

## **Chapter 2**

# **Irrigation and Land Drainage in the Venetian Republic during the Sixteenth and Eighteenth Centuries**

## **Agricultural Development of the Venetian Terra Firma during the Sixteenth Century: The Lombard Provinces**

Various recent studies have cast new light on that process of 're-feudalisation' which occurred during the sixteenth and seventeenth century in Italy and elsewhere when, faced with sluggish trade and manufacturing sectors that were losing in profitability, urban capital 'fell back' upon investment in agriculture. Though an undoubted reality, this phenomenon is not to be seen in purely negative terms, especially when one looks at the general picture of the European – and, particularly, the Venetian – economy around the middle of the sixteenth century. In fact, this re-direction of urban capital was due less to a slackening-off in Venetian trade than to the steady upward trend in cereal and agricultural prices that had begun around 1520 in concomitance with the undoubted demographic growth of the second and third quarter of the century.<sup>1</sup> As Braudel comments 'it was the increase in prices and agricultural profits that drove Venetian capital onto the mainland'; though he also underlines that 'land ownership was not a step towards social elevation; it was only a question of investments and revenues'.<sup>2</sup> The same general point is made with regard to sixteenth- and seventeenth-century Milan by De Maddelena, when he rejects 'the widespread accusations that the countryside of the region had a 'narcotic' effect upon enterprise and capital, drawing them away from profitable investment within the city and thus initiating the socio-economic decline of the Milanese

state'. In effect, in sixteenth-century Lombardy, as in the Venetian Republic of the day, this shift towards the countryside reflected a clearly chosen strategy of the industrial and mercantile 'establishment'.

In Lombardy, the stimulus thus given to agriculture and the organisation of agricultural activity was unique within Europe, while the effects within the Venetian Republic were less remarkable.<sup>3</sup> It is, therefore, important to look at the significance of land reclamation and irrigation projects within the Venetian Republic, asking why the Venetian nobility focused more on the former (land reclamation) than on a modern system for the use of water, which would have resulted in an increase in agricultural productivity. In Lombardy, on the other hand, land reclamation had a much less significant effect upon boosting productivity and earnings than did the spread of irrigated meadows and rice as a crop: as Aymard and Basini comment 'water use in Lombardy was much more productive than it was elsewhere, due both to the level of technology used and, perhaps, to the level of investment'.<sup>4</sup>

In effect, throughout the world, modern agricultural development rests on an increase in irrigated meadow-land and herd size (to supply urban meat markets and provide fertilisation for the soil) and on crop diversity and rotation (to break out of what has been called the 'blocage céréalière'). Of course, higher wheat production would long remain the number-one priority of European agriculture, and there was great reluctance to adopt a revolutionary 'field grass system' such as that which began to be fully operative in England in the sixteenth century; in Lombardy itself – and even more so in Tarello's Brescia – the introduction of fodder into the crop cycle was predicated primarily on the need to increase cereal crop production. Nevertheless, whilst in sixteenth-century France the demand for corn would effectively paralyse the development of livestock herds, in other areas of Europe – fifteenth and sixteenth-century Holland, late-sixteenth-century England, or the Lombardy plain areas of the fifteenth/sixteenth century – there was a marked trend towards an increase in meadow-land and irrigation. For example, from the middle of the sixteenth century to the beginning of the eighteenth, fodder crops in Lombardy increased by 320 per cent, and whilst there was a decrease in areas of permanently-irrigated meadow-land, there was a sizeable increase in cereal/fodder rotation and a clear

improvement in the agricultural techniques used in growing crops.<sup>5</sup> Even the spread of maize as a crop did not undermine the central role of fallow-land in rotation cycles as it occurred at the expense of the less important cereal crops.

In the Venetian Republic development was not so clear-cut. In 1573 the agricultural land owned by the city's nobility in the various areas of the mainland comprised relatively low percentages of meadow-land: 13.2 per cent in the Vicenza area, 6 per cent around Padua and only 3.3 per cent in the Treviso area. Such figures do go up when one looks at the land owned by the actual inhabitants of the terra firma, but even there the maximum is 18.5 per cent in the Vicenza area. The limited quantity of permanent or rotation-cycle meadow-land – whether irrigated or not – meant that the modest-sized herds of the Veneto had to rely for fodder on the neighbouring markets of Ferrara, Mantua and Trento; reference has already been made to the dispute that arose between Verona and Venice in the period 1529–1557 when the former claimed it was incapable of meeting the beef quotas set by the Venetian government. What is more, the fact that share-croppers in the Veneto were not obliged to provide themselves with the necessary livestock (as they were in the Bologna region, for example, where they were granted the right to all the fodder produced on the land they farmed) might well provide another explanation for the scarce interest in expanding fodder crops.<sup>6</sup> Nor should one overlook here the influence of the fact that for a long time Venice was happy to meet part of its beef needs from the well-stocked herds of Hungary, with the result that meat was never in abundant supply and was expensive (both in Venice and on the mainland). According to Vera Zimányi, meat consumption in Venice over the period 1624–1647 never went above an annual average of 21 kilograms per head (in the mainland cities it was even lower); admitting the exceptional circumstances of Hungary, she points out that over the same period, average annual consumption figures for every single inhabitant of that country were 60 kilograms of meat, 50 kilograms of animal fat, 50 kilograms of pork and around 600 to 700 litres of milk.<sup>7</sup>

However there were partial success stories in water use within the Venetian state, above all in the areas 'beyond the Mincio': around Brescia, Cremona and, to a lesser extent, Bergamo. Thanks to the irrigation canals drawn off the Oglio, the Garza and the Mella, the

mediocre soil of the Brescia area was made 'most fertile in grasses, hemp, vines and all sorts of fodder'. It was commonly said that the Oglio was like the Nile, making fields fertile, fattening the land of meadows and olive groves, and producing fine wines.<sup>8</sup> According to a report of 1563, the Cremona area was no less fertile: three-quarters of the zone enjoyed the benefits of irrigation, producing hemp (in 1599 it is calculated there were some 500 linen looms), corn, millet and hay. In the seventeenth and eighteenth century, these crops would be joined by rice and mulberry, both of which flourished in the area. Irrigated crops undermined the emphasis on cereals and vines that would long continue to be dominant in the countryside of the Veneto as a whole; it is no coincidence that in 1597 stress was laid on how the area dedicated to vineyards in this province was rather low owing to the prevalence of irrigation.<sup>9</sup>

In the Bergamo area, the Brembo and the Serio provided power for mills, hammers, saw-works and fulling machinery, but the reports of the *rettori* [City Governors] make it clear that not all the available water sources were put to full use: the province was, for example, not entirely self-sufficient in grain and often had to import from the neighbouring Cremona area. Furthermore, proposals to channel the waters of the Brembo and Serio – or use the Lake of Spinone as a reservoir of irrigation water – fell on deaf ears.<sup>10</sup>

## The Verona Area

In the lands 'on this side of the Mincio' – that is, in the Venetian Mainland proper – the shortcomings noted in the Bergamo area become even clearer: for example, the failure of numerous irrigation projects in the upper and middle plain areas around Verona at the end of the sixteenth century, or the poor performance of the Brentella canal near Treviso. Comparison of irrigation investment with that in projects for the draining of low-lying areas – particularly around Padua and in the Po delta – reveals a sharp bias towards the latter. It has been estimated (with some approximation) that two million ducats was spent on land drainage during the sixteenth century alone,<sup>11</sup> whilst the records of concessions by the *Provveditori ai Beni Inculti* (from 1556 onwards) suggest only 50,000 to 55,000 ducats was spent on the actual use of water. Of course, one must also add to this figure the costs of creating canals, digging irrigation ditches, building

embankments and other preparation of terrain. As we shall see in the case of rice-fields, water accounted for about one-sixth of total costs, and therefore perhaps the above sum of 50,000 to 55,000 ducats for concessions should be multiplied by six (though for irrigated pasture land the factor should certainly be lower). Overall, therefore, the revenue of the *Beni Inculti* suggests that the amount spent on irrigation work might be put at around 100,000 to 200,000 ducats.

It is beyond question that there was some significant increase in the areas of irrigated pasture land, arable land, vegetable plots and, above all, rice-fields during the sixteenth century. This is particularly clear in the Verona area, located between the well-irrigated western part of the Venetian state and that central-eastern area which was less irrigated and more in need of constant drainage. Here, the local – and to a lesser extent – the Venetian nobility managed to take advantage of the numerous rivers and springs of the area to increase the value of their sizeable estates. There was a profound change in the landscape due to the massive reduction of waste land, woodland and marsh, with a large part of the Verona plain being irrigated and land being turned over to the cultivation of rice. This transformation began as early as the second half of the fifteenth century, when the local feudal aristocracy – as well as the mercantile and financial aristocracy of the city – began the conquest of this ‘agrarian frontier’ which would turn the province of Verona into the most original example of agricultural development in the Venetian terra firma. As Giovanni Zalin makes plain, investment in the agriculture of the area by Venetian patricians amounted to almost 70,000 ducats during the fifteenth century, even if – as Beltrami points out – their presence here was not destined to grow as it did in other mainland areas (such as Padua and the Po delta).<sup>12</sup> This latter point would explain why so few of the water-concession holders in the sixteenth century were Venetians, whilst a much larger number came from the powerful families of Verona itself, whose role within this province should not be underestimated. The entrepreneurial dynamism of the Veronese nobility is clear from the second half of the fifteenth century onwards, and by the second half of the following century their awareness of the chances offered by the growing markets for agricultural produce in Venice and throughout Europe was leading them to increase output of rice, mulberry, fodder, fruit and garden vegetables, as well as invest in ways of improving the fertility of their lands.<sup>13</sup>

In the Verona area alone, sales of water for agricultural and manufacturing use (but primarily the former) in the period 1558 to 1604 accounted for some 29,452 ducats out of a mainland total of 54,837 ducats – that is, more than half – even if, according to one source, the water purchases in the area made by the Venetian aristocracy over this period amount to little more than 1,000 ducats (in 1586 and 1595 the Boldù family paid to irrigate 440 *campi*, whilst in 1589 the Cavalli family bought water to create some 60 rice-*campi*).<sup>14</sup> And even if this source does not include all Venetian water purchases – for example, the water used by the Donà from 1563 onwards for 50 rice-*campi* at Albaro; the 150 rice-*campi* created in the Colognese area by the Querini in 1560; or the water that the Gritti must certainly have used to irrigate their estate at Villabella – it does seem that the lion's share of the water was being put to use by the local aristocracy. At the end of the fifteenth century such great Verona families as the Giusti, the Serego, the Cipolla and the Sagramoso had already started land reclamation on the left bank of the Adige – along the Bussé and the Tartaro – and would subsequently invest substantial sums of money in the creation of rice-fields and the irrigation of their vines, pastures and arable land.<sup>15</sup> For example, extensive stretches of the Serego estate in the Cologna area benefited from irrigation that drew on the waters of the Fibbio and the drainage from other aristocratic estates<sup>16</sup>: at Cucca and Becciacivetta alone the irrigated land was said to total 765 hectares, including 500 rice-*campi* (between 1570 and 1579 the Serego paid some 1,350 ducats to the *Provveditori ai Beni Inculti*).

For their part, some time between 1520 and 1530 the Sagramoso had followed the example of Teodoro Trivulzio – said to have been the first to introduce rice as a crop in this area – by investing in land reclamation, irrigation and the creation of paddy-fields (the Maffei, another powerful Verona family, probably began to do so shortly afterwards). However, in this period it was technically almost impossible to reconcile the needs of rice-fields, land drainage and irrigation, as one can see in 1599 when the sizeable land-reclamation consortium in the area between Palù and Isola Porcarizza – headed since 1561 by the Sagramoso – came under savage criticism from the Presidents of the Ronca and Tomba consortia located in the area where the Bussé flowed into the Adige. It was argued that the Sagramoso rice-fields were causing serious damage to the drained land by drawing

excessive quantities of water from the Adige – perhaps as much as 50 *quadretti* – which then overflowed embankments and flooded the terrain that had been reclaimed with such difficulty.<sup>17</sup>

The Sagramoso were not the only ones to be accused of exceeding the water quotas fixed by the *Provveditori* experts. The Boldieri, for example, obtained a concession for some 6 *quadretti* from the Menago but actually drew off more than 50; true, this latter figure was calculated in times of heavy rain, but it certainly meant that the concession-holders had much more water at their disposal (the Boldieri were also accused of cultivating some 800 of their 2,000 *campi* with rice, whilst the original concession had authorised only 500). The *Provveditori*, always seeking to protect their revenues, clearly took these charges very seriously, but Orazio Boldieri – who personally oversaw ‘the rice-workers and the other seasonal and permanent labour’ – replied that the agreed area for rice-fields had been exceeded because an attempt had been made to use not only the purchased waters of the Menago but also other spring water, in an experiment that had turned out to be a costly failure. What is more, his brother, Francesco, who had herds of cows and horses, had leased some 300 *campi* of pasture land which he had then discovered sloped downwards at the centre; hence he had made them over for the cultivation of rice.<sup>18</sup>

Further confirmation that aristocrats personally ran their own estates comes from the development of different types of contract during the sixteenth century, resulting in ‘hands-on’ estate-management by property owners, with a resultant reduction in the number of long-lease tenants and the traditional access to open fields and natural resources. The Bonetti, for example, totally abandoned trade for farming – as their ‘neighbours’ pointed out with some acrimony<sup>19</sup> – and the list of those who became more active in agriculture would include some of the greatest names of the Verona aristocracy (owners of the largest and most profitable rice-fields) as well as recently-wealthy bourgeois.<sup>20</sup>

The ‘race for water’ that emerged so clearly in the second half of the sixteenth century involved not only the digging of water channels but also the harnessing of spring water. Although far from easy to raise to the surface, this latter was exploited precisely because river water was an expensive resource contested by so many.<sup>21</sup> And just how expensive water might be can be seen from the fact that, in

optimum conditions, experts estimated it at 200 to 250 ducats per *quadretto*, with the smaller landholders – for example, the Cermisoni brothers who purchased 500 ducats worth of water in 1559 – paying in instalments. However, the very existence of such staggered payments reveals that the profitable exploitation of this valuable resource was not limited to the city's aristocracy.<sup>22</sup>

## Rice

Amongst all the irrigated crops, rice occupied the largest areas and drew the largest amount of speculative capital in the Verona area. The middle and lower Po valley regions – together with the dry and gravelly upper plain area above the zone of the water springs – underwent irrigation on some scale, with benefits for pasture land, arable crops, vineyards, mulberry plantations and *broli* (fruit and vegetable gardens), all of which often resorted to water concessions.<sup>23</sup> However, it was rice – particularly in the middle and lower Po valley areas – which spread most extensively as a crop. Nevertheless, comparison of the Verona area with Piedmont and Lombardy reveals that in the former rice had nowhere near the same role as a stimulus of agricultural development. Between 1558 and 1604, 1,448 hectares were given over to rice-fields in the Verona region<sup>24</sup>, some 0.46 per cent of the entire surface area of the city's province (3,096 km<sup>2</sup>). This compares very well with the percentage that emerges from a similar comparison made with regard to Lombardy at the end of the sixteenth century by Pugliese and De Maddalena (0.5 per cent). However, by the beginning of the eighteenth century, the percentage of total area given over to the cultivation of rice in the latter region had increased almost sevenfold to 3.4 per cent.<sup>25</sup> In effect, a more flattering term of comparison for the Verona province would be others in the lower Po valley area – for example, Ferrara and Mantua. At the end of the eighteenth century, in fact, the total area of rice-fields in Mantua (4,216 hectares) was still lower than that in the Verona province at the end of the seventeenth (4,965).<sup>26</sup>

When considering why, in spite of the high initial costs, rice was preferred to other crops, one has to bear in mind its persistently high returns (up to two to four times more than corn or maize) as well as the fact that rice could figure as part of a crop-rotation cycle. What is more, the agricultural entrepreneur required only a limited permanent

workforce, being able to employ seasonal labour for the harvesting, husking and threshing, thus restricting his wage bills to certain periods of the year. However, the role of many variables is yet to be fully clarified. How high a part of initial costs was accounted for by water? In discussing a later period – the end of the eighteenth century – Luigi Faccini says that the costs of water and its delivery/transport amounted to some 15 per cent (allowing for depreciation) of all the expenses a rice-grower had to meet during the course of a year.<sup>27</sup> Venetian government experts calculated in 1655 that about 10 ducats were needed to set up a rice-*campo* (the actual figure given being 1,000 ducats for 100 *campi*). This would include the costs of digging channels, raising embankments, connecting them with the irrigation canal and actually purchasing the water (to this were to be added another 600 ducats per year for running costs: the wages for the *risaro* [rice farmer] and for the occasional labour and so on).<sup>28</sup> In another case – the rice-fields set up by Pietro Zenobi in 1655 – the government experts assessed total costs at 220 ducats – a good 200 of which went for the water concession (that is, 90 per cent of the total). One gets therefore the clear impression that the 15 per cent estimate for eighteenth-century Lombardy could rise sharply in other contexts, above all in the years when there was a high demand for water (the period of agricultural growth when the rice-fields were being set up).<sup>29</sup>

The high yields associated with rice are to be seen in conjunction with the growing demand for cereals within the Venetian Republic and abroad. But whilst wheat was a crop largely grown for local consumption (and subject to restrictive legislation), rice was much more of a market crop, providing aristocratic land-owners with a high return on their initial investment, particularly after the sharp increases in prices at the end of the sixteenth century. Although there has been no comprehensive study of rice consumption, it does seem reasonably certain that it was seen as a luxury replacement for wheat. Even if in times of shortage, rice might also be used to make loaves that were sent to the Levant to feed galley slaves – and was therefore subject to the same norms regarding commerce and consumption as other cereal crops – it was some time before it became part of the popular diet (for example, in the pea risotto known as *risi e bisi*). Proof of just how long it maintained its status as the chosen food of the urban classes is to be found in the fact that a substantial part of the crop found its way to market: most of the rice

from the Verona province (in 1584, some 100,000 *minali* = 2,860,100 kilograms) was shipped to the port of Venice, where it was joined by the (perhaps even larger) amounts imported from Lombardy.<sup>30</sup> This 'boom', however, very soon drew attention to other aspects of rice that were far from positive: the unhealthy air in the neighbourhood of the rice-fields; the destruction of pasture land; the shortage of other cereals and fruit; the detrimental effect on the diet of the poor (although the number of rice-fields continued to increase, so did the price of the crop, and thus consumption at the lower levels of society dropped).

All of this led to the decree of 17 September 1594<sup>31</sup>, which undoubtedly slowed development of rice production in the Verona area (and throughout the Venetian terra firma) for some decades to come, its effects being aggravated by the stagnation of the early decades of the seventeenth century. The same train of events can also be seen in Lombardy, where restrictive legislation was introduced some twenty or so years before – the result of the same sharp clash of socio-economic interests between the large land-owners and the local population, which had stimulated a lively debate as to the health risks posed by rice-fields.<sup>32</sup> As for the Venetian Republic, the legislation meant that, from 1594 onwards, rice-fields could only be created in low-lying marshy areas and certainly not on reclaimed land along rivers – a restriction that led to a sharp inversion in the growth trend of the previous decades.<sup>33</sup> The 'destruction' of rice-fields in the Verona area was, however, less extensive than in other areas of the mainland Republic – for example, around Vicenza. Perhaps one reason for this was that the local aristocracy had always been viewed as forming an intimidating political group, and great prudence was required before making any moves that might clash with their economic interests.<sup>34</sup>

## Other Provinces of the Venetian Mainland

Both irrigation and rice plantation became features of agriculture in the other provinces of the terra firma during the course of the sixteenth and seventeenth centuries, even if they affected more limited areas. In the zone around Vicenza, irrigation was present from the upper plain lands of the north-west to the Brenta in the east. However rice-fields tended to be concentrated in the *bassa* [lowland

areas], with some exceptions to the north of the city and along the banks of the Brenta itself.<sup>35</sup> Up to 1595 a total of 774 hectares (2,000 *campi*) were sown with rice, around one-half of the figure for the Verona area (1,448 hectares).<sup>36</sup> As a result of the 1594 decree, however, the number dropped substantially – by about 40 per cent (320 hectares) – due to enforced closures.<sup>37</sup> Thus, as elsewhere in the Venetian state, rice in the Vicenza province over the coming decades would make only a limited contribution to meeting food needs. By 1794 Vicenza was nevertheless producing 36,206 bushels of rice, which put it in second place – but a long way behind – the province that continued to be the main rice-growing area of the Republic: Verona (88,621 bushels).<sup>38</sup>

In Vicenza, too, the Venetian landowners – whose estates here in 1661 actually totalled 1,000 hectares more than in the Verona area (10,079 hectares as against 9,141) – had less resort to the *Provveditori ai Beni Inculti* than did the local aristocracy: in 1594–5 only nine of the rice plantations in the Vicenza area were owned by Venetian noblemen and five of those would be destroyed after the 1594 decree. The only ones that remained in production were those owned by the Grimani at Carmignano (100 *campi*); by the Pisani at Bagnolo (300 *campi*); by the Priuli at Villa del Ferro (Sossano), where rice alternated with wheat in 343 *campi* shared with the Dolfin; and by the Balbi at Saianega (100 *campi*, laid out as a rice plantation around 1580).<sup>39</sup>

Expenditure on water tells the same story, with the Venetians falling far behind the local Veronese nobility; although there were exceptions, for example the 600 ducats paid by Zuanne Mocenigo to irrigate his fields near Marostica.<sup>40</sup>

In the province of Padua the major concession-holders for the use of water were Venetian patricians, as might be expected given their extensive presence in this area as land-owners (with estates totalling some 66,236 hectares in 1661). However, even here the purchase of surface water was not widespread and concerned some few hundred *campi* (arable, pasture land, rice-fields) as against the approximately 100,000 *campi* that were drained for agricultural use here during the sixteenth century. There were attempts to introduce rice-plantations, but they did not meet with much success. For example, Girolamo Grimani stirred up the protests of the Gorzon land-reclamation consortium because of the damage caused by his plantation;<sup>41</sup> and

though we do not know the response to the applications made by Piero Marcello, Bartolomeo Querini and Piero Morosini to develop rice plantations at Masi, Piacenza and Castelbaldo – using the drainage from the Grimani plantation as well as water drawn from the Gorzon and Adige – they were probably as unsuccessful as those made by Girolamo Barbarigo and Antonio Cavalli. All in all, water sales in the Padua area between 1558 and 1604 did not go above one thousand ducats, a more than modest sum.<sup>42</sup>

Numbers alone would suggest that irrigation was pursued no more actively in the Treviso area; but this is a case where the official concessions granted are a poor illustration of the actual historical situation. In fact, irrigation was much more extensively practised than was indicated by the approximately 1,500 ducats received in payment for concessions in the second half of the sixteenth century. This was largely due to the fact that, thanks to the Brentella canal, the Treviso province comprised a sizeable area of irrigation (in the north-west), within which water distribution had taken place in the fifteenth and sixteenth centuries. According to figures for 1572, the Brentella consortium covered some 2,446 hectares<sup>83</sup> (Raffaello Vergani argues that in 1595 only 4–5 per cent of the area of agrarian land, at that date around 23,000 hectares, was being irrigated).<sup>43</sup> Certainly, this fell far short of what had been expected of the project. And if one bears in mind Bruno Caizzi's estimates that, as late as 1937, the land in the Treviso area requiring intense irrigation amounted to 12,000 hectares, one can see that the thirst of this terrain had only been partially satisfied.<sup>44</sup>

This problem is linked with that of herd size in the Treviso province. Even if some scholars (for example, Jean Georgelin) argue that it was large enough to supply meat needs during the course of the eighteenth century, one should not forget that a large part of the livestock was 'in transit' (from Austria and Hungary), feeding here before passing on to slaughterhouses in Venice.<sup>45</sup> If the pasture lands of the province were sufficient, it was probably due to the transitional nature of the livestock grazing.

As far as rice is concerned, the few attempts to create plantations in Treviso (at Oderzo, Castelfranco, San Donà) were faced with the limits imposed by the Venetian Senate.<sup>46</sup>

As in Bassano, it was market-gardening that was more prevalent here, occupying part of the grounds of the numerous villas owned by

the Venetian aristocracy; there were numerous *broli* of even 20 to 30 hectares within the larger estates that were extensively irrigated. Nevertheless, it is probable that artistic considerations prevailed over agricultural in the laying-out of the grounds of Venetian villas.

Water concession-holders also included small land-owners, who however rarely irrigated pastures and vegetable gardens of more than 2 to 3 hectares.

In Friuli and the Po delta there was an almost total absence in this period of irrigation and rice plantations; these would only expand in the latter area during the course of the eighteenth century (in the sixteenth, Feliciano Perona wrote, 'In the Polesina, it is universally said that there are no rice plantations or irrigation – and for all I have ridden over and seen [a lot] of the area, I have encountered none'). As shown by the extensive literature on the subject, land reclamation here would have required greater financial investment than elsewhere. As for Friuli – where the area of the *bassa*, with its ample supplies of water, would have been particularly suitable for the crop – there were only two attempts to set up rice plantations, both of which came to nothing (in 1595 the 60-*campi* plantation created seven years earlier some two miles from San Vito al Tagliamento was made into pasture land, whilst the 120-*campi* plantation at Prata di Pordenone, owned by the nobleman Giovanbattista Bernardo, proved to be insufficiently supplied by the 3 *quadretti* of water drawn off the Cellina<sup>47</sup>).

## The Crisis of the Seventeenth Century

Investments in water purchases within the Republic dropped in both number and size during the first decade of the seventeenth century, signalling what is generally regarded as a slow-down – if not a reversal – of the expansive trend of the sixteenth. Wallerstein, however, sees the seventeenth century as marking only a temporary pause in the growth of the capitalistic world-economy that had reached maturity over the previous one hundred years;<sup>48</sup> and this idea of an essential continuity between the two centuries is undoubtedly proved by the fact that a new phase of expansion would begin very quickly. Given the different dates for this slow-down and subsequent new growth within the various states of Europe and Italy, it is perhaps legitimate to wonder whether this variegated crisis formed a single whole. What is certain is that agriculture within the Venetian Republic did not enter

its period of stasis until the decades 1600–1610, when the difficulties caused by weather conditions and food shortages that had occurred around 1590 had been overcome. This was only partly due to a drop in population; the plague of 1575 had had a dramatic effect upon numbers, without however significantly depressing demand and, therefore, prices (the Republic differed from the other states of north-western Europe – and even southern Italy – in having managed to contain the situation up to the end of the century).<sup>49</sup> However, the drop in investment in the next few decades is shown from the irrigation revenues of the *Beni Inculti*<sup>50</sup>: 29,047 ducats for the period 1605–1645, as against 54,837 ducats for the period 1558–1602.<sup>51</sup> The fact that numerically there was an increase in concessions during the first half of the seventeenth century (428, as against 384 in the second half of the sixteenth) is misleading as they involved much smaller areas, especially in the province of Vicenza. Concessions there actually doubled – from 142 to 280 – but only 109 rice-*campi* were added to the 1,176 still in production at the end of the sixteenth century: the total area planted with rice in 1645 amounted to just 496 hectares.<sup>52</sup> The situation in the Verona (and Cologna) areas seems to have been better, where the Venetian Senate ratified the conversion of a further 944 *campi* (283 hectares) for rice production as they were judged low-lying and marshy; the total area of rice plantation here in 1645 was 1,731 hectares.<sup>53</sup>

There was no increase at all in rice plantation in the Treviso, Friuli or Padua areas, where the slump in irrigation itself is clear from the fact that water purchases totalled only a few hundred ducats. In the Padua province, such irrigation as there was remained the preserve of the Venetian nobility – the Barbarigo, the Contarini, the Pesaro, the Corner and other families – whereas in the Verona and Vicenza areas there were few exceptions to the rule that it was the local nobility that played the leading role in rice production and irrigation.<sup>54</sup> Overall, what emerges in this period is the consolidation of large landed concerns, with a static focus on extensive rather than intensive agriculture and a tendency to live off the status quo until market conditions improved. Small-scale concessions did not, however, disappear altogether: in fact, it is no coincidence that, with the modest capital they required, they form the majority of concessions in the first half of the seventeenth century. Nevertheless, in the case of rice, the difficulties of withstanding a situation of

falling demand and prices were all too clear:<sup>55</sup> attracted to this crop by the favourable agricultural/economic circumstances of the second half of the sixteenth century, the small- and medium-sized agricultural concerns were now in no condition to meet the high costs involved in cultivating rice '[given that they rested] on the traditional principles of mixed agriculture and estate self-sufficiency. The way for large-scale agricultural enterprises thus opened up automatically'.<sup>56</sup>

The low point of the seventeenth-century crisis as far as the Venetian Republic is concerned comes around 1630, coinciding with a serious plague outbreak of that year. However, if it is legitimate to take irrigation as an index of agricultural activity as a whole (especially given the weakness of other such indices – for example, tithes – and the absence of sufficiently wide-ranging regional studies of fluctuations in wheat prices<sup>57</sup>), it seems that the 1640s saw a new influx of capital and entrepreneurial energy into the countryside of the terra firma. In this period, the average of one to two concessions per year would increase slowly but surely; and this is further borne out by the taxation calculated for each irrigated *campo* (which passed from the 3 ducats per *campo* which had been maintained right up to 1631, to 4–5 ducats and then, as early as 1641, to 10 ducats). The solidity of this upward trend remained uncertain until the 1650s; but it seems clear that the years 1645–46 marked a turning-point. Very probably it was the supplies required for the War of Candia (1645–1669) that pushed agricultural production levels up to what they had been before the crisis. Another factor in this new influx of capital into agriculture may have been the up-turn in population figures following the plague.<sup>57</sup>

If the above conclusions are correct, then the Venetian Republic was one of the first states in Europe to move beyond the agricultural stagnation of the first part of the seventeenth century, which Le Roy Ladurie describes as 'the bitter fruit of war, taxation, weather conditions and perhaps the breakdown in the monetary system'. Another comparably early recoverer was Spain, where there was an improvement in agricultural production from 1645 onwards; at the other end of the scale comes somewhere like Southern Italy, where the crisis in the sector lasted up to 1690.<sup>59</sup>

In the Venetian Republic there were encouraging signs in land reclamation, with a return to projects of a certain scale (even if it is

true that throughout the early decades of the century there was no excessive slump in agricultural activity but only a sharp drop in the capital invested). As mentioned above, the War of Candia had a significant influence, coming as it did in conjunction with the sale of common lands (above all, in the Po valley area).<sup>60</sup>

The increase in the number of water concessions led to a concomitant increase in total revenues for the *Beni Inculti* during the period 1646–1700. Though in many cases these were confirmations of old use rights, one has the clear impression of increased activity and expansion. Even taking into account inflation, it seems that the overall sum of 66,732 ducats collected in the period marks a return to – if not an improvement on – the sum collected during the second half of the sixteenth century (54,837).<sup>61</sup> All the various provinces were affected by this phase of expansion; however, once again, it was more modest in the areas of Padua, Treviso and Friuli. In the province of Vicenza, *Beni Inculti* revenue totalled 15,394 ducats, which may not have been exceptional but is noteworthy for other reasons: a growing amount of the water purchased was in fact destined to power paperworks, sawmills, hammers, spinning mills and, above all, flour mills. It would seem that in this period of fundamental importance for the history of the Republic a sharp division of roles was appearing within the economy of the state, with the province of Vicenza becoming predominantly proto-industrial<sup>62</sup> and that of Verona predominantly agricultural. The latter, in fact, invested a good 44,582 ducats in water purchases (66 per cent of the total for the Republic), thus confirming and continuing the brilliant performance of the sixteenth century.

191 (40 per cent) of the 486 concessions granted in the Verona area were for rice plantations (as opposed to 47 in the Vicenza area, 8 in the Padua and 3 in Friuli); and by the end of the century a further 3,234 hectares (10,772 rice-*campi*) had been added to the 1,731 already dedicated to rice production in the Verona area in 1645. Assuming that there were no substantial reductions or changes of use in the land covered by the 1645 figure, this means that the total rice-growing area within the province was 4,965 hectares (triple the 1,448 hectares in use at the end of the sixteenth century). And though the increase in the Vicenza area was on a lesser scale, the figure for the end of the seventeenth century (1,000 hectares) is still more than double the 454 hectares at the end of the sixteenth.<sup>63</sup>

The expansion of rice as a crop led to important improvements in agricultural practice, especially within the Verona area, with rice being part of a two- three- or four-year rotation cycle involving wheat, maize, fallow land and pasture.<sup>64</sup> It seems, in fact, that this increase in the use of rice as part of a crop cycle represented a technical advance on permanent rice-fields; however, even these latter – with rationalised periods of ‘fallow’ and re-fertilisation – could be just as productive.<sup>65</sup>

Similarly, how can one not see a sign of progress in both technology and productivity in the applications to the Venetian authorities for permission to dedicate ever larger expanses of land to profitable crop-rotation? Or in the growing demand for water from rice plantations that had not increased in surface area? And when one looks at the concessions granted, one gets the clear impression that the Venetian Senate and the *Provveditori* fully approved of the way things were developing. The old decree of 1594, which limited rice fields to low-lying terrain, was no longer respected: rice plantations now expanded into ‘pasture land’ and ‘non-productive (sic) raised land’, whilst old applications were granted or else permission was generously given to ‘irrigate and create rice plantations freely’.<sup>66</sup>

Once again, such plantations were highly profitable.<sup>67</sup> In 1651 the state’s experts estimated the average income per *campo* for a rice plantation as 7 ducats, double that from normal arable land; in 1682, Giammaria Sagramoso declared an income of a good 300 ducats from just 30 rice-*campi* at Palù.<sup>68</sup>

Given that circumstances were improving, the numerous families of the Verona nobility once more turned their financial resources and speculative acumen towards the countryside. Whilst one does not intend here to make any revolutionary claims, exaggerating the contribution that the aristocracy of seventeenth-century Italy made to stimulating entrepreneurial activity, it is important to underline the error of those interpretations which see the nobility’s role in the countryside as being merely parasitic. On the contrary, the case of the Venetian terra firma – and of the province of Verona in particular – reveals the existence of a patrician class that was ready to venture beyond the safety of the land-rents in which it had taken refuge during the stagnation of the early part of the seventeenth century, once market conditions made a more active presence in the countryside potentially profitable. Just as in the neighbouring

Lombardy at around the same time<sup>69</sup>, one sees a return to the direct management of agricultural estates that had proved so successful in the past.<sup>70</sup>

This period also saw the aristocracy of Venice and Vicenza becoming more active in the countryside. Slowly but surely, the patricians of the capital became a more capillary presence within the terra firma (as one can see from the growing number of water concessions held by such families as the Duodo, the Grimani and the Balbi).<sup>71</sup> And in the Vicenza area greater dynamism is to be seen not only in the activities of the important families – such as the Trissino and the Da Porto, etc. – but also in those of the wealthy religious institutions of the city.<sup>72</sup>

## **Irrigation and the 'Agricultural Revolution' of the Eighteenth Century**

The eighteenth century saw continuing use of those surface water supplies which, regulated by the *Provveditori ai Beni Inculti*, had enabled the Republic to increase the area of its irrigated pasture land and establish rice plantations. However, exploitation of this water was yet to lead to the establishment of modern and capitalist-based agricultural enterprises similar to those which were emerging in the regions of northern Europe. In effect, the seventeenth century had been the watershed that marked the clear separation between a northern Europe that was agriculturally, politically and economically advanced, and a southern Europe that had failed to break free entirely of the late-sixteenth/early-seventeenth-century recession (not that one should slip back into an interpretation of this latter century as a period of 're-feudalisation', 'bourgeois betrayal' and the 'decline of urban elites' – all concepts which prevent a proper understanding of that slow transfer of energy and economic initiative from the cities to the countryside and the smaller towns).

Even in this 'century of crisis' things were happening in the countryside of Italy, and of the Venetian Republic in particular, making it clear that the division between a rich and fertile northern Europe and an arid and backward southern Europe is far too schematic. The north of the continent too had its less fortunate regions as well as those where agriculture was more developed and crop yields higher (for example, Flanders, Brabant, Zeeland and

Friesland, all of which were being highly praised by English travellers by the middle of the seventeenth century, some time before efforts were made to introduce into England what has been misleadingly defined as 'new agriculture').

It is no coincidence that from the Middle Ages onwards the more advanced regions had seen the need for irrigated pasture land, the cultivation of fodder crops and for more differentiated cycles of rotation. For a long time one of the most agriculturally-advanced regions in Europe had been the Po valley, a status revealed by the 'revolutionary' teachings of such figures as Camillo Tarello and Agostino Gallo, which made such a mark upon the agriculture of Lombardy and the Veneto. The problem was that, in the Venetian Republic as in other regions of Europe, such teachings were very slow in becoming widespread; even eighteenth-century England, in the analyses of Slicher van Bath, emerges as home to a gradual evolution rather than a sudden revolution in agriculture, with knowledge gleaned from the writers of Classical Antiquity continuing to play a role. However, the fact is that in eighteenth-century England such measures as the introduction of rape and other leguminous plants into the rotation cycle; the increase in area of irrigated pasture land and herd size; the upturn in agricultural yields and the spread in the use of fertilisers – in effect, all of that which comes under the umbrella term of 'the agricultural revolution' – benefited from a highly-favourable socio-economic situation: more modern relations of production (enclosures, a very 'hands-on' presence of landowners); heavy investment; and government policies that were very attentive to the needs of agriculture. Nevertheless, some English historians have been at pains to argue that this process of development was not as straightforward as some accounts make it appear. For example, it has been pointed out that the progress achieved within particular estates cannot be automatically extrapolated to cover the country as a whole (accurate estimates of overall production are not available) and that in spite of significant internal migration there would not be a decisive drop in the size of the rural population living on agriculture until around 1850.<sup>73</sup>

This more nuanced picture has to be borne in mind when attempting to draw conclusions regarding the Venetian Republic and its failure to implement its own 'agricultural revolution'.<sup>74</sup> However, one thing is undeniable: the role of water in increasing agricultural

production. By providing essential fodder for livestock and being the *sine qua non* of more complex crop-rotation cycles, this resource was indispensable to the undoubted development in agriculture within eighteenth-century Europe.

And yet even if in 1768 the *Provveditori ai Beni Inculti* was joined by another agency – the *Deputati all'Agricoltura* – which was specifically intended to study ways of increasing yields and herd size and of introducing new agricultural techniques, the government's measures to manage water-use and promote agriculture do not always seem to have been adequate to the situation. Proposals, theoretical dissertations and memoranda of a strictly-local focus far outnumber the genuine steps taken towards agricultural progress; even if it would be unfair to argue that the Venetian state did not have an agricultural policy worthy of the name, there was undoubtedly much greater dynamism in the cultivation and exploitation of new agricultural land elsewhere in Europe. In England, for example, Parliament had long played a key role in the drainage of the Fens, and from the sixteenth century onwards had permitted those enclosures which stimulated the development of a market-focused agriculture on privately-owned farmland.<sup>75</sup> Of course, the English model is not always an adequate term of comparison for the developments everywhere in Europe – for instance, France<sup>76</sup> – but one only has to look at an area such as northern Germany to see more openness to experimentation and a shrewder level of agricultural management than one finds in the Venetian Republic. This is partly explained by the fact that after the accession to the English throne of the House of Hanover, numerous agricultural treatises were translated into German and made their influence felt in the north of the country.<sup>77</sup>

This does not mean that there were no longer contacts between Venetian agronomists and those elsewhere in Europe: the works of Duhamel du Monceau, Johann Beckmann, Albrecht Thaer and Arthur Young were well known in Venice, where they became the object of detailed commentary. But, given the absence of figures who could actually implement innovation, discussion and description rarely got beyond wishful thinking. Certainly, there were those in Venice who experimented with new crops, and land-owners who were directly involved in the running of their estates<sup>78</sup>, but this was not enough to guarantee a real turn-around in the productivity levels

and range of the region's agriculture. And the fact that the members of the Venetian aristocracy also controlled the government and the land-reclamation consortia – dealing with land in which they had powerful vested interests – inevitably means that an interpretation of the course of agricultural development here must take into consideration the political context – and the very Constitution – of the Venetian Republic.

## **The Eighteenth Century and the Development of Rice Plantations**

Obviously in discussing the flow of capital investment towards agriculture in the Venetian Republic – or anywhere else in eighteenth-century Europe – one also has to take into account the prevailing international situation. The improvement in this sector of the Venetian economy from the 1730s onwards should be seen in a wider context, with the agricultural sector of Europe as a whole benefiting from increasing population numbers and a consequent growth in cereal prices. Moreover, in the case of Venice, the end of the seventeenth and the beginning of the eighteenth century also saw the conquest of the Peloponnese and the peace treaties of Carlowitz and Passarowitz (1699 and 1717 respectively), all of which gave a boost to the Venetian economy as a whole. It is no coincidence that this was a period of more intense agricultural activity and a higher number of water concessions. As has been pointed out, the second half of the seventeenth century had already seen a certain recovery from the stagnation of the first half, with the so-called 'crisis of the seventeenth century' being more circumscribed than the traditional label leads one to assume (even if the above-mentioned recovery was, overall, a very slow one).

Of course, the expansion of rice plantations within the Veneto was nowhere near comparable to that of the agriculturally stronger areas of the Po valley, such as Lombardy and Piedmont (to cite just one example, between 1710 and 1803 the Vercelli province of Piedmont saw rice plantations pass from an already noteworthy 8 per cent of total agricultural land to 33 per cent).<sup>79</sup>

Once again, within the Veneto it was the Verona and Vicenza areas that took the lead, with the late-sixteenth-century reservations regarding this type of crop appearing to be abandoned. Even if every single document still makes formal reference to the health dangers

posed by the miasmas raised by rice-fields near residential areas, and even if there were still anxieties that expanding rice plantations were taking away arable and pasture land, there is no denying the growth within this particular area of agriculture. In the Verona area a further 1,975 hectares (6,578 *campi*) were given over to rice production during the eighteenth century, theoretically making a total of 6,940 hectares by the end of the century (an increase of about 40 per cent on the 4,965 hectares at the end of the seventeenth).<sup>80</sup> Rice also spread socially, even if Berengo does point out that in the nineteenth century domestic consumption of the crop was still 'concentrated in urban centres, and largely restricted to the more affluent classes'.<sup>81</sup>

The wealthier families of Vicenza – the Thiene, the Monza, the Barbarano, the Capra, the Piovene and the Garzadori – showed no less an interest in this typically speculative crop: a further 630 hectares (1,634 *campi*) were given over to rice, marking an approximately 60 per cent increase on the previous 1,000 hectares (though still only making a modest 0.60 per cent of the total agricultural land of the Vicenza province).<sup>82</sup>

Other areas of the mainland state followed the same trend: Padua, Treviso and, above all, the Po delta areas (where the first rice plantations of the eighteenth century were the beginning of the extensive growth of this sector here in the nineteenth). In effect, as a result of the diversion of a branch of the Po – the so-called Portoviro Cut (1599–1604) – the very ground area of the delta would increase continually due to the greater amount of silt deposited by the river; and this new terrain presented new opportunities of profitable investment for the area's landowners (most of whom were Venetian patricians).<sup>83</sup>

In 1766 the Soranzo family were granted a water concession for a 22-*campi* rice plantation at Lendinaro di Rovigo, whilst the Mocenigo would flood a further 30 *campi* in 1778 at Gnocca 'on the branches of the Po'. Two years later, Giovanni Battista Mora exploited the waters of the river to make rich rice-fields of 60 'marshy and low-lying' *campi* at Donzella (again in the Rovigo area).

Favourable economic circumstances meant that even far from wealthy landowners could invest in rice, as had already happened in the second half of the sixteenth century, when the better-off amongst the smallholders had been caught up in the interest in land reclamation and irrigation.

The sharpest peaks in the curve that I have tried to chart on the basis of water-concessions for irrigation and rice plantations come in the decades 1760–1790. In the first two decades of the century there was a clear increase in the number of rice plantations; this was followed by a certain loss of momentum, explained by some as due to strong competition from the rice-growers of Lombardy and Piedmont.<sup>84</sup> Thereafter improving economic conditions would lead to Veneto rice recovering some ground on the international market; hence, this partial but significant indicator illustrates and confirms a chronology in which European – and not just regional – factors come into play.

Over this period this was also a concomitant improvement in methods of cultivation: many landowners did not just increase the areas of their rice plantations, they made rice a key part of complex rotation cycles that were intended to boost yields.

### **The Trend in Irrigation and Land Reclamation: Limits of Agricultural Growth**

The general trend in the curve of the graph plotting the number of irrigation projects is the same as that for rice plantations, even if it is rather more even and less inclined to brusque variations (rice was more subject to market fluctuations). In both cases one can see a definite improvement from the 1730s onwards, with difficulties becoming apparent in the last decade or so of the century.

It is clear that in these favourable conditions both the small- and medium-sized holdings had greater access to water, with numerous small plots of just a few hectares (and sometimes even smaller) being irrigated to improve the fertility of land intended for pasture or (more rarely) arable crops. Nevertheless, it was still the large landowners who made the most considerable investments in the irrigation of pasture and arable land. For example, Alvise and Filippo Balbi, two brothers of the Venetian nobility, would in 1763 extend irrigation from 100 to 900 *campi* in the San Floriano area outside Treviso (paying the *Beni Inculti* some 646 ducats), whilst another important Venetian aristocrat, Nicolò Tron, would have an irrigation channel dug that added a further 60 irrigated *campi* to the main body of his 545-*campi* property.<sup>85</sup>

Analysis of the concessions reveals the continuing dependence upon the rivers of the regions – and the Adige in particular (the canals

drawn off this watercourse were much more numerous than those off other comparable rivers such as the Brenta, the Piave, the Sile). And given that most irrigation canals depended upon river water there was less resort to spring or underground sources, with increasing use of mechanical instruments – bucket wheels, pumps and so on – to raise water (especially from the Adige); even those of limited financial resources applied for authorisation to install such machinery.<sup>86</sup>

Nevertheless, the revenue from water concessions for irrigation remained relatively limited, as can be seen from the fact that

---

**Water Concession Revenues over Five-year Periods  
(in ducats, allowing for depreciation)**

---

For Rice Cultivation		Irrigations
1701-1705	duc. 1,725	2,180
1706-1710	" 1,667	1,345
1711-1715	" 3,226	2,180
1716-1720	" 1,318	2,215
1721-1725	" 558	555
1726-1730	" 931	410
1731-1735	" 1,206	385
1736-1740	" 1,606	890
1741-1745	" 998	450
1746-1750	" 2,505	1,375
1751-1755	" 1,448	615
1756-1760	" 1,673	2,805
1761-1765	" 2,891	3,090
1766-1770	" 5,411	1,910
1771-1775	" 3,107	2,230
1776-1780	" 3,316	2,250
1781-1785	" 5,814	1,455
1786-1790	" 5,722	4,380
1791-1795	" 2,342	2,265
1796	" 112	--
1797	" --	--
Total	" 47,576	22,375
General Total	" 69,951 <sup>87</sup>	

---

throughout the century they totalled 22,375 ducats (whilst the revenue from rice plantations reached 47,576 ducats).

A comparison with the figures for the previous century immediately reveals the limits of the expansion that took place during the eighteenth; for if, in the second half of the seventeenth century, around 66,000 ducats was invested in water concessions, over the entire eighteenth the figure does not top 70,000 (taking into account inflation). True, this latter figure does not include manufacturing uses of water, but even so one would have expected the total to be rather higher during what is considered to have been a growth period in Venetian – and European – agriculture. However, in the second half of the seventeenth century alone, the rice-plantations in the Verona area increased by 86 per cent, whilst the figure for the entire eighteenth century is around 40 per cent (the same figures for the Vicenza area are around 100 per cent and 60 per cent). Hence, once again, there is a need to review the prevailing opinions with regard to the two centuries. Morineau has, in fact, already defined the eighteenth century as a false start, a '*démarrage économique manqué*', highlighting the discrepancy between demographic growth, calls for agronomic development and the actual investment of technical resources and funds in order to bring it about (although his argument deals with France, his conclusions are equally valid with regard to Venice).<sup>88</sup>

The picture is just as nuanced when one looks at land drainage, which continued to be an important part of the Republic's agricultural policy. The extrapolated data regarding the areas of land drained by consortia show that one should not underestimate the importance of this activity; and even though it is clear that some areas were subject to periodic re-flooding, the overall situation is not as grim as it at first appears. Whilst it had previously been estimated that within the Venetian Republic a total of around 150,000 hectares were drained and reclaimed over the period 1500 to 1800 – with the figure for Holland over the same time-span being about 280,000 hectares<sup>89</sup> – more extensive study of the documentation<sup>90</sup> suggests that the total area of reclaimed land within the various consortia active in the terra firma at the end of the eighteenth century amounted to some 188,000 hectares, so the gap between the two countries must be re-assessed (we shall see below further evidence in support of this claim).

Still, in spite of the openness to innovation that can be seen in published writings, in government policy and in the concession of patents<sup>91</sup>, the limits and contradictions in the agriculture of the Veneto emerged clearly. The impact of agricultural land-use upon the environment was worrying, and the action of the various land-reclamation consortia – and even the *Provveditori ai Beni Inculti* themselves – were not always adequate. One gets the clear impression of a gradual breakdown in organisational structure, with a certain irreconcilable conflict between the various social agents involved in the maintenance of reclaimed land. The result of this is clear from the description of the Verona area given in 1738 by the *Provveditore* Andrea Longo: many fields that had been reclaimed as arable land had subsequently become pasture land or even marshland. Similarly, the land of the Lower Gorzon consortium was described in 1787 as in 'a terrible state', as was the reclaimed land alongside the Brancaglia. The former, where the consortia members were from Padua and Venice, had become little more than a drainage basin for the water run off from the rice-fields and irrigation canals of the Verona area, whilst the second – where the drainage dams had been designed as early as 1521 – was suffering as a result of miscalculations in the creation of a new drainage canal.<sup>92</sup> And things were little better<sup>93</sup> at the other consortia of the Padua area: the Fratta, the Middle Gorzon, the Upper Gorzon and the 'Seven Channels (*Prese*) of the Brenta'. In the latter area, due to the level of the last cut off the Brenta, the river actually ran higher than the surrounding countryside, so the water in the drainage channels flowed backwards. Throughout the eighteenth century various attempts were made to remedy the problem – imposition of a new *campatico* tax on land-owners and investment in such schemes as canal-bridges, culverts and moving gates to shut off the channels – but the hydro-geological imbalance remained.<sup>94</sup>

Overall, a general state of neglect made it inevitable that canal-bridges collapsed, drainage channels became blocked and watercourses overflowed onto land that had taken years to reclaim. Obviously crops suffered, in particular the hemp that was an essential raw material for the Venice Arsenale shipyards and was intensively cultivated in the low-lying Padua area that was criss-crossed by such watercourses as the Gorzone, the Frassine and the Brenta.<sup>95</sup>

As far as energy sources are concerned, peat may have been the subject of various state projects and studies, and have been

championed by various 'enlightened' writers and journals of the period, but it never achieved the same economic importance as it did in the Netherlands (in part due to the poor deposits of this fuel within the Veneto). And in spite of all Simone Stratico's efforts in championing what was the key technological innovation of the late-eighteenth century, the steam-driven drainage pump made little impact here, owing to restricted finances and the consequent unwillingness of the Venetian patricians to invest in it. In effect, this failure to innovate could be seen as symptomatic of their ultimate decline.<sup>96</sup>

At an administrative level, there was an equal degree of uncertainty: in 1728 the consortia members responsible for the reclaimed land along the Brancaglia failed to achieve a quorum to vote on the most urgent work required, and thus it was the *Beni Inculti* themselves who took on responsibility for measures which were outlined in a precise Senate decree. In 1790 it was not even possible to elect Presidents for the Frassine consortium; the *Capitano* [Military Governor] had undoubtedly been correct when, a few years earlier, he had commented that land-owners were more interested in running their own estates than in carrying out the work necessary for the consortium as a whole.

If this was the case, it was inevitable that whenever they got the chance, consortium members would try to get out of paying their dues to consortium funds. The result of such 'disobedience' was the increasing debt of the consortia themselves, a phenomenon that was clear from the early decades of the seventeenth century. The remedies sought for this situation were half-hearted improvisations: the imposition of special field taxes (*campatici*), which often the communities could not pay, or the seizure of goods from the land-owners who had failed to pay their dues.<sup>97</sup> To pay for the more urgent work, the consortium often borrowed money by mortgaging land. However, if one looks at the records of those providing such loans, one finds the names of all the best-known Venetian families; in other words, those same Venetians who were unwilling to pay their dues to their particular consortium, granted mortgages which financed minimal maintenance of the hydro-geological equilibrium within the consortia areas themselves.<sup>98</sup>

The scarce political will to undertake thorough-going territorial measures throughout the plain area of the Veneto – see, for example,

the numerous unsuccessful attempts to reclaim the land of the *Valli veronesi* – went together with a clear impasse in the very technology of land drainage (which, as we shall see, also became apparent in other areas of Europe, in spite of the fundamental developments that had occurred in seventeenth-century Holland). As Simone Stratico perceptively observed, Venetian technicians knew ‘no other way of reclaiming land than through the use of embankments and internal drainage channels’.<sup>99</sup>

There is, of course, no doubt as to the historic role and importance of the Venetian nobility in the management of land-reclamation consortia: they provided the most investment; they controlled the largest expanses of land; and they acted as the representatives of the consortia in relations with the *Beni Inculti*. In fact, throughout the seventeenth and eighteenth century, the very structure of consortium management perpetuated patrician control over land reclamation and exploitation; even as late as the middle of the eighteenth century peasant farmers were not only required to dig the drainage and irrigation channels, but they were also ‘afflicted and further impoverished ... by severe special contributions in money’.<sup>100</sup> (For a long time, the payment of rent ‘in kind’ – wheat, maize, and so on – had been far from an uncommon practice). Clearly capitalism was having difficulty emerging in the countryside of the terra firma if an eighteenth-century account still mentions that, in the management of their estates, the Venetian landowners limited themselves to renting out one or two *campi* to a poor peasant-farmer who lived there in a miserable hut. At the same time, the tenants had to provide labour for the safeguard of hydraulic installations (one man for every twenty *campi*). In this very burdensome situation, ripe with potential conflict, it is no surprise if smallholders tried in every way possible to get out of the maintenance work required by the consortium – so much so that the magistrates themselves had to force the holders of large *boaria*-contract estates to undertake the urgent work on the drainage and irrigation systems.<sup>101</sup>

However, it would be historically inaccurate to describe the situation on the terra firma as one of mere backwardness. First of all, small-scale landowners continued to exist, even within consortia dominated by the aristocracy. And secondly, in the seventeenth – and even more so, the eighteenth – century, the maintenance of reclaimed land relied not only on the labour of smallholders and

tenant farmers but also involved outside contractors, who not only provided 'fair pay for the workmen',<sup>102</sup> but were also required to create the necessary infrastructures ('huts, barriers, strengthening for dams and river walls, and other reinforcement') and supply the necessary materials (wheelbarrows, shovels, ropes, nails).<sup>103</sup> Hence, the situation was more nuanced than it at first appears.

Those in power also took measures which relieved - or were designed to relieve - the harsh conditions of life that the hydro-geological imbalance caused the rural population.<sup>104</sup> Nevertheless, those living on land level with - or even below - the rim of rivers and canals often had to flee their miserable housing to take refuge on embankments or migrate to safer land.<sup>105</sup> This happened most frequently in that key area stretching from the Verona and Padua Po valley areas to the river delta and the neighbouring Ferrara; the fact that this was a border region simply added to the difficulties of taking any decisive measures to counteract the continual flooding that occurred, for example, during the latter part of the eighteenth century. And that general conditions had not improved by the turn of the nineteenth century is clear when one sees that the 18,000 *campi* of fertile land within the old Lower Gorzon consortium had gradually decayed into unhealthy marsh areas that served solely as fish farms.<sup>106</sup>

The rural population of the Padua area was not the only one to suffer in this way. In proposing reclamation schemes, mention was often made of the contribution they would make to improving health conditions - for example, as early as 1589 it was observed how the dredging and embankment of the Vallio near Treviso would not only help trade but also make the area more salubrious<sup>107</sup> - but when such schemes started to become run-down and neglected, they had the very opposite effect: by 1634 the decay of the Lugugnana reclamation near Portogruaro was said to have resulted in the creation of a swamp that was a threat to the lives of all who lived there. A century later - in 1763 - the district doctor of this latter area, Carlo Giuseppe Patrini, would note how such places as Fossalta, Villanova, Grado, Gussago and Lugugnana had a ghostly air due to the fact that the local population were gradually abandoning them. Infant mortality was high; and those who reached old age were described as 'sickly, cachectical and scurvy-ridden [...] Subject to terrible verminosis, very few of them have the strength to survive it'.<sup>108</sup>

## Notes

1. Ventura, 'Considerazioni sull'agricoltura veneta', p. 528; Pullan, 'Wage-Earners and the Venetian Economy', in *Crisis and Change in the Venetian Economy*, Pullan ed., p. 148.
2. Braudel, *Civilisation matérielle. Les jeux de l'échange*, II, p. 247.
3. A. De Maddalena, 'A Milano nei secoli XVI e XVII: da ricchezza 'reale' a ricchezza 'nominale'?', in *Rivista Storica Italiana*, 89 (1977), pp. 558-59. On the early development of capitalism in the Po valley, M. Aymard, 'La transizione dal feudalesimo al capitalismo', in *Storia d'Italia. Annali 1*, Romano and Vivanti eds. pp. 1133-34. On the relation between feudalism and the Venetian patrician class, G. Gullino, 'I patrizi veneziani di fronte alla proprietà feudale (secoli XVI-XVIII). Materiale per una ricerca', in *Quaderni Storici*, 15 (1980), n. 43, pp. 162-93. On agriculture in Lombardy, Chittolini, 'Alle origini delle 'grandi aziende' della bassa lombarda', pp. 828-37.
4. M. Aymard and G.L. Basini, 'Production et productivité agricoles en Italie (XVI<sup>e</sup>-XVIII<sup>e</sup> siècle)', in *Proceedings of the Seventh International Economic History Congress*, Flinn ed., I, p. 144.
5. On this question, see the comments in B. Bennassar, 'L'Europe des campagnes', in *Histoire économique et sociale du monde*, Bennassar and P. Chaunu eds. (P. Léon General editor), I, pp. 470-71. On the spread of Tarello's ideas, see G. Schröder-Lembke, *Studien zur Agrargeschichte*, Stuttgart, 1978, pp. 139 and 168. On the limits of the development of an 'agrarian capitalism' in Languedoc, E. Le Roy Ladurie, *Les paysans de Languedoc*, I, pp. 291-313; idem, 'Les paysans français du XVI<sup>e</sup> siècle', in *Conjoncture économique, structures sociales. Hommage à Ernest Labrousse*, Paris, 1974, p. 341. Similarly, many of the new fodder crops developed in France from 1630 onwards in the area around Paris did not become part of crop-rotation cycles. The increase in beef and dairy produce in Normandy was more a case of regional specialisation than a step towards an authentic 'agricultural revolution' (J. Jacquart, 'Traditionalismes agricoles et tentatives d'adaptation', in *Histoire économique et sociale du monde*, Jacquart and P. Deyon eds. (P. Léon General editor), II, pp. 446-47). See also Ambrosoli, *The Wild and the Sown*, pp. 163-222; J. Thirsk, 'Farming Techniques', in *The Agrarian History of England and Wales, 1500-1640*, Thirsk ed., IV, Cambridge, 1967, pp. 180-81; De Vries, *The Dutch Rural Economy*, pp. 32-33.
6. Coppola, *Il mais nell'economia agricola lombarda*, p. 44; Beltrami, *La penetrazione economica*, pp. 52-53; Poni, *Gli aratri e l'economia agraria nel Bolognese*, p. 46.
7. Tucci, 'L'Ungheria e gli approvvigionamenti veneziani di bovini', pp. 153-59; V. Zimányi, 'Venedigs Rinderimport in den Jahren 1624-1647', in *Agrartörteneti Szemle*, 14 (1972), pp. 387-97.
8. *Relazioni dei rettori veneti. Podestaria e Capitanato di Brescia*, Tagliaferri ed., XI, 1978, pp. 3-4, 10 and 97.
9. *Relazioni dei rettori veneti. Podestaria e Capitanato di Crema - Provveditorati di Orzinuovi e Asola*, Tagliaferri ed., XIII, 1979, p.75, 90 and 320. On flax/linen

- production in Lombardy, see D. Sella, 'Per la storia della cultura e della lavorazione del lino nello stato di Milano durante il secolo XVII', in *Felix olim Lombardia*, Milan, 1978, pp. 781-803.
10. In the area 'beyond the Mincio' agriculture was already more comparable to that in Lombardy than in the the Venetian Terraferma. A fundamental work on the hydro-geographical situation in the Bergamo area is *Descrizione di Bergamo e suo territorio, 1596*, edited by Giovanni da Lezze, Bergamo, 1988. See also *Relazioni dei rettori veneti. Podestaria e Capitanato di Bergamo*, Tagliaferri ed., pp. 144-45, 274-75, 450-51 and 475; *Relazioni dei rettori veneti. Podestaria e Capitanato di Crema*, Tagliaferri ed., p. 43.
  11. Ventura, 'Considerazioni sull'agricoltura veneta', p. 539.
  12. *Relazioni dei rettori veneti. Podestaria e Capitanato di Verona*, Tagliaferri ed., 22 April 1575, p. 96; Zalin, 'Economia agraria e insediamento di villa', p. 55; Beltrami, *La penetrazione economica dei veneziani*, pp. 94 e 141.
  13. E. Le Roy Ladurie and J. Goy, 'Peasant Dues, Tithes and Trends in Agricultural Production in Pre-industrial Societies', in *Proceedings of the Seventh International Economic History Congress*, Flinn ed., I, Edinburgh, 1978, pp. 118-20; Zalin, 'Economia agraria e insediamento di villa', pp. 62-64.
  14. Psbi (henceforth, unless otherwise specified, all archive references are to this series), *busta* 264, Concession 23 September 1586; *busta* 378, Concession 22 September 1595; reg. 316, cc. 28v.-29r., Concession 12 August 1589. An individual concession could envisage various different uses for the water. Such figures should, however, be treated with a certain caution because it was not uncommon for payments not to be made in full (or at all), and for concessions (once granted) not be taken advantage of. What is more, numerous unlicensed irrigation canals were opened.
  15. With regard to the rice plantation of Leonardo Donà, see Davis, *A Venetian Family and its Fortune*, p. 81; Girolamo Querini's right to run the family rice plantation was confirmed by a Senate decree of 1684: S.T., *filza* 1053, 16 December 1684. The Venetian families of the Malipiero, Corner, Loredan and Mocenigo owned particularly extensive property in the Cologna area (Borelli, 'Per una tipologia della proprietà fondiaria della villa', pp.143-44; Zalin, 'Economia agraria e insediamento di villa', pp. 74-76).
  16. *Busta* 44, 23 April 1570 and 25 May 1570; *busta* 89, 3 July 1570 and 27 June 1579; *busta* 262, 15 July 1574.
  17. *Busta* 81, Applications 13 January 1561, 16 May 1572 and 19 June 1599.
  18. *Busta* 11, Application 23 May 1570 (the concession was granted on 20 March 1568); *ibid.*, 29 November 1591, 9 March 1592 and 29 April 1592.
  19. Zalin, 'Economia agraria e insediamento di villa', pp. 70-75; *busta* 13, Lawsuit against the Bonetti by Leone Aleardi, 8 July 1561.
  20. Psbi, *Catastico of Verona*, c.36v., 29 March 1572; *ibid.*, cc. 37, 94v. and 100v., 26 May 1570, 26 February 1589, 22 April 1592; reg. 310, cc. 68r.-v., 27 March 1572; reg. 264, cc. 139r.-140v., 27 March 1572.
  21. *Busta* 9, Application 19 November 1569; *busta* 377, 5 June 1589; reg. 300, cc. 24v.-26v., 10 January 1558.

22. Borelli, 'Città e campagna in rapporto all'Adige', p. 311; *Catastico of Verona*, cit., c. 8r., 5 October 1559; c. 14v., 13 June 1562; reg. 309, cc. 111v.-112r., 22 June 1571; *busta* 376, 12 June 1584; *ibid.*, 14 May 1586; S.T., *filza* 465, Senate decree 2 January 1642. The *conferme di possesso* (recognition of ancient use rights) did not usually require payment.
23. The *brolo* was a 'field laid out for the cultivation of vegetables and perhaps with some fruit plants'; but the term might also be used to refer to a garden or park. On the *broli* in the Verona area, see V. Bonuzzi, 'Il brolo', in *La villa nel Veronese*, Viviani ed., p. 173.
24. *Catastico of Verona*, cit., cc. 4r.-133v.; *buste* 376-79.
25. Pugliese, 'Condizioni economiche e finanziarie della Lombardia', p. 30 e n.; De Maddalena, 'Il mondo rurale italiano', pp. 380-85, espec. p. 381; Faccini, *Uomini e lavoro in risaia*, pp. 36-41 and *L'economia risicola lombarda*, pp. 75-104.
26. De Maddalena, 'Il mondo rurale italiano', p. 385; C. Vivanti, *Le campagne del Mantovano nell'età delle Riforme*, Milan, 1959, p. 158.
27. Faccini, *Uomini e lavoro in risaia*, pp. 18-20; De Maddalena, 'Il mondo rurale italiano', pp. 382-83; see also the item *Acqua*, by P. Lemonnier, in *Enciclopedia*, R. Romano ed., I, Turin, 1977, pp. 181-97. Rice-farming might also use a fixed labour force.
28. *Busta* 78, Report of 20 August 1655 concerning the rice plantation of Vincenzo Righi.
29. Reg. 603, Report by the Psbi, 9 September 1655. Generally, the *Provveditori* established the costs of the water by looking at average values for quantity, at the provenance of the water (river water was always the most expensive) and the area of land involved. On average, a *quadretto* was valued at 100 ducats if used for irrigation, and 150 if used for a rice planation (at least in the 16<sup>th</sup> cent). The cost was in direct proportion to the area of the ground involved, with account also being taken of the increased productivity due to the use of the water. A *quadretto* was considered enough for between 50-100 rice-fields (*busta* 262, Report by the expert Panfilo Piazzola, 15 July 1574; *busta* 11, Report by Antonio Glisenti il Magro, 17 April 1592).
30. Sella, *Commerci e industrie a Venezia*, p. 87; De Maddalena, 'Il mondo rurale italiano', p. 383; Falcone, *La nuova, vaga, et dilettevole villa*, pp. 253-54; *Provveditori alle biave*, *busta* 34, 5 January 1672.
31. S.T., *filza* 133, Senate decree 17 September 1594.
32. Pugliese, 'Condizioni economiche e finanziarie', pp. 33-38; V. Mazzucchelli, 'Catasti e storia dell'agricoltura', in *Critica Storica*, 16 (1979), p. 325.
33. *Catastico of Verona*, cit., c. 114ff.; *busta* 378, 9 June 1595 and 37 April 1602).
34. Cf. on this point the comments in J.E. Law, 'Verona and the Venetian State in the Fifteenth Century', in *Bulletin of the Institut of Historical Research*, 52 (1979), p. 22.
35. See the Map 1, 'Variations of Terrain within the Veneto' at p. 21; *busta* 264, 'Report by the expert Bartolomeo Galese', 12 August 1595.
36. The area given over to rice was thus only 0.2-0.3 per cent of the total area of the province (Km.<sup>2</sup> 2.722) (Georgelin, *Venise au siècle des lumières*, p. 222).

37. 'Report by the expert Bartolomeo Galese', 1595, cit.
38. Georgelin, *Venise au siècle des lumières*, p. 222.
39. Beltrami, *La penetrazione economica dei veneziani*, p. 94. In effect, the *quadretto vicentino* cost in monetary terms about one-third as much as the *quadretto veronese* or *bresciano* (cf. Psbi, *Catastico of Vicenza*, c. 23v., Concession 28 June 1584 and *Report by the experts*, 12 January 1580).  
The list of these local patrician families is as long in the Vicenza area as it is in that around Verona. The investments could be quite sizeable: 1.300 ducats invested by Girolamo Schio and the Valmarana family in 1589 for 270 fields (pastureland and rice); 480 ducats by Conte Muzio Muzani for 100 fields (irrigated arable land and rice); 800 ducats by conte Girolamo Capra for 3 *quadretti* from the Zugliano canal for his 200 fields (see Psbi, *buste 376*, 377 and 378, Concessions 23 February 1589; 9 June and 18 July 1593; 13 April 1594; *Catastico of Vicenza*, cit., c. 33v., 24 May 1593 and c. 34r., 9 June 1593; reg. 306, cc. 2v.-3r., 22 March 1567). Other rich families that irrigated land included the Da Porto, Trissino, Garzadori, Franceschini, Thiene and Ghellini; whilst the Traversi, Caldogno, Godi and Loschi bought water for their rice plantations.
40. Reg. 300, cc. 7v.-8v., 8 April 1557; *Catastico of Vicenza*, cit., c. 1ff..
41. Ventura, 'Considerazioni sull'agricoltura veneta', p.537; *busta 377*, 2 August 1590; Psbi, reg. 532, c. 17r., 15 March 1589. Grimani had paid 420 ducats for one-and-a-half *quadretti* from the river Fratta, to irrigate 400 *campi* at Castelbaldo as a rice plantation. Compared to wheat, rice would long be a negligible crop in the Padua area.
42. M.C.V., Mss. P.D., C. 519/6, Applications 28 March 1590, 29 April 1589, 30 March 1590 and 4 June 1590; ASV, SEA, *busta 89*, 14 and 23 January 1573; Psbi, *Catastico of Padova, Treviso and Friuli*, cc. 3v.-4r. Between 1571 and 1604 I have found only 6 water concessions and 2 *conferme di possesso*.
43. Vergani, *Brentella. Problemi d'acque nell'alta pianura trevigiana*, pp.224-25; Psbi, *Capitolare secondo*, cc. 138r.-139v., 27 July 1572; *ibid.*, cc. 133v.-140r., 22 June, 21 and 29 July, 1 August 1572; *busta 263*, *Report by the expert Feliciano Perona*, 13 November 1595. Written in response to the Senate decree of 17 September 1594, the report by Perona provides a detailed picture of irrigation within the Treviso area.
44. Caizzi, *Aspetti economici e sociali*, p. 103.
45. Georgelin, *Venise au siècle des lumières*, p. 210; A. Pozzan, *Zosagna. Paesaggio agrario, proprietà e conduzione di un territorio tra Piave e Sile nella prima metà del secolo XVI*, Treviso, 1997.
46. S.T., *filza 182*, Senate decree 2 August 1597 and Report enclosed by the Psbi, 26 February 1597; *Report by the expert Feliciano Perona*, cit., cc. 2r.-29v.; *busta 388*, 8 May 1679.
47. *Report by the expert Feliciano Perona*, cc. 34r.-35r.; *busta 377*, Concession 20 September 1593 to G.B. Bernardo.
48. I. Wallerstein, 'Y a-t-il une crise du XVII<sup>e</sup> siècle?', in *Annales. E.S.C.*, 34 (1979), p. 133. The need to re-assess the seventeenth century has often been reiterated in the last few years: see E. Le Roy Ladurie, 'The seventeenth

- century: general crisis or stabilization?', in *Tithe and Agrarian History from the Fourteenth to the Nineteenth Centuries*, Le Roy Ladurie and Goy eds., Cambridge, 1982, pp. 120–53; G. Koenigsberger, 'The Crisis of the 17<sup>th</sup> Century: a Farewell?', in *Politicians and Virtuosi. Essays in Early Modern History*, London, 1986, pp. 149–68; H. Lehmann, 'Die Krisen des 17. Jahrhunderts als Problem der Forschung', in *Krisen des 17. Jahrhunderts*, M. Jakubowski-Tiessen ed., Göttingen, 1999, pp. 13–24; E. Stumpo, 'La crisi del Seicento', in *La Storia. L'età moderna. Stati e società*, 3, N. Tranfaglia and M. Firpo eds., Torino, 1986, pp. 313–37.
49. Braudel, *La Méditerranée*, II, pp. 950–51; B. Pullan, *Wage-earners and the Venetian Economy, 1550–1630*, in *Crisis and Change in the Venetian Economy*, Pullan ed., p. 153; Jacquart, 'Les inerties terriennes', in *Histoire économique et sociale du monde*, Jacquart and Deyon eds. (P. Léon General editor), II, pp. 351 and 356; Le Roy Ladurie and Goy, 'Peasant Dues, Tithes and Trends', in *Proceedings of the Seventh International Economic History*, Flinn ed., cit., p. 122.
  50. At the same time, there was a drop in the number of excavation projects to raise water.
  51. Psbi, *Catastico of Verona, Cologna, Vicenza, Padova, Treviso and Friuli*, cit.; buste 376–379.
  52. *Catastico of Vicenza*, cit., c. 79r. and 115r.; S.T., *filza* 241, Senate decree 17 August 1620 and *filza* 270, Senate decree 15 October 1624.
  53. Psbi, *Catastico of Verona and Vicenza*, cit.; buste 379–382.
  54. Among many others, conti Enza and Adriano Thiene – together with G.B. Valmarana – at Thiene and Schio; Girolamo and Vincenzo Garzadori; Antonio Maria Da Porto; Marc'Antonio Capra (*buste* 379–380, 28 March 1608, 28 February 1611, 26 September 1612, 14 December 1613). In the Verona area, there were the rice plantations of the Pompei (150 *campi*), the Emilei (120 *campi*), the Spolverini (99 *campi*), and the Sanbonifacio, Pellegrini, Morando, Maffei and Lisca (*Catastico of Verona*, c. 173v., 12 December 1624; S.T., *filza* 252, Senate decree 20 May 1622; *filza* 273, 17 April 1625; *Catastico of Verona*, c. 174r., 3 July 1625; *ibid.*, c. 154v., 4 April 1620; S.T., *filza* 192, 7 November 1609; *Catastico of Verona*, c. 176v., 29 November 1635; *busta* 382, 29 July 1645; *busta* 379, 19 September 1606; S.T., *filza* 182, 29 May 1607). The Donà received a concession of 40 rice-fields in Legnago in 1642, with two *quadretti* to be drawn off the Adige and then drained into the Tartaro. In 1613, the Grimani and Tomaselli paid 1,360 ducats to irrigate their properties at Spessa, S. Pietro in Gù and Ancignano, in the Vicenza area, with 4 *quadretti* from the Brenta (S.T., *filza* 465, Senate decree 2 January 1642; *Catastico of Vicenza*, cit., c. 74r.).
  55. On the vulnerability of the smaller as opposed to the larger agricultural concerns, see the fundamental study by Abel, *Agrarkrisen und Agrarkonjunktur*; on rural pauperisation, Jacquart, 'Des sociétés en crise', in *Histoire économique et sociale du monde*, Jacquart and Deyon eds. (P. Léon General editor), II, pp. 462–67.

56. M. Berengo, 'Patriziato e nobiltà: il caso veronese', in *Rivista Storica Italiana*, 87 (1975), pp. 502-3.
57. The pioneering work by G. Lombardini (*Pane e denaro a Bassano tra il 1501 e il 1799*) has been followed by few similar studies. See, however, the bibliography collected by G. Cozzi, M. Knapton and G. Scarabello in *La Repubblica di Venezia nell'età moderna. Dal 1517 alla fine della Repubblica*, Turin, 1992, pp. 527-28.
58. The cadastre in the Verona area has only eleven water concessions for the period 1627-1635, whilst there are seven for the year 1646 alone.
59. Le Roy Ladurie, 'Peasant Dues, Tithes and Trends', cit., pp. 120-22.
60. Hydraulic maintenance and safeguard work was undertaken by the comune of Cavarzere in 1650; nel *retrato* [reclaimed area] of the Gorzon, in 1663; and in the S. Giustina area in 1665 (Georgelin, *Venise au siècle des lumières*, p.370); G. Ferrari, 'La legislazione veneziana sui beni comunali', in *Archivio Veneto*, n.s., 36 (1918), pp. 39-62.
61. The concession payment is always expressed in *ducato buona valuta*, not *ducato valuta corrente*, the other form in which these public payments were given with increasing frequency during the seventeenth century. (U. Tucci, 'Convertibilità e copertura metallica della moneta del Banco giro veneziano', in *Studi Veneziani*, 15 (1973), pp. 349-51; on depreciation, see also J.G. Da Silva, *La politique monétaire à Venise*, *ibid.*, 11 (1969), p. 67).
62. For a general account, cf. H. Medick, P. Kriedte, J. Schlumbohm, *Industrialisierung vor der Industrialisierung*, Göttingen, 1977; Ciriaco, 'Venise et la Vénétie dans la transition vers l'industrialisation. A propos des théories de Franklin Mendels', in *Etudes en mémoire de Franklin Mendels*, R. Leboutte ed., Ginevra, 1996, pp. 291-318; *idem*, 'Protoindustria, lavoro a domicilio e sviluppo economico nelle campagne venete in epoca moderna', in *Quaderni Storici*, 18 (1983), pp. 57-80.
63. *Catastico of Verona and Vicenza*, cit.; buste 382-92.
64. S.T., *filza* 676, Senate decree 19 May 1670; busta 385, 28 April 1667; *ibid.*, 16 July 1667. On the basis of nineteenth-century figures regarding the Verona and Vicenza areas, Berengo argues that the best rice-fields rotated the crop yearly with clover (Berengo, *L'agricoltura veneta*, pp. 280-81).
65. Faccini, *L'economia risicola lombarda*, p.120; Mazzucchelli, 'Catasti e storia dell'agricoltura', cit., p. 330).
66. *Busta* 385, 1 April 1664; *ibid.*, 28 April 1667; busta 383, copy of the Senate decree 21 July 1656; S.T., *filza* 699, Senate decree 18 March 1662.
67. Average yield per hectare was around 848 kilos, rarely reaching 1,300. It was certainly lower than the 1,600 per hectares achieved in the Milan area in the period 1750-1800; though still double the 342-513 kilos achieved in the Verona area in the sixteenth century (cfr. M. Lecce, 'Un'azienda risiera veronese nel XVII e XVIII secolo', in Lecce, *Ricerche di storia economica medievale e moderna*, cit., pp. 125-27; Aymard and Basini, 'Production et productivité agricoles', cit., p. 143; Borelli, 'Introduzione storica' to *Relazioni dei rettori veneti. Podestaria e Capitanato di Verona*, Tagliaferri ed., p.XXVII). The richest part of the exports went northwards, spec. England

- and Holland: *Provveditori alle biave*, busta 34, 29 April 1670, 27 December 1670 and 5 January 1672; busta 35, 22 December 1693, 11 June 1695; Sella, *Commerci e industrie*, p. 88).
68. Psbi, buste 388–392; Borelli, *Un patriziato della Terraferma*, p. 313.
  69. Faccini, *La Lombardia fra '600 e '700*, pp. 236–46.
  70. For example, after 1653 the Bevilacqua ceased to rent out their land and ran it themselves (Borelli, *Un patriziato della Terraferma*, p. 76). In 1650 Francesco and G.B. Bevilacqua Lazise had already invested 400 ducats in some rice plantations at Nogarole; twelve years later, they would invest another 1,000 ducats in water and the construction of two power hammers (*Catastico of Verona*, c. 199v., 29 May 1650; Psbi, busta 384, 18 March 1662). In 1687 Ottaviano Spolverini added to the 20-campi rice plantation set up by his father Girolamo in 1678, spending 1,050 ducats to extend it to 270 campi. A good investment, as under the equally skilful management of G.B. Spolverini, the plantation would be yielding 3,000 ducats by 1745. (S.T., *filza* 1091, Senate decree 12 February 1687; Berengo, 'Patriziato e nobiltà', cit., pp. 505–6).
  71. Busta 383, 21 July 1656; busta 385, 15 September 1665 and 26 April 1668; busta 43, 16 September 1660, 29 March 1661, 20 November 1663, 26 February 1664; S.T., *filza* 967, Senate decree 26 March 1678; busta 43, 15 July 1689; busta 389, 5 September 1682; busta 391, 10 May 1691; *Catastico of Verona*, cit., c. 315r., 24 March 1685.
  72. S.T., *filza* 628, 9 August 1656; *filza* 899, 3 November 1674; *filza* 1024, 24 June 1682; ; *filza* 1024, 25 July 1682; *Catastico of Vicenza*, c. 243v., 23 February 1673; Psbi, busta 383, 9 May 1654; busta 384, 5 February 1657.
  73. B.H. Slicher van Bath, 'Eighteenth-century Agriculture on the Continent of Europe: Evolution or Revolution?', in *Agricultural History*, 43 (1969), pp. 169–70. This line of interpretation is also taken by Kerridge, *The Agricultural Revolution*, pp. 15–40; idem 'The Agricultural Revolution Reconsidered', in *Agricultural History* 43 (1969), cit., pp. 463–75. See also *ibid.*, pp. 181–83, F. Dovring, 'Eighteenth-century Changes in European Agriculture: a Comment'.
  74. Clark re-assesses the role of manual labour in English agriculture during the first part of the nineteenth century, reducing the role of that mechanisation which theoretically should be one of the linchpins in any industrial or agricultural revolution ('Productivity growth without change in European agriculture before 1850', pp. 419–32).
  75. J. Thirsk, 'Agricultural Policy: Public Debate and Legislation', in *The Agrarian History*, Thirsk ed., V/2, p. 298f.; Kerridge, *The Agricultural Revolution*, pp. 326–48; G. Garavaglia, 'Una questione mal posta ? Il ruolo delle recinzioni in Inghilterra dalla crisi del Trecento alla Rivoluzione industriale', in *Società e Storia*, 9 (1986), n.34, pp. 903–45.
  76. E. Le Roy Ladurie, 'De la crise ultime à la vraie croissance, 1660–1789', in *Histoire de la France rurale*, G. Duby and A. Wallon eds., II, Paris, 1975, p. 580.
  77. O. Ulbricht, *Englische Landwirtschaft in Kurhannover in der zweiten Hälfte des 18. Jahrhunderts. Ansätze zu historischer Diffusionsforschung*, Berlin, 1980, p.

- 52ff.; G. Schröder-Lembke, 'Englische Einflüsse auf die deutsche Gutswirtschaft im 18. Jahrhundert', in *Studien zur Agrargeschichte*, Stuttgart, 1978, pp. 103–10; Ciriaco, 'Agricoltura e agronomia a Venezia e nella Germania del nord (fine Settecento-inizi Ottocento): un approccio comparativo', in *Fra studio, politica ed economia: la Società Agraria dalle origini all'età giolittiana*, R. Finzi ed., Bologna, 1992, pp. 15–41.
78. Gullino, 'Le dottrine degli agronomi', pp. 400–7.
79. G. Bracco, 'Acque e risaie del Vercellese nel XVIII secolo', in *Agricoltura e trasformazione dell'ambiente, secoli XIII–XVIII* (11<sup>th</sup> Settimana di studio, Prato), Guarducci ed., p. 757.
80. Psbi, *buste* 393–409. This made for 2.25 per cent of the area of the province, a respectable figure. The assumption that the previous rice plantations had not been abandoned is based on the fact that authorisation usually had to be obtained from Venice when the water was no longer being put to this use. Of course, due account must be taken of the continuing fraud in such matters (on this point, see Berengo, 'Patriziato e nobiltà', cit., pp. 501–4).
81. Berengo, *L'agricoltura veneta*, p. 283.
82. Psbi, *buste* 393–409.
83. Lazzarini, *Fra terra e acqua. L'azienda risicola di una famiglia veneziana*, p. 117ff.; G. Scarpa, *L'agricoltura del Veneto nella prima metà del XIX secolo. L'utilizzazione del suolo*, Turin, 1963, specially Appendix IV, Zona XV, Basso Polesine; E. Bevilacqua, 'L'influenza dell'uomo nella costruzione del delta del Po', in *Les deltas méditerranéens*, J. Bethemont and C. Villain-Gandossi eds., Doubrovnik, 1987, pp. 271–75; M. Zunica, 'Sul filo della piena', in *Il delta del Po. Terra e gente al di là dei monti di sabbia*, Zunica ed., pp. 50–51; P. Preto, 'Dagli interessi ferraresi e veneziani allo sciopero de la boje', *ibid.*, pp. 101–10; D. Kelletat, *Deltaforschung. Verbreitung, Morphologie, Entstehung und Ökologie von Deltas*, Darmstadt, 1984, p. 114.
84. *Busta* 404 (1760–1767); *busta* 405 (1768–1775); *busta* 406 (1776–1782); *busta* 407 (1783–1788) and 408 (1789–1793); Lecce, *La coltura del riso in territorio veronese (secoli XVI–XVIII)*, Verona, 1958, pp. 36–46
85. *Busta* 404 (1760–1767).
86. *Busta* 402 (1748–1752); *busta* 406 (1776–1782).
87. *Buste* 393–409.
88. Morineau, *Les faux-semblants d'un démarrage économique*.
89. Romano, *Tra due crisi*, pp. 56–57; Cools, *Strijd om den grond*, p. 131; Smith, *An Historical Geography of Western Europe*, p. 507. Neither Romano nor the other authors cite their historical sources.
90. Psbi, *buste* 736, 741, 767, 779, 781–82, 785–86, 789, 791–92, 796, 799, 806, 809–14, 817, 819, 827 bis, 828–29, 831–32, 917; P. all'A., *buste* 259, 261, 262; S.T. 2701.
91. Berveglieri, *Inventori stranieri a Venezia (1474–1788)*; idem and A. Rossetto, *Tre secoli di privilegi veneziani (1474–1788). I casi polesani*, Verona, 1988.
92. P. all'A., *busta* 258, 3 February 1738; Psbi, *busta* 750, Report of 18 September 1787 and 11 April 1788.

93. In the nineteenth century, all this area would be described by Pietro Paleocapa as the *maremna veneta* because of the vast areas of low-lying land that it was difficult to drain (he does distinguish it from the Tuscan *maremna* for its absence of marshes, scrubland and woods): P. Paleocapa, *Parere sulla bonifica dei due consorzi padovani Gorzon medio e Gorzon inferiore*, Rovigo, 1868, p. 11; idem, *Su la condizione idrografica della maremna veneta e le bonificazioni di cui è suscettibile*, Venezia, 1848, p. 22.
94. The 'Sette Prese' consortium – covering a vast area that ran from Padua and Treviso to Asolo and Mestre – had been set up at the beginning of the sixteenth century, when the Brenta *nova* was being dug (Caporali, *Brenta vecchia*, pp. 68–74; SEA, reg. 320, 10 June 1795 and 15 March 1796; reg. 307, 2 May 1757).
95. Psbi, *busta* 735, 18 May 1735; *busta* 812, 31 May and 2 June 1772; *busta* 790, Report by the Podestà and Vicecapitano of Montagnana, 2 November 1778; S.T., *filza* 1637, Document from the Podestà and Capitano of Este, 2 April 1725.
96. P. Preto, 'La torba: un esempio del rapporto 'lumi'-territorio nel Veneto del '700', in *La Nuova Olanda. Fabio Asquini tra accademia e sperimentazione*, L. Morassi (ed.), Udine, 1992, pp. 69–74; L. Morassi, 'Un nobile imprenditore nel Friuli del Settecento. Mattoni e calcina alla 'Nuova Olanda'', in *Quaderni Storici*, 52 (1983), pp. 81–103; V. Giormani, 'La mancata introduzione della macchina a vapore nelle bonifiche dello stato veneto nell'ultimo decennio del '700', in *Studi Veneziani*, 17 (1989), pp. 157–224. It is no coincidence that many of the marshy areas would not be fully drained until after the end of the Republic, when modern steam pumps would make a decisive difference (Ciriacono, 'Le bonifiche venete alla caduta della Repubblica e al tempo di Pietro Paleocapa', pp. 317–40).
97. Psbi, *busta* 736, 20 March 1728; *busta* 781, 21 May 1699 (Consortium of Brancaglia); *busta* 790, 4 July 1778 and 8 August 1790; *busta* 794, Information on the reclaimed land of the Gorzon – undated, this is undoubtedly from the second half of the eighteenth century; *busta* 795, 2 August 1677, Appeal by the community of Monselice; *busta* 801, 4 July 1633 (Consortium of Lozzo); *busta* 804, 8 June 1696.
98. In 1749 the Frassinella consortium, in the Rovigo area, had an outstanding debt of 20,000 ducats, owed to the Venetian nobleman Bernardo Michiel since 1639: S.T., *filza* 2098, Senate Senate decree of 9 August 1749.
99. E. Bevilacqua, 'Le grandi linee di evoluzione del paesaggio agrario in territorio veronese', in *Uomini e civiltà agraria in territorio veronese*, Borelli ed., I, p. 28; S. Stratico, *Osservazione sulla necessità che ha la Repubblica di Venezia di rivolgere le applicazioni del suo governo a riordinare alcuni fiumi principali del suo stato*, place of publication unknown, 1771.
100. SEA, reg. 305, Document of the Savi, 1749.
101. Psbi, *busta* 798, Note of how much collected by Giacinto Corradin, agent of the *President of the ritratto of Lozzo*, 1687. Contractual relations of this kind are mentioned in the Gastaldia consortium at Livenza, which covered 2686 *campi* (cf. Psbi, *busta* 819, 26 August 1778). See also *busta* 745, 31 December

- 1657; *busta* 736, Report 6 May 1789 (Consortium Brancaglia); *busta* 745, 28 November 1713 (Consortium Frassinella).
102. *Busta* 794, Copy of Senate decree, 7 October 1679.
103. *Busta* 812, Auction of the Consorzio del Piavon, 27 March 1748; P. all'A., *busta* 260, Note by the Presidency of the consortium of Castagnaro, Rovigo, 18 April 1794.
104. Expression of this view by the Venetian Senate: cf. P. all'A., *busta* 260, Copy of the Senate decree 1 June 1774.
105. Psbi, *busta* 812, Report by the *Inquisitore alla sanità* Giacomo Nani, 3 June 1772; *busta* 741, Report by the Psbi, 19 September 1764.
106. P. all'A., *busta* 263, 10 March 1691; Psbi, *busta* 741, Report by the Psbi, 19 September 1764; *busta* 812, Report by the *Inquisitore straordinario alla sanità* Giacomo Nani, 3 June 1772. On Nani, see P. Del Negro, 'Giacomo Nani. Appunti biografici', in *Bollettino del Museo civico di Padova*, 60 (1971), pp. 115-22; idem, 'Giacomo Nani e l'Università di Padova nel 1781', in *Quaderni per la storia dell'Università di Padova*, 13 (1980), pp. 101-9; S.T., *filza* 2701, Senate decree 26 August 1779 and attached Document of the *Provveditori all'Adige*, 17 August 1779.
107. Psbi, *busta* 827, Copy of Senate decree 16 November 1589.
108. Psbi, *busta* 804, 3 January 1634 and 17 April 1763.