

## **Introduction**

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# **Water and Agriculture: Venice, Holland and European Land Reclamation**

## **Water within the Man-Made Environment**

This book is the fruit of many years of research, with an initial interest in the agriculture and fluvial system of Venice and its mainland Republic gradually expanding into a study of hydrological management in other areas of Italy and Europe (with particular emphasis on France, Holland and Germany).

In recent years there has been enormous growth in attention to all the various aspects of water as a natural resource, not only with regard to agricultural uses (one of the key concerns behind the irrigation and drainage policies that form a fundamental part of this book), but also with regard to the environment in general. Innumerable publications and conferences have been dedicated to questions as diverse as urban water supplies, water-powered machines, the professions and trades linked with water, water as a source of energy, the science of hydraulics, the role of water in health and personal hygiene, and even the psychological perception of water in the human consciousness. Though the range of contributions to such discussions, at both a European and international level, might give the impression that the area dealt with in this book is excessively restricted, I have maintained the focus within this revised English version on agriculture and economic questions in general, taking the view that the issues of irrigation, land reclamation and the exploitation of water by manufacturing industries are of fundamental importance. True, there is often the tendency to see such manufacturing uses as limited to pre-industrial economies; but to see the dangerous generalisation behind such a notion one simply has to recall the serious environmental threat

posed when, in the torrid summer of 2003, the water coolant in French nuclear power stations began to reach temperatures of 40° or 50°C.

As already mentioned, the starting-point – and the constant term of comparison – for this study of water management within Europe is Venice and its mainland territories. As the research of recent years has so clearly demonstrated, Venice provides a particularly rich example of the use of water not only for irrigation but also as a resource for manufacturing industries; in effect, one might say that in both the Veneto itself and the Lombardy areas it was this exploitation of water which laid the basis for the agricultural and economic development of the area over the last few decades of the twentieth century.

A full analysis of this role obviously requires even fuller study of the complex history of the region, so there is a lot more research to do, particularly with regard to comparative studies of irrigation within the Mediterranean basin.

One area that certainly requires fuller study is that of the *regadío* in Spain, where water played a key role in a number of dry regions which were practically forced to opt for extensive land-use since – unlike the fertile Valencia, for example – they were unable to establish *huertas* and citrus fruit orchards. As Macías Hernández's study of the Canary Islands has illustrated, water would also play a key role in the development of the Atlantic economy and modern colonialism: on the Canaries themselves, it was essential to the establishment of a plant that is almost synonymous with early colonialism – sugar cane – and hence became part of a network of international interests (not least amongst which were those of Italian investment capital). In effect, within this very specific habitat water became the key determinant of social and economic hierarchies, a commodity that generated a market which existed parallel to – and independent of – the land market. The distortions in the management of agricultural concerns which resulted from this state of affairs were to have clear social and economic consequences: in various areas of the Mediterranean – in Spain at Alicante, Elche and Novelda; in Sicily at Palermo<sup>1</sup> – the existence of water as a distinct market commodity could lead to the economic value of this natural resource actually outstripping that of land itself. Those who merely owned land but did not control supplies of water were pushed to sidelines of the

economic hierarchy and practically excluded from the processes of production, with the inevitable result that they were quickly forced to cede their property to those who could more profitably exploit it.<sup>2</sup>

Be they of Arab creation or dug as part of the reform-driven push towards rapid modernisation in the eighteenth-century,<sup>3</sup> drainage and irrigation canals played no less important a role within Spain itself, even if the full extent of their influence on the social and economic development of the country still requires study in greater depth. In such arid areas as the Iberian peninsula or the southern regions of Italy, irrigation was of dramatic effect; but even within the Venetian Republic its advent served to mark the beginning of an 'agricultural revolution' or – if one considers such terms as 'revolution' to be both misleading and excessively theoretical – made it possible to start tackling previous inadequacies in development. As has been so clearly illustrated by the likes of Kerridge and Morineau (in his *Faux-semblants d'un démarrage économique*, Paris, 1971), this eighteenth-century 'revolution' in agriculture was not as straightforward as it may seem, and still requires careful analysis. However, for all these reservations, it undeniably opened the way to agricultural progress during the course of the century. Not only in Venice but also in France and other areas of Europe, it was only through these changes in technology, social organisation and methods of production that one could break free from an 'under-nourishment trap' within which agricultural productivity was barely sufficient to feed the rural and urban populations, who during the course of the eighteenth century were slowly recovering from the demographic stagnation of the seventeenth.

A comparison with neighbouring Lombardy is an essential benchmark for understanding what was happening in the Venetian Republic, even if in this period – from the sixteenth to eighteenth centuries – Lombardy itself hardly enjoyed the levels of agricultural productivity and crop yields that one sees in the areas of north-eastern Europe. However, whilst such international comparisons help us understand the role of water in the different economies of the continent, they should not be made without due account being taken of the specific characteristics of each individual context, where the differences in national or regional agricultures are to be seen not only in the size and degree of specialisation in peasant farms, but also in the social classes that played a role in the transformation of

agriculture (be they *métayers* and *dessicateurs* in France, commoners and undertakers in England, or *Polder-Fürsten* and *Fehntjer* in Germany). Whilst the research in this book is profoundly influenced by the comparative approach championed by Braudel and the French school of historiography, I am also convinced that it is only through detailed study of individual regions that one can bring out the full nature of the transformations that took place within the various states of Europe and the achievements that resulted from them. When faced with water as a threat and peril, or as positive resource to be used in irrigation and the generation of power, the regions of Europe reacted differently; and those differences – the result of a mix of social, institutional and mental factors – can only be understood from the ‘inside’, by illustrating the distinctive features of each regional or national context.

## **Water Use within the Venetian Republic**

There is no doubt that developments in land drainage and irrigation not only played a key role in the recovery and cultivation of agricultural land, but also represent one of the essential ways in which mankind has exploited water as a resource. Put to such use, water not only increased agricultural productivity, it also contributed to the growth of the urban and rural population as well as to the development of manufacturing processes and, thence, industrialisation proper (even then, its role was not entirely taken over by steam-power). As is well known, the notion of the ‘proto-industrial’ implies a specific approach to the question of the original accumulation of capital within the agricultural sector and its subsequent transfer to the industrial; it has even been pointed out that some areas developed as centres of proto-industrial or industrial activity precisely because they were poor in agriculture. However, whilst accepting the value of the proto-industrial as an area of research, I am convinced that development within a society and economy – for example, those of Venice in the crucial period from the sixteenth to the eighteenth century – is to be understood in relation to the transformations and improvements being made in its agriculture.

As I have tried to illustrate in the second chapter of this book, the use of water in the Alpine foothills certainly stimulated proto-industrial activities that had a profound effect upon the subsequent

industrial development of the Veneto mainland: one need only think of the small- and large-scale industrial concerns located in the various foothill valleys of an area that ranges from Bergamo, through Brescia and Vicenza to Friuli. A study of water concessions, especially from the second half of the seventeenth century onwards, reveals the emergence of not only a proto-industrial Veneto but also one in which there were a number of different sub-regional economies (with the differences being due to pedological and orographical factors that had a direct influence on types of settlement and size of agricultural concerns). On the one hand, one sees the emergence of a river-plain agriculture which used water to extend rice fields, irrigate pastures and cultivate arable land; on the other, one sees within the foothill valleys themselves an almost spontaneous focus on subsistence agriculture and on manufacturing activities that exploited the abundant supplies of timber, wood, coal and hydraulic power.

Even viewed within the context of Europe as a whole, the series of water concessions granted by Venice's *Provveditori ai Beni Inculti* [Office for Uncultivated Natural Resources] provides us with a remarkably rich source of information; the detailed accounts of which areas of land were irrigated provides a very full picture of agricultural conditions within the Veneto and of the wide range of uses to which water resources were being put. This detailed information has made it possible to trace trends which developed over centuries, putting forward possible interpretations and drawing up tables that chart the developments in the use of rice fields, pasture, arable land, market gardening, mills and other machinery powered by water. For all its incompleteness, the picture that emerges from these fiscal documents provides a useful account of a very complex situation.

The scale of water-use by the manufacturing activities within Venice itself confirms not only the city's expansion during the sixteenth century but also underlines the importance of land reclamation, which historians of the Republic have long stressed. Figures reveal the clear existence of a depression of the seventeenth century; but they also show that the crisis which loomed in the second half of that century was largely avoided. This picture bears out the conclusions reached by more recent historians, both in Italy and elsewhere, that the seventeenth century should perhaps be seen as more than simply the 'century of crisis', given its real contribution to the reorganisation of urban, regional and rural economies.

Undoubtedly, the crisis, as noted in the cities of the late sixteenth century, did lead to a focus on extra-urban territory, where the populations of the countryside or of small to medium-sized towns could provide labour at costs lower than those imposed by powerful city guilds. Hence, the crisis of the seventeenth century might be read as the reorganisation/redistribution of an urban economy throughout an entire region. Certainly, one example of this process can be seen in Venice, which, during the sixteenth century, had enjoyed the status of a 'world-economy' but now saw a clear drop in its standing not only within the international economy but also within the more restricted context of its own mainland State.

Still, even if stagnation in the first half of the seventeenth century was followed in the second half by the redistribution of productive activity that accompanied a slight up-turn in the economy, there is no denying that the really extraordinary achievements, in terms both of capital investment and technological innovation, had come in the sixteenth century.

In the case of the Venetian Republic, land reclamation was seen as playing an essential role in the recovery of new terrain; and such schemes would be all the more incisive if they were carried out not by individuals within single estates but envisaged within the framework provided by an articulated network of canals (as had been the case in Lombardy since the Middle Ages). The results achieved are clear in the observations and comments left by travellers and agronomists, especially in the eighteenth century – think, for example, of Arthur Young or Jérôme de la Lande. However, having described the great number of small and large waterways which cut across the plain of the Veneto and complement the economic role of such rivers as the Adige or the Brenta – providing both transportation for goods and irrigation for land and rice fields – these same observers, whose impartiality there is no reason to doubt, then immediately make mention of the denser network of canals and channels within Lombardy, some of which dated from as early as the twelfth century.

An even more striking contrast is with the hydrographical system of Holland, where the system of canals was not only fully exploited along capitalistic lines to provide transport for goods and passengers, but was also closely interwoven with an equally rational and modern network of urban development. In the Veneto, the waterways

provided a system of transport that was of nowhere near the same scale or economic significance, for all that numerous watercourses in the region were put to use. More recent studies have explored various aspects of the rivers of the Veneto – the Brenta, the Brentella (which runs off the Piave in the Treviso area), the Battaglia canal in the Padua area, the Sile, and the whole system of rivers linked with the Venetian lagoon (the Adige is the river that has perhaps attracted most attention from historians of the Venetian Republic)<sup>4</sup>. The overall picture which emerges is one of a Veneto where economic practices were much more conservative and limited than in the more dynamic, aggressively capitalistic Holland.

In effect, what Venice was lacking was an agriculture that fully exploited its water resources to boost fodder production, increase herd size and thus achieve higher agricultural yields. For example, comparison with the Waas region of western Flanders – which English travellers of the eighteenth century cited as the most fertile area in Europe – is hardly flattering for the Venetian Republic (even though, to be fair, it should be pointed out that Lombardy itself, the Italian region which enjoyed the highest levels of investment and yield, would not fare much better in such a comparison). Obviously climate played a part here, with the high rainfall of the Waas, as of many other regions in northern Europe, making livestock herds more profitable and increasing levels of agricultural production. What is more, such achievements must also be seen in relation to how the property was run, the level of investment in it, and the types of contract enjoyed by farmers. It would be a mistake to see everything in terms of 'capitalist investment' and ignore those forms of high-intensity labour that were as essential in the *land van Waas* as they were elsewhere. However, having made those caveats, one cannot deny that historical analysis of agricultural development in the Venetian Republic, and its links with projects of irrigation and drainage, reveal how this area lagged behind the standards of agricultural progress being achieved in the heart of Western Europe: in Holland, Flanders, England, and northern France.

The limits that explain and the characteristics that define this 'shortfall' have long been described by a number of historians – most significantly, by Marino Berengo, Daniele Beltrami, and Ruggiero Romano – and their theses are borne out by the detailed research offered in this book. However, the overall picture that emerges is not

one of outright catastrophe or of irreversible decline from the sixteenth to the seventeenth century. True, the expansion in irrigation and in the areas of rice cultivation that had continued during the sixteenth century ground to a halt in the first decades of the seventeenth. But it is also true that there was an upturn in the areas of rice fields and irrigated pasture-land in the second half of the century, with this positive trend being further consolidated from the 1730s onwards (something which can also be seen in many other areas of Europe). As has already been pointed out, research seems to confirm this revaluation of the last decades of the seventeenth century, to some extent qualifying all those interpretations that stress solely the expansion of the eighteenth (often more quantitative than qualitative). As in Morineau's analysis (Paris, 1971) of the situation in France, there seems to have been an undoubted increase in production, which went to maintain a concomitant increase in population<sup>5</sup>; but in the Veneto there was also insufficient expansion of irrigated pasture and fodder production, with no development at all in livestock breeding or in agronomic techniques. In effect, entrepreneurial initiative in the countryside seems to have been weak.

Eighteenth-century land reclamation is itself not a story of continual successes. In fact, as one proceeds from the sixteenth to the eighteenth century, the picture becomes less and less encouraging overall. From the point of view of quantity, the data gathered in this book suggests that one should not underestimate the amount of syndicate land reclaimed through drainage from the sixteenth century onwards; such operations never came to a complete stop, and would themselves enjoy an upturn in the seventeenth/eighteenth century. However, the decline of these syndicates – their debts, the conflict within them and the relations of production they implied – meant that the picture for the eighteenth century is far from being one of rapid consolidation: the finances and administration of these consortia were in the hands of a class that was either incapable of or indifferent to meeting the challenges posed by water resources and watercourses which in the Veneto – as in other countries of Europe – were never fully tamed and subjugated.

Reconciling the demands of the lagoon and its port with those of the mainland was an even more delicate affair. It would seem to be the case that perfect balance between these two components of a



complex hydro-geological system would not be achieved until after the end of the Republic: in the nineteenth and twentieth centuries, not only had the terms of the problem changed, but so had the relation between Venice and the mainland. The period of Austrian rule is, therefore, very important here, as is the predominance of agricultural – and later, industrial – interests over those commercial considerations that had always been of paramount importance for the Republic<sup>6</sup>; though, of course, one cannot deny the decline that would take place during the course of the nineteenth century, or the grave consequences of industrial development on the mainland areas of the lagoon in the twentieth. With regard to this latter point, however, I would argue that whilst Venetian patricians must, right up to the fall of the Republic, be given full credit for their far-sighted policy concerning the protection of the lagoon, this policy is revealed to be far less laudable when one looks at the problems and environmental instability that continued to exist just beyond the shores of the lagoon throughout the eighteenth century.

Perhaps the champions of Venice's achievements as a *civilisation d'eau* might reply that focus on these failures is excessive; however, whilst archive sources amply document the successes achieved in the arduous task of maintaining a stable relationship between land and water, one should not forget the technological difficulties encountered during the seventeenth and eighteenth centuries. This was the period in which the Dutch would establish their supremacy in the field throughout Europe, whilst Italian hydraulics – which all agree laid the basis for modern hydrostatics – were overtaken by the more advanced research being carried out in France. As in other areas of social or economic life, the absence within Italy of a unifying centre such as Paris or London had a detrimental effect upon the financing and organisation of science. Limited financial resources would have a constrictive effect even on the cultural policies of such States as the Venetian Republic and Tuscany, which had a long-standing tradition of intellectual research (in the Veneto, the continuing openness of cities such as Venice, Padua and Verona to outside influence and input does not seem to have made much difference). The final verdict with regard to the effective place of Italian science within the Europe of the day thus becomes a very delicate one. Though cultural exchange and the reading of scientific papers continued to maintain a link between the old Italian States

and the major international centres of research, one cannot deny the diminishing importance of Italian scientists in general; it was the more ambitious cultural policies being pursued outside Italy that were generating dynamic research. However, having said that, it is also true that these centuries saw the continuation of a fascinating historical and scientific tradition, within which eighteenth-century scientists like Giovanni Poleni and Simone Stratico find a place alongside fifteenth/sixteenth-century technicians Marco Cornaro and Cristoforo Sabbadino, and such late-seventeenth/early-eighteenth-century figures as Domenico Guglielmi and Bernardino Zendrini. Figures of some importance, none of whom should be seen as lagging behind the forefront of European research into the 'science of water'.

### **Holland and Venice: *civilisations d'eau***

The starting-point for this work was my collaboration on the extensive research project behind the *Storia della Cultura Veneta*<sup>7</sup> (indeed, the essays I contributed to it were subsequently incorporated within this book). However, other – no less stimulating – works played a part in the later chapters. I am indebted to Ruggiero Romano for his insistence that one cannot understand the problems of the Venetian lagoon and water management on the terra firma unless one looks at Holland. In effect, it is only by looking at what this relatively small nation achieved in the fields of territorial planning – and the use of water resources therein – that one can understand the original, even if less influential, achievements of the Venetian *civilisation d'eau*.

There can be no doubt that, from the Middle Ages onwards, these were the two regions most intensely involved in the struggle with and regulation of inland and coastal waters. For the Dutch, the raising of *terpen* (mounds on which the population could take refuge during floods) and the building of dikes (initially as river embankments, rather than as a means of reclaiming land for agriculture) were measures predicated on the simple need to survive – just as the fortunes of Venice would have been unthinkable without measures to control the flow of the rivers into the lagoon and protect inhabited islands against the tides of the Adriatic. More than any other European nations, these two States reveal a profound link with water throughout their history, and thus fully merit definition as *civilisations d'eau*.

It seems to have been the case that, from both a technological and institutional point of view, during the Middle Ages it was *civitas Venetiarum* that was more efficient than the Low Countries in dealing with the problems posed by water; this superiority appears particularly marked when one looks at the northern Low Countries, where Amsterdam was far from playing the fundamental role it would have in the seventeenth and eighteenth century. Nevertheless, one must look at the history of this medieval period – as recounted in the works of Fockema Andreae, Korthals Altes, Beekman, van der Linden and Verhulst – if one wants to grasp the original nature of what was happening in the Low Countries from the eleventh century onwards. The first question that comes to mind is why the peoples from the German interior should even have thought of settling in an area of wind-blown marshland which was exposed to frequent flooding by both river and sea (primarily the former). The answer, as offered by van der Linden (1984), starts from considerations of geography to then include questions of social history: in effect, the various populations coalesced into a settled nation precisely because they had to face a common enemy, water. However, another no less influential circumstance was that the feudal lords of the region (the Counts of Holland, above all) were so intent on settling these areas that they granted greater freedom to the settlers, who thus formed closely-bound communities that enjoyed a much higher degree of liberty than the rural populations of Germany. Throughout Dutch history one would see shared community values prevailing over the conflictual tendencies and the urge to domination that would – under a veneer of paternalism – become characteristics of the Venetian Republic.

A second difference between the two States would come in the seventeenth century, when Venice's balance of trade took a downturn and that of the Republic of the Seven United Provinces improved. In such a situation, when Venice was playing a more and more marginal role in the international economy, it was perhaps inevitable – or at least understandable, from a strategic point of view – that the State and its ruling class should fall back upon social and economic conservatism. Here, the existence of an extensive but weakly-organised workforce within the countryside also worked to the advantage of the Venetian patricians, who within the expanding agricultural concerns of their country estates could impose the pay and conditions that suited them.

On the other hand, the international situation of the Low Countries during the course of the seventeenth century was much more auspicious. Being able to count on the grain from the Baltic, Dutch agricultural entrepreneurs could focus on more remunerative specialist crops and on the raising of dairy herds. This extension of farmland, together with the exercise of efficient hydro-geological control of territory, was to play a key role in laying the basis for Holland's status as a 'world economy'. Dutch historians have spoken here of a 'mud-based industry' to describe the growing number of patents and technical improvements involving the various components of the windmill (waterwheels, Archimedes' screw, sails, rotating blade mounts, internal mechanisms) which were an essential feature of the 'Golden Age' enjoyed by seventeenth-century Holland, when the nation established its superiority not only in comparison to Venice but also to most other European States.<sup>8</sup>

One can also see a difference between Holland and Venice in the very approach taken to the infinite problems posed by water: whilst in the latter – as in the other States of Italy – there was lively interest in the scientific and theoretical problems posed by hydraulics, the Dutch approach was much more practical, focusing on the construction of hydraulic structures and machinery, and the digging of canals, rather than the publication of learned memoranda or theoretical studies concerning the movement or nature of water. Not that Holland was lacking in lively debates of ideas regarding practical questions – see, for example, the various projects put forward for the drainage of the famous Harlemmermeer in the first decades of the seventeenth century – but the broad picture which emerges is still that of a practical approach to the age-old questions raised by the relationship between man and water. The inconclusive theoretical debates that absorbed ever more energy and time within the Venetian Republic were largely avoided. The end result was the creation of an agrarian landscape that has become the very symbol of the country: a geometrical network of canals and dikes, a constellation of windmills whose power is put to the most varied uses, and massive sea-walls. These latter can serve as protection against even the most violent seas – think, for example of the Deltawerk along the coast of Zeeland – and also help to regulate the flow of rivers into the seas; through a skilful mix of hydraulic science

and chemistry, they can even play a direct role in agriculture, being used to control the saline content of soil.

During the course of the sixteenth and seventeenth centuries, clashes between vested interests, and differences with regard to the technological solutions to be adopted, did not prevent the *Serenissima* from protecting the key to its own power: the port of Venice and its lagoon. However, by the following century, government indecision, disputes and increasingly limited funds resulted in an inability to completely dominate a unique and highly-delicate hydro-geographical system. Though occurring in different periods, the case of the Brenta at the end of the eighteenth century – when interminable discussions as to the project to be adopted at a key section of the river ultimately came to nothing – and the endless debate within modern-day Venice regarding the use of mobile sea defences, both seem to me to indicate the degree to which Venice has slipped from its former pre-eminence in such fields.

Nevertheless, to some extent the economic and agricultural situation within the two Republics would develop in a similar fashion; and for at least part of the eighteenth century, tendencies within them seemed to have run parallel. In effect, the sharp distinction that historians usually draw between a *rentier* patrician class in Venice and an entrepreneurial class in the Dutch countryside would seem to have become more attenuated in the economic crisis of the eighteenth century. In both cases, there was a fall back on land rents; from the end of the seventeenth century, both the *regenten* and the urban elites in Holland reveal the same tendency to 'live off' rather than 'invest in' the countryside, when – together with the drop in agricultural profits – the fall in the price of grain and, to a lesser extent, that of dairy products led to a reluctance to invest further in undertakings such as land reclamation, which had once been profitable but had now become more risky. As in Venice, the capital that had formerly been invested in agriculture was now channelled into other areas of the economy (though the actual route it took has yet to be fully identified). At the same time, both States were meeting the need to replace their wooden sea defences with stone structures; and here they were helped by the fact that the situation within the agricultural sector towards the end of the eighteenth century seemed much more encouraging.

## **Political, Socio-Economic and Environmental Factors**

Though parallels emerge in a direct comparison of the two Republics, the contrast between them becomes abundantly clear when one looks at them in the wider context of Europe as a whole, where the influence of Dutch technicians was decisive. The role of such figures in water management and land-reclamation projects throughout Europe is a significant complement to achievements within Holland.

The Dutch influence was not only at the level of capital investment and technology (its engineers being much appreciated throughout Europe); it also made itself felt through successful waves of migration and settlement from the Middle Ages onwards. These were a response to population increase (within Flanders or the northern Low Countries), to religious persecution at home, or perhaps explicit invitations from princes or States for settlers to come and farm previously uncultivated land. As an eighteenth-century French source argued, who better than the Dutch to carry out work for which they were renowned: the tough job of reclaiming marshy or swampy terrain?

Such colonisation and settlement went together with the exploitation of peat deposits, which were particularly rich in northern Europe and themselves attracted investment of urban capital. The result there was poor-standard agriculture that went hand-in-hand with peat-digging. This latter activity, both in Holland and in the regions of northern Germany, was controlled by private companies; but behind this capitalist organisation of investment one glimpses a particularly grim social situation, with what is at times outright exploitation of these very special kinds of farmer/labourers.

Another area on which this book aims to throw light is the relation between private capital and the State in the history of European land reclamation. There is no doubt that during the Dutch 'Golden Age' private companies were the main source for channelling capital towards the drainage of marshy areas, both within Holland itself and elsewhere in Europe. However, according to Thurkow (1990), even in Holland the State played no irrelevant role in furthering land-reclamation projects; in fact, when there was a downturn in the economy and speculative capital began to lose interest in drainage

projects, the State's role increased in inverse proportion to that of private investors.

And within German principalities, the range of action of the State was no less extensive, even if – especially when economic conditions were favourable – private companies also played a role that can hardly be dismissed as secondary. Obviously, like the nation itself at the time, the history of land reclamation and drainage within Germany presents us with a composite picture. Whilst the rulers and local lords of the North Sea coasts (the *Polder-Fürsten*) appear to have been more open to market forces and to have encouraged the influx of foreign investors and technicians, the Hohenzollerns of Prussia – and the political class that worked under them – intervened much more directly in the processes of settlement and land reclamation. And Bavaria, in the south, seems to have followed a policy that lies halfway between the two. However, this point requires further research; German historians do not seem to be as interested in these questions as they might be.

Historical geographers, on the other hand, have made a great contribution to the study of the questions of land drainage, soil fertility and the reclamation of previously under-used terrain. And it is the questions they raise – together with those that come within the scope of ecology and climatology – which historians should address in their own research. This is no less true with regard to France, where geographers such as Vidal de la Blache, Numa Broc and Paul Wagret – together with the more regionally-focused Pierre George, Paul Masson, J.A. Barral – have for some time been producing abundant material for further reflection. However, economic history has not always taken full advantage of this, revealing itself to be rather sketchy in its judgements (and even knowledge) of the numerous inland and coastal marshy areas of France that were the subject of an enormous number of publications during the course of the eighteenth century. It seems that more in-depth archive research focused on individual areas – such as that carried out by Jean-Laurent Rosenthal, Jean-Michel Derex, Patrick Fournier and others – will make a fundamental contribution to our knowledge of the history of French agriculture and the French economy. As for the latter, whilst it may have drawn on Dutch capital and enterprise at the beginning of the seventeenth century, it is also true that by the end of that century it was following an exclusively national course,

which was however detrimental to agricultural development as a whole. In effect, France ultimately revealed a regional individualism and levels of local conflict that would hinder many projects involving irrigation, navigable waterways and land reclamation.

The situation in England alone could be taken as the testing-ground for the theoretical premises put forward in this book – that is, the thesis that the reclamation of marshy or under-used land, as well as the irrigation of terrain suitable for improvement, was one of the most important ways in which capitalism penetrated into the countryside (quite as important as the much-discussed question of ‘enclosures’). In England, the social problems latent in any speculative process of land reclamation might find violent expression. Popular revolt, the breaking of dikes, a clash of both ideology and agronomy that found an echo in the debates of Parliament – all of these would turn out to be thorns in the side of the various companies concerned (initially made up of Dutch investors, these later brought together the various social classes – City, financiers and merchants, large landowners, courtiers and the monarchy itself – who wanted to put an end to subsistence agriculture managed at a communal level).

Another point to be mentioned is how economic and agricultural progress throughout Europe brought with it a desire for a new equilibrium between man and his environment, first and foremost in terms of health and hygiene. Local authorities were continually pressuring central government to drain swampy marshland that was a source of malaria and other diseases; although such schemes did not always prove as effective as was hoped. This is an aspect of the question of water management that is not dealt with very extensively in this book, so one can understand the criticism that it is rather naive to praise the economic progress brought about by land reclamation whilst ignoring its not always positive environmental results.<sup>9</sup> In effect, a hydro-geological scheme always results in an at least partial modification of a given environment; and technical solutions favoured in one period – for example, the towpaths built along the Loire in the sixteenth century, or the various diversion cuts (*diversivi*) created in the Veneto in the seventeenth and eighteenth centuries – may turn out later to be either inadequate or positively harmful.

Returning to France, there is another question that the authorities had to face in the eighteenth century: land reclamation might led to



the recovery of extensive tracts of land, but it also destroyed the livelihood of the hunters and fisherman who lived in those marshy areas, earning more than simple peasants (and thus very reluctant to start working the land). This may be true, but the fact of the matter is that agricultural interests – and policies aimed at eliminating areas that were frequently breeding-grounds of malaria – would over the centuries reveal themselves to have a far from indifferent political and economic influence. Ultimately, their advantages outweighed their drawbacks. And while questions of environmental preservation – the maintenance of the hydro-geological features of a specific natural habitat – have in recent years become a very urgent issue, there is no doubt that in the Early Modern period they were viewed very differently. What is more, whilst the safeguarding of such an environmental equilibrium requires the adoption of ever more advanced techniques and technology, it can also result in a veritable situation of deadlock. It is perhaps significant here that by the end of the eighteenth century Dutch windmills – along with the technology they employed – were revealing their limits in dealing with the increasingly unmanageable hydraulic situations to be found in many areas of Europe. A perfect example of that technological ‘impasse’ which Braudel (1992) also identifies in contemporary technology.

## Notes

1. Glick, *Irrigation and Society in Medieval Valencia*, pp. 12–13; H. Bresc, ‘Les jardins de Palerme (1290–1460)’, p. 60: water here is private property, alienated ‘à perpétuité et dont les propriétaires louent chaque année l’usage’ [in perpetuity, with landowners paying annual hire for its use].
2. Macías Hernández, ‘Les Îles Canaries, 1480–1525. Irrigation et première colonisation atlantique: le domaine de l’eau’, in *Eau et développement*, Ciriaco ed., pp. 37–48.
3. G. Pérez Sarrión, ‘Hydraulic Policy and Irrigation Works in Spain in the Second Half of Eighteenth-Century’, in *The Journal of European Economic History*, 24 (1995), pp. 131–43.
4. *Il Sile*, A. Bondesan, G. Caniato, D. Gasparini, F. Vallerai and M. Zanetti eds., Verona, 1998; *Il Piave*, A. Bondesan, G. Caniato, F. Vallerai and M. Zanetti eds., Verona, 2000; *Il Brenta*, A. Bondesan, G. Caniato, D. Gasparini, F. Vallerani and M. Zanetti eds., Verona, 2003.
5. Morineau, *Les faux-semblants d’un démarrage économique: agriculture et démographie en France au XVIII<sup>e</sup> siècle*.

6. Ciriaco, 'Le bonifiche venete alla caduta della Repubblica e al tempo di Pietro Paleocapa', pp. 317–40.
7. Idem, 'Scrittori d'idraulica e politica delle acque', in *Storia della cultura veneta. Dal primo Quattrocento al concilio di Trento*, Arnaldi and Pastore Stocchi eds., 3/II, 1980, pp. 491–512; idem 'L'idraulica veneta: scienza, agricoltura e difesa del territorio dalla prima alla seconda rivoluzione scientifica', in *Storia della cultura veneta. Dalla controriforma alla fine della Repubblica. Il Settecento*, Arnaldi and Pastore Stocchi eds., 5/II, 1986, pp. 347–78.
8. Israel, *Dutch Primacy in World Trade, 1585–1740*.
9. Cf. for example, Paolo Squatriti's review in *Technology and Culture*, 41 (2004), pp. 368–70.