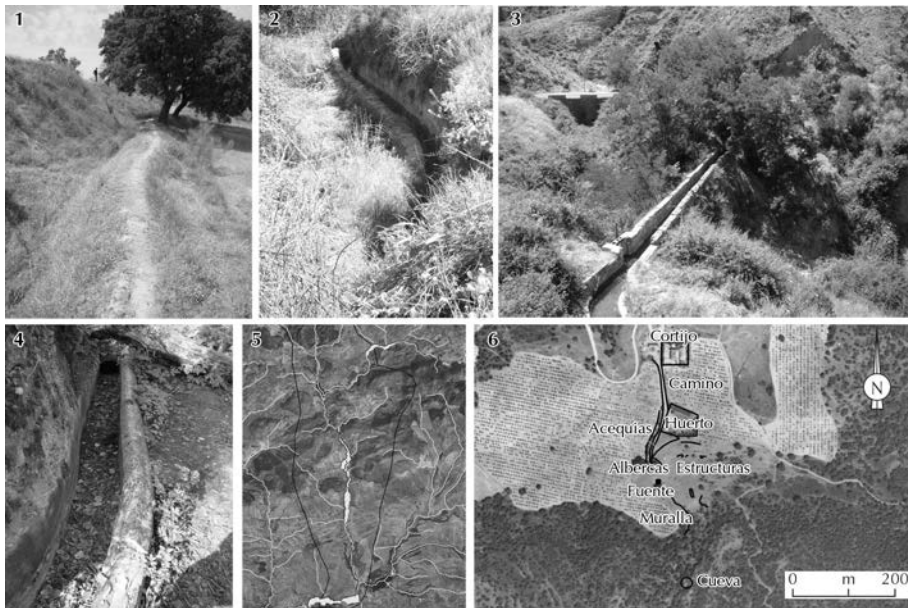
### ***Irrigated Agriculture***

The use of irrigation systems during the Middle Ages has been thoroughly explained by many scholars (WATSON, 1983; BARCELÓ, 1989; MALPICA CUELLO, 1997). The settling down of new populations, together with the introduction of new species, usually resulted in profound environmental changes, especially when irrigated agriculture was used. The particular case of the *Vega* is a good example of this type of environmental transformation. However, this change was gradual, and only a few irrigated systems were constructed immediately after the Muslim conquest, unlike in other areas of al-Andalus. Until the 11<sup>th</sup> or the 12<sup>th</sup> c., most settlements in this area seem to have been founded on hills and foothills without any irrigation systems. One example is the *Castillejo de Nívar* (JIMÉNEZ PUERTAS *et alii*, 2009). Nevertheless, smaller irrigation systems may have been developed at a smaller scale prior to the 12<sup>th</sup> c., but more research needs to be done in this regard. In fact, some traces of irrigation systems have been found around Granada as well, illustrating the attempt of the colonists to transform nature in the same way they had done in their homelands. Examples are *Medina Elvira*, the capital of the *cora* until the 11<sup>th</sup> century, with a *qanat*-based system of water extraction; *Llanos de Silva* and *Caparacena*, settlements by the riverside, fitted with small canals; and finally, *Frontil*, near *Loja*, where water was collected in a reservoir.

This development seems to have been taking place quite slowly, and it is important to notice that most of the written evidence available today dates from the Late Middle Ages, when there was already a complex irrigation network in place and the landscape had been entirely transformed. An important part of the system reached the city of Granada (founded in the 11<sup>th</sup> century), with canals such as *Aynadamar*, *Axares*, *Romayla* and the Royal Canal of the *Alhambra*. The construction of these facilities is thought to have been carried out by the authorities, with the aim of creating a large production area to supply the needs of the city, although probably with the concurrency of rural and urban communities.

Another example of the changes that were taking place in rural areas can be seen around the village of Alfacar, where a system of three canals withdrew water from three springs. The first one, *Aynadamar*, supplied mainly the town of Granada and the periurban orchards; the second, *Morquíl*, was exploited to irrigate the lands around the village of *Jun*; and the third, the *Fuente Chica*, which was the smallest one, and it provided water for Alfacar only. The different communities probably came to an agreement in order to establish a system that allowed the largest possible area to be cultivated.

In the *Vega*, the irrigation system was extended after the Middle Ages, but this is not the case of *Los Montes* (fig. 2). The village of Íllora is a good example of this as there was no more space for further construction, as the most fertile lands were



**Fig. 3.** Different canals within the study area showing the different construction as well as the different size of the irrigation area.

1. Canal of Morquíl. 2. Canal near Íllora. 3. Canal of Aynadamar, bridge near Alfacar. 4. Royal Canal of the Alhambra. 5. Irrigation areas (depicted over the aerial photography) in the Colomera Valley. 6. Irrigation area in *alquería de Pera* (with all elements surrounding the canal: spring, water tanks, orchards and so on).

irrigated from the very beginning. The total extension of the irrigated lands mentioned in 16<sup>th</sup> c. records remained unchanged until at least the late 18<sup>th</sup> century.

From all of these examples, it becomes apparent that major changes occurred in al-Andalus during the Late Middle Ages, when inhabitants took the most from the natural resources (fig. 3). Regardless of their size, all of these systems follow the same pattern: Firstly, it is necessary to take the water from a river or a spring, and therefore to divert the watercourse (at least partially) into one or several canals. Secondly, the fields to be irrigated needed to be prepared. Thirdly, water-sharing plans must be drawn up. All of these decisions must be made at the time of designing the system (BARCELÓ, 1989). Other aspects to be considered include soil quality, existence of previous settlements, availability of grazing areas and so forth. In fact, the growth of settlements and the emergence of tracks and pathways often go along with the development of irrigation systems. The landscape is therefore transformed continuously, although it is a slow and gradual change.

### **Dryland Farming**

At the other end of the *Quempe*, in the only mountain range in the area, we can find *Alquería de Pera*, a small settlement in which environmental conditions are quite distinct, as temperatures are lower, vegetation is wild and there is no



watercourse. However, a few metres away from the housing ruins, a water mining facility has been found, linked to several hydraulic structures forming a very small irrigation system. It is likely that this place was chosen in order to exploit the drylands and the resources of the mountains, as well as to take advantage of the connection between Málaga and Granada.

A similar pattern can be observed in los *Llanos de Silva*, in the area of *Los Montes*. It is located in the foothills that give access to the Valley of the *Colomera* river. The main production activities seem to have been dryland agriculture and animal husbandry. However, a modest irrigated area has also been documented, and it seems to have been planned at the very beginning of the settlement. The site has been dated to the 9<sup>th</sup> or the 10<sup>th</sup> c., according to the surface remains. If this is to be accepted it may be surmised that the transformations increase in complexity over time, which suggests an increasing pressure by the authorities who were eager to raise revenue.

## Conclusions

The case studies briefly presented here are examples of the effect of human activity on landscape change, but resulting transformations are not uniform, neither in time nor in space. On the one hand rather than being an insurmountable obstacle, harsh environmental conditions may have furthered the emergence of new economic systems in certain regions. On the other hand, the transformation may have been greater during the late Middle Ages, when population growth, Arabization, State pressure on rural communities and market development were most evident. Thus, we assume that there was an adaptation to the environment to a greater extent in the early stages of the occupation, when some of the new populations chose the perfect place to settle given the variables offered by the environment.

In conclusion, research should be continued in this line, though a lot of other data that has not been developed into in this contribution should be produced for a broader interpretation of the landscape. This effort should be focused on the collection of environmental data, since there is almost no evidence of vegetation, soil and climate from the Middle Ages. Animal husbandry should also be investigated more deeply. Evidence of it can be found in all areas to a greater or lesser extent, although it has proven very difficult to determine to which degree it contributes to landscape change, as shepherds adapt very readily to evolving natural conditions and to the needs of their livestock.

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## VARIABILITÉS ENVIRONNEMENTALES, MUTATIONS SOCIALES

### *Nature, intensités, échelles et temporalités des changements*

*Sous la direction de Frédérique Bertoncello et Frank Braemer*

La perception des interactions entre les facteurs naturels et anthropiques sur l'évolution des environnements et des sociétés est une préoccupation majeure de la communauté scientifique, au croisement des sciences de la Terre, de l'Environnement et de la Société. La question centrale est celle de l'impact respectif des processus naturels (climatiques essentiellement) et anthropiques dans les dynamiques sociales et environnementales, que l'on peut désormais restituer avec de plus en plus de finesse. Pour dépasser les interprétations déterministes et mécanistes qui recherchent des relations directes de causes à effets, et envisager les relations sociétés-milieux dans la perspective d'un système en co-évolution, il est nécessaire de proposer des modèles de représentation et d'interprétation de plus en plus nuancés et adaptés à la variabilité des situations étudiées et des fonctionnements régionaux des géosystèmes et des anthroposystèmes. Cela passe par la mobilisation de données hétérogènes (climatiques, paléoenvironnementales, archéologiques, historiques...), souvent lacunaires, de résolutions chronologiques et spatiales variées et différents degrés de précision. De même, les effets des changements climatiques et des actions anthropiques sur les environnements et les sociétés ne se manifestent pas avec la même intensité, selon les mêmes rythmes ni les mêmes échelles. Pour confronter, dans l'espace et dans le temps, des dynamiques environnementales et sociales, des outils méthodologiques permettant de mesurer et de modéliser le changement commencent à être élaborés.

Ce sont ces questions de nature, d'intensité, de seuils, d'échelles et de temporalité des impacts climatiques et anthropiques, principaux enjeux de la modélisation des dynamiques socio-environnementales, qui ont été explorées au cours de ce colloque.

Our perception of the interactions between natural and human factors on environmental and social dynamics is a major concern of the scientific community at the crossing of Earth, Environmental and Social Sciences. The central question is the relative impact of natural (mainly climatic) and human processes on the evolution of ancient environments and societies, which we can now perceive with more accuracy. In order to go beyond mechanical and deterministic interpretations seeking direct causal links, and to consider on the contrary human-nature interactions in a co-evolutive perspective, it is necessary to propose finely-tuned models adapted to the regional diversity of the geosystems and anthroposystems. This implies to mobilise heterogeneous data (climatic, palaeoenvironmental, archaeological, historical...), often incomplete, with various chronological and spatial resolutions and degrees of accuracy. Moreover, the intensity, rhythm and scale of the impacts of climatic changes and human activities on the environments and societies can differ greatly. New methods and tools allow change measurement and modelling in order to compare environmental and social dynamics, in space and time. This conference aimed to investigate these questions of nature, intensity, threshold, scale and temporality of the climatic and social impacts, key issues in the modelling of socio-environmental dynamics.

