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Challenges, Knowledge and Innovation from the Early Modern Period to the Present

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1 Introduction: Teodoro Monticelli and the "Statistica"

The Abbé Teodoro Monticelli was in no doubt: the worst problems encountered in the Kingdom of Naples were closely linked to deficiencies in the management of water courses, the fault of a "Government that never did anything"[1]. Water, Monticelli argued, merited "the most serious and constant attention by any well-ordered People", but centuries of disregard were the "physical cause of our calamities and that depression in which we wallow for many centuries"[2]. This had resulted in two devastating phenomena: on the one hand, a shortage of water, which "causes vegetation and people alike to languish", and on the other hand, after the rains, the "abundance" of waters that generates marshes which, "infecting the air with their effluvia, deprive the inhabitants of their vigor and health, wretchedly shortening their lives and laying waste to entire populations"[3].

So wrote the Brindisi native, teacher and naturalist, director of the Jesuit college in Naples, the "Gesù Vecchio", and secretary of the city's Academy of Sciences, in a short work entitled *Dell'economia delle acque da ristabilirsi nel Regno di Napoli* (On the economy of the waters to be re-established in the Kingdom of Naples)[4]. Published for the first time in 1809, Monticelli's book experienced a moderate success and was reprinted three times. More pamphlet than technical manual, it explores issues of policy

1 T. Monticelli, *Sulla economia delle acque da ristabilirsi nel Regno di Napoli*, Napoli 1820, pp. VI–VII.

2 *Ibid.*

3 *Ibid.*

4 I have made use of the third edition, the most complete and containing the most extensive apparatus of notes, published in Naples during the brief experience of constitutional government, 1820–1821. On the figure of Monticelli, see F.P. De Ceglia, sub voce, *Dizionario Biografico degli Italiani*, 2012, vol. 76, http://www.treccani.it/enciclopedia/teodoro-monticelli_(Dizionario-Biografico)/, and G. Foscari, *Teodoro Monticelli e l'"Economia delle acque" nel Mezzogiorno moderno. Storiografia, scienze ambientali, ecologismo*, Salerno 2009, pp. 59–88.

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and landscape study, mixing proto-environmentalism with concerns for the state and material conditions. In the words of the political and environmental historian Giuseppe Foscari, Monticelli focuses on "the most varied questions on the subject, from public works to feasibility studies, from the management of rivers and water courses to the correct forest management, to the encouragement of new forms of cultivation"[5].

Given that Monticelli was part of a group of scholars who together compiled the chapter on the province of Naples for the *Statistica* commissioned by Joachim Murat, it makes sense to ask to what extent his ideas were reproposed in the *Statistica* and to what extent they were shared by his fellow compilers. We will do this by comparing Monticelli's own ideas with what the *Statistica* has to say about water-related infrastructure in the Kingdom of Naples, in terms of both their presence in the landscape and their working condition[6].

But first a word on the *Statistica Murattiana* itself and its interest as a historical source[7]. In 1809 Joachim Murat – French military commander, brother-in-law to Napoleon and King of Naples from the previous year – ordered a detailed survey aimed at obtaining a clear picture of the situation in the kingdom, its natural, physical, demographic, social and economic conditions. A "foundational moment of the French-Neapolitan colonial project"[8], the work was begun by the Ministry of the Interior in 1811, charging the intendants of each of the kingdom's twelve provinces (Fig. 1) with appointing a provincial editor, who would be responsible for compiling the responses to a series of questions[9]. The main themes were: 1) the nature of the soil and the climate; 2) population numbers; 3) subsistence and condition of the populace; 4) agriculture and livestock rearing; 5) trades and manufactures[10]. The *Statistica* provides a "real investigation into the conditions of the country and its inhabitants"[11], which allows us to "get to know its geographic spaces, including those little-studied, at a key moment in the passage

5 G. Foscari, *Teodoro Monticelli*, p. 90.

6 I have discussed the *Statistica* and the quality of water in the kingdom in another study, which should be seen as complementary to the present one: *"La qualità delle acque". Le risorse idriche nel Regno di Napoli agli inizi dell'Ottocento*, in E. Bini / D. Carnevale / D. Cecere (eds.), *L'acqua: risorsa e minaccia. La gestione delle risorse idriche e delle inondazioni in Europa dal Medioevo all'età contemporanea*, forthcoming.

7 D. Demarco (ed.), *La "Statistica" del Regno di Napoli nel 1811*, 4 vols., Roma 1988.

8 S. Barca, *Enclosing Water. Nature and Political Economy in a Mediterranean Valley, 1796–1916*, Cambridge 2010, p. 41.

9 It followed on from a questionnaire sent to the provinces in 1807, also by the Interior Ministry, in response to a government request to study the kingdom's water resources, but the initiative did not go very far. A. Scirocco, *La Statistica Murattiana nel Regno di Napoli: ricerche e dibattiti*, in S. Martuscelli (ed.), *La popolazione del Mezzogiorno nella statistica di re Murat*, Napoli 1979, p. VII.

10 D. Demarco, *La "Statistica": Introduction*, I, p. LIII.

11 V. Ricchioni, *La Statistica del Reame di Napoli del 1811: relazioni sulla Puglia*, Trani 1942, p. 7.

from the modern period to the contemporary"[12]. And because the question of water, and in particular hydraulic infrastructure, regarded most of the above-mentioned themes, the *Statistica* is a precious resource for understanding and evaluating the reality of water resources, their use and condition in the kingdom during a precise moment in time.

The hydraulic reality was challenging enough, in a country dominated by the Apennine mountains and rivers that were torrential in winter and dry in summer[13]. And while this reality does emerge from the pages of the *Statistica*, there are several reasons why we should not consider it an objective and factual snapshot of the situation in the Kingdom of Naples.

The first limitation lies in the structure of the survey itself, consisting as it does in a series of quite specific questions, which often elicit brief answers. Secondly, not all of the provincial editors – chosen from members of the provincial agricultural societies, clerics, teachers and doctors – were possessed of the same zeal or cultural background for the task. Moreover, the editors were dependent on their local informants and correspondents, whose task it was to provide the information (for example, on the water system) and they might reply according to their own interests, too summarily, too slowly or in disagreement with the provincial editor. Having said that, from another perspective one could argue that it is precisely these limitations that make the *Statistica* more interesting for the historian: we should regard it less as a reliably, accurate and objective survey and more as a cultural construction suited to the new political reality under French rule.

One final point is worth making: the *Statistica* is not concerned with infrastructure *per se*, but rather with the geography, environment, economy and living conditions throughout the kingdom. As a result, the questionnaire contains no single query relating to what we call "hydraulic infrastructure" on which the provincial editors were called to provide local information. And yet the information is there, even if it has to be culled from a number of distinct sections (and their relative sub-sections): physical topography (hydrography; waters: town fountains, mineral springs, rivers and streams, lakes and marshes); subsistence and diet (foodstuffs: water; public health; pathology; agriculture); manufactures (clothing: linen and hemp; wool); hunting, fishing and rural economy (agriculture [again!]; livestock farming). Moreover, the data is not always where one would expect it. Thus, much of the information concerning the provision, condition and maintenance of aqueducts, fountains, rainwater cisterns and wells – as presented in the following pages – comes from the question relating to the condition of drinking water included in the section on the subsistence and diet of the local population. Data on irrigation practices comes partly in answer to the questions on

12 E. Sarno, *Il decennio francese e la qualità della vita in una provincia del Mezzogiorno italiano: analisi geo-storica della Statistica murattiana*, in "Biblio 3W. Revista bibliográfica y ciencias sociales", 16, 2011, 908, http://www.ub.edu/geocrit/b3w-908.htm.

13 P. Bevilacqua, *Breve storia dell'Italia meridionale dall'Ottocento a oggi*, Roma 2005 [1993], pp. 32–37; L. Cafagna, *Dualismo e sviluppo nella storia d'Italia*, Venezia 1989, p. 85.

agriculture, as one would expect, but more often in response to questions on public health and pathology – because of widespread fears that stagnant waters led to disease. The same is true of information regarding linen and hemp production, because of the need to ret them for long periods in pools of water.

Fig. 1: Map of the Kingdom of Naples, showing its provinces around 1816. In: P. Allodi / F. Naymiller, *Atlante di geografia universale: cronologico, storico, statistico e letterario*, Milano 1865 (unpaginated).

2 Notions of decay in Monticelli and the "Statistica"

In his essay on the economy of the waters, Monticelli expresses a perception widely shared by the different provincial editors: the decay of water-related infrastructure when compared to those of antiquity and the neglect of waters resources more generally, with devastating effects on the entire economy. It was part of a widespread view of the kingdom's decline already voiced by key exponents of the Neapolitan Enlightenment in their late-eighteenth-century studies of the landscape, environment and economy, such as Giuseppe Maria Galanti, Giuseppe Palmieri and Francesco Longano[14]. As Monticelli would also do, they had proposed solutions: a "restoration" of ancient glories, in order to bring "nature" and "nation" back together in the life of the kingdom[15]. It was a political economy that mixed history, geography and Arcadian myth, as Stefania Barca has said of Galanti's *Descrizione*[16]. Escalating population made the decay in infrastructure all the more evident, putting increased pressure on the competition for scarce resources[17].

For Monticelli, when it came to a well-ordered and attentive management of the waters, the point of reference was the ancient Greeks. They "created" reservoirs and aqueducts, "abhorred" stagnant waters and "showed sacred respect" to forests[18]. But the successive conquests of Magna Graecia and Samnium by the Romans brought only ruin. (Monticelli's judgement here is strangely negative, "summary and contradictory"[19], but he is following Galanti's lead here.) From the Saracens onwards follows a litany of disasters, especially along the coasts which become marshy and unhealthy[20]. As Monticelli comments in an aside, "the limits of this essay do not allow me to list the ruins and remains of so many aqueducts, canals, wells and thermal baths, which can nevertheless be quite easily noted in our ancient cities, even if they are largely in decay"[21] (Fig. 2). Monticelli details the harm done to the kingdom's

14 G.M. Galanti, *Della descrizione geografica e politica delle Sicilie*, ed. by F. Assante / D. Demarco, Napoli 1969; G. Palmieri, *Riflessioni sulla pubblica felicità relativamente al Regno di Napoli e altri scritti 1787–1792*, ed. by A.M. Fusco, Roma / Bari 1991; F. Longano, *Raccolta di saggi economici per gli abitanti delle Due Sicilie*, Isernia 1988, and *Viaggio per lo contado di Molise nell'ottobre dell'anno 1786*, ed. by R. Lalli, Isernia 1980.

15 S. Barca, *Enclosing Water*, pp. 16–25.

16 *Ibid*., p. 23.

17 On this link, see A.F. Saba, *L'allocazione delle acque dolci fra teoria e storia*, in L. Mocarelli (ed.), *Quando manca il pane. Origini e cause della scarsità delle risorse alimentari in età moderna e contemporanea*, Bologna 2013, pp. 57–58.

18 T. Monticelli, *Sulla economia delle acque*, p. 6.

19 G. Foscari, *Teodoro Monticelli*, p. 103.

20 T. Monticelli, *Sulla economia delle acque*, p. 10.

21 *Ibid*., p. 79.

coastlines and the resulting economic decline, as with regard to his native Brindisi[22]. Curiously, he does not discuss provinces like the Abruzzi which in his own time still possessed examples of sophisticated, imposing and largely functioning hydraulic infrastructure (as remarked upon both by local historians[23], as well as the provincial editors of the *Statistica* for the Abruzzi provinces, as we shall see below). Rather, Monticelli's interest in the mountainous parts of the kingdom is limited to the problem of deforestation and the resulting floods[24].

Fig. 2: Taranto's ancient aqueduct as picturesque ruin. Watercolor by the Swiss artist and engraver Louis Ducros, from his album *Voyage en Italie, en Sicile et à Malte*, 1778. Rijksmuseum, Amsterdam.

Given this, how does the *Statistica* compare? In Nola (Terra di Lavoro), for instance, fresh water is drawn from wells and rainwater cisterns, but "in ancient times the *Nolani* were much more attentive to the provision of good water", according to the provincial editor Francesco Perrini, cathedral canon in Capua and corresponding member of the agricultural commission[25]. With regard to the towns of S. Apollinare and S. Ambrogio he

22 *Ibid.*, p. 18.

23 C. Ciccarelli, "Storie locali nell'Abruzzo di età moderna (1504–1806)". Unpublished PhD thesis, Università degli studi di Udine, 2010/11, pp. 38, 307.

24 T. Monticelli, *Sulla economia delle acque*, p. 25.

25 D. Demarco, *La "Statistica"*, IV, p. 151.

remarks that "if one could revive the genius of the beautiful ancient aqueducts, it would doubtless bring the greatest of benefits"[26]. Such is the awe with which the editors tended to regard the Ancients that even natural features are attributed to their handiwork, such as the *vore* of Terra d'Otranto: "large pits, partly opened up by nature and partly the work of ancient inhabitants [. . .] which devour the waters"[27]. Monticelli likewise regarded it as "not likely" that the *vore* were natural in origin, rather providing "yet another argument in support of the concern of our betters to avoid mephitism"[28].

In the case of Basilicata it is the lack of waterworks or their state of abandon that most strikes the provincial editor, the lawyer Giulio Girolamo Corbo. This is true in Viggiano, where

> in the summer [water] is often lacking and it is necessary to search for stagnant water far away, which has none of the qualities of potable water; whereas with a small outlay the channel could be restored which would bring most abundant water, as it formerly did, from a distance of one kilometer from the town, which has all potable qualities[29].

At the town of Stigliano "the ancient reservoir, which was well built, is abandoned; [the water] comes via discontinuous and poorly maintained channels, so that it arrives turbid, especially during the rains"[30]. The same at Tursi, where

> there is an abundant spring that has its origins in sandy soil and which would therefore have all potable qualities if extraneous materials were not occasionally immersed in it producing putrefaction; it should be blocked and the water allowed to flow through pipes[31].

Other provincial editors indicate examples of insufficient maintenance, such as in Venafro (Terra di Lavoro), where the fountains provide waters that are "certainly the province's most limpid and good, and yet the basins are so poorly kept that they cause disdain to look at"[32]. If the province of Abruzzo Ultra II can boast impressive water works, as we will see below, in other places, as in the district of Achillopoli, the aqueducts "are propped up and poorly kept [. . .] indeed tumbledown and decayed for a long stretch", while in Manforno "the Fontacciano aqueduct is more or less ruined"[33].

26 *Ibid.*, IV, p. 182.

27 *Ibid.*, II, pp. 148–149. V. Manghisi, *Leggende carsiche salentine*, Castellana Grotte 1981, http://www.salogentis.it/2009/04/30/le-vore-di-barbarano/.

28 T. Monticelli, *Sulla economia delle acque*, p. 45, note 26.

29 D. Demarco, *La "Statistica"*, III, p. 92. By "potable qualities", the editors have in mind the definition suggested by the *Statistica* itself, which they often repeat word for word in their reports: "perfectly limpid, without odor, of lively and fresh flavor, pleasant, easily and readily boiled without becoming cloudy, able to cook legumes well without turning them to mush, able to dissolve soap completely and consistently, of easy passage through the stomach and favorable to the digestion of other foods".

30 *Ibid.*, III, p. 161.

31 *Ibid.*, III, p. 195.

32 *Ibid.*, IV, p. 209, note 2.

33 *Ibid.*, I, pp. 54–55.

At Volturara (Capitanata) the waters "are spoilt for a long stretch by the conduit which is in bad repair"[34].

Meanwhile in the kingdom's capital, the problems are *sui generis* given the unique nature of the city's ancient underground water system[35], and occur primarily when water enters these subterranean spaces, causing "alterations" in water quality. According to the provincial editors, one of whom was Monticelli:

> The inappropriate architectural construction of the water reservoirs close to sewers and washbasins, as well as the underground aqueducts that cross one another or are adjacent, with filthy conduits, sometimes broken and these not well plastered, often results in the depositing of a slime of vegetable and animal substances at the bottoms of the said reservoirs, which steeping there give off noxious gases and provide a nesting ground for the eggs of numberless insects, with the waters becoming foul smelling, tepid, turbid and disgusting[36].

3 Hydraulic typologies

In fact the water resources available to local populations in the kingdom vary widely from province to province, as well as within single provinces, depending on a range of factors, from physical (geography and geology) to infrastructural. In those areas where sourcing water for human use does not present particular difficulties and the needs are fairly limited the infrastructure is correspondingly basic. "All the province makes use of spring waters, having fountains in abundance", according to the editor of Calabria Citeriore[37]. The same is true of Calabria Ulteriore, where springs are likewise abundant so that it is enough "to place gutters made from tree trunks or large leaves into the crevices in the rock to make it possible to draw water into pitchers"[38]. In Sant'Angelo le Fratte (Basilicata), "the fountain near the town, with most abundant water, gushes up out a pile of stones, is collected into a masonry container and from there flows into a basin through a covered channel"[39]. Some of the towns in Abruzzo Ultra II "make use of very pure spring waters, but which lack purpose-built fountains, and draw their water from the natural fountain where it springs forth"[40]. Elsewhere there is more

34 *Ibid.*, I, p. 393.

35 D. Gentilcore, *Cool and Tasty Waters. Managing Naples's Water Supply, c. 1500–c. 1750*, in "Water History", 11, 2019, 3, pp. 125–151.

36 D. Demarco, *La "Statistica"*, IV, pp. 26–27. Monticelli's fellow authors for the contribution on the city of Naples were Melchiorre Delfico (councillor of state), Giovanni Battista Gagliardo (agronomist), Luigi Petagna (zoologist) and Michele Ferrara (chemist). D. Demarco, *La "Statistica": Introduction*, I, pp. LXXIX–LXXX.

37 *Ibid.*, II, p. 313.

38 *Ibid.*, II, p. 534.

39 *Ibid.*, III, p. 113.

40 *Ibid.*, I, p. 50.

artifice, as in Lauria (Basilicata), where the water "gushes out of a boulder and is channeled into a covered conduit, from which it flows through various iron pipes into a chiseled stone basin"[41]. The nature of water fountains differs from town to countryside, for instance in Calabria Citeriore. Here the fountains in town are generally built in the following manner: "through underground conduits, almost all imperfect, the water flows from the spring into a limewashed container commonly called a *botte*. The water is extracted via a small pipe of bronze or iron located at the bottom". In the countryside, by contrast, "only on rare occasions does artifice embellish the gifts bestowed by nature: a small concave piece of wood, resting on a rock, offers the water to those who go to draw it"[42].

Elsewhere in the kingdom the hydraulic infrastructure is much more sophisticated and impressive, in the views of the provincial editors themselves. The aqueduct supplying Aquila "is truly remarkable", according to the editor of Abruzzo Ultra II[43], while Leonessa's "is due to the magnificence of Marguerite of Austria, duchess of Parma", he adds in historical vein[44]. The town of Faicchio (Terra di Lavoro) "has a noteworthy aqueduct, which is probably of Roman construction"[45] and the province of Terra d'Otranto possesses several remarkable aqueducts, according to the provincial editor, like Gallipoli's, which feeds "a fountain located at the entrance to bridge which unites it to the continent", the Fontana Greca[46] (Fig. 3).

On the island of Ischia (province of Naples) "there are also good flowing waters which gush out of volcanic rocks and flow via well-constructed aqueducts, covered and fully maintained, and from the distant springs reach the inhabited area"[47]. And in the capital itself what strikes the editors is the "surprising branching out of the waters of the Carmignano and Bolla", the two aqueducts which together supply Naples (the former dating from the seventeenth century and the latter ancient in origins): "surprising" because they flow underneath the urban space "by means of underground conduits, plastered internally and paved". "In most houses", the editors continue, access to these waters is via "the so-called *formali* [. . .] large basins for the flowing waters" which are "square in shape [. . .] [and] built entirely of stone"[48].

Needless to say, not all towns in the kingdom have the advantage of being able to access their water by impressive aqueducts or natural springs and so have to adopt a

41 *Ibid*., III, p. 174.
42 *Ibid*., II, p. 331.
43 *Ibid.*, I, p. 53.
44 *Ibid.*
45 Other towns of the district "have channeled the waters flowing down from the mountains [. . .] but the aqueducts are poorly maintained, so that the water is polluted by animals and waste", *ibid*., IV, p. 106.
46 *Ibid.*, II, p. 155.
47 *Ibid.*, IV, p. 25.
48 *Ibid*., IV, p. 26.

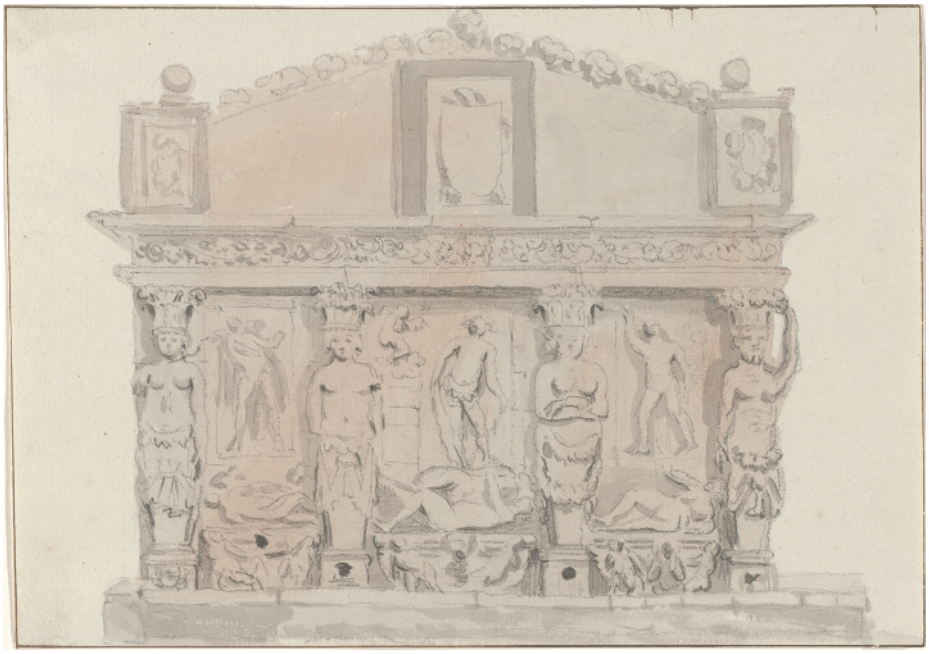

Fig. 3: The "Fontana Greca" in Gallipoli. Watercolor by Louis Ducros, *Voyage en Italie, en Sicile et à Malte*, 1778. Rijksmuseum, Amsterdam.

strategy of double or triple provision, according to available resources. Thus the town of Calvello (Basilicata) has recourse to a mixed supply system in order to eke out a meager water supply, relying on "spring water, river water and sometimes rain water"[49]. Even the capital (Italy's largest city) is forced to rely on mixed water provision. "For the most part" Naples depends on "the good flowing waters" of the two aqueducts just mentioned, but these are unable to supply the whole city. Thus "in the mountainous part of the city [. . .] rainwater and springs are used, the latter found in the depths of wells dug out of the tuff rock, and rainwater fountains [*fontane di acque di distilli*]"[50].

In this case, the comments provided by the *Statistica* can shed light on debates over the relative reliance on rainwater cisterns or groundwater wells in different regions of Europe. It has been suggested that in medieval Italy, rainwater cisterns were more common than dug wells[51]. Apart from the difficulty posed by terminological imprecision in the records, with words like "well" and "cistern" often used interchangeably, was this also the case during the early nineteenth century? Can we also conclude

49 *Ibid*., III, pp. 83–84.

50 *Ibid*., IV, p. 23.

51 P. Squatriti, *Water and Society in Early Medieval Italy, AD 400–1000*, Cambridge 1998, pp. 23–32.

that rainwater cisterns predominated in drier southern Europe whilst wells were more common in wetter northern Europe?[52]. For instance, in Terra d'Otranto "it can be reckoned that half of the population [. . .] makes use of rainwater, and half of spring wells", the former primarily in towns, the latter mostly in the rural areas[53]. In many areas of the kingdom dug wells supplement other forms of water provision by necessity. The towns of the province of Naples are especially reliant on groundwater wells, where "they are normally cylindrical in shape, dug into the tuff bedrock or into the ground and entirely lined with cement from the opening down to the spring at the bottom"[54].

Rainwater cisterns provide a vital type of hydraulic infrastructure, though this is truer in some areas of the kingdom more than in others. Thus in mountainous areas, as in the Aquino valley (Terra di Lavoro), rainwater basins are rare and serve only "for washing clothes and watering animals"[55]. Nor are they very widespread in Calabria Citeriore, where they appear to be a casual, semi-permanent feature, "consist[ing] of basins made of cement, built into the earth, covered with boards and then flat tiles, supported by two columns raised above the top of the basin"[56]. By contrast, in the low-lying, less water-rich provinces of the kingdom – namely Terra d'Otranto, Terra di Bari and much of Capitanata – rainwater cisterns are essential. Some of these cisterns are suitably ancient, like "the famous fountain of Manduria", according to the laconic remark of the provincial editor[57]. Monticelli provides the details, noting that "the fountain of Manduria, praised by none other than Pliny, is a large underground reservoir which captures rainwater and provisions that ancient and celebrated city"[58] (Fig. 4).

In fact, when it comes to the potential of rainwater capture Monticelli is unreservedly enthusiastic – not surprising, perhaps, given his own origins in Brindisi (Terra d'Otranto). For those places which "do not enjoy the benefits of spring waters or rivers", rainwater cisterns provide an ideal solution, since "there is no place without the benefit of more or less abundant rains, which if captured with diligence can meet the needs of a large population"[59]. For Monticelli, it is a question of carefully capturing it, and if the roofs of houses are not sufficient for the purpose, one captures the waters of torrential rivers and marshes, as the ancients did[60]. And as regards "that vast and arid plain" of the towns of Foggia, Cirignola and Lucera (Capitanata), he proposes the digging of large

52 D. Alexandre-Bidon, *Archéo-iconographie du puits au Moyen Âge (XIIe–XVIe siècle)*, in "Mélanges de l'école française de Rome. Moyen-Âge", 104, 1992, 2, pp. 519–543.
53 D. Demarco, *La "Statistica"*, II, pp. 171, 154–155.
54 *Ibid*., IV, p. 26.
55 *Ibid*., IV, p. 78.
56 *Ibid.*, II, p. 331. Curiously, they are known locally as *pozzi*, wells.
57 *Ibid*., II, p. 173.
58 T. Monticelli, *Sulla economia delle acque*, p. 76. Known today as the "Fonte Pliniano", after its description by Pliny the Elder in his *Natural History*, it is located at the entrance to the Parco Archeologico delle Mura Messapiche.
59 T. Monticelli, *Sulla economia delle acque*, p. 80, note 35.
60 *Ibid.*, pp. 81–82 n.

Fig. 4: The "Plinian Fountain" in Manduria. Watercolor by Louis Ducros, *Voyage en Italie, en Sicile et à Malte*, 1778. Rijksmuseum, Amsterdam.

water reservoirs, which would serve "not only for the ordinary uses of men and animals, but also for irrigation"[61].

How do Monticell's suggestions for rainwater capture compare with the observations made by the provincial editors of the *Statistica*? Inhabitants in the towns of Terra di Bari are reliant on rainwater captured "from the roofs and terraces of their own houses, and conducted by means of earthenware pipes down to *wells* dug beneath the houses' foundations"[62]. Here the editor, the agronomist Vitangelo Bisceglie, italicizes the word "wells" (*pozzi*), as if to highlight what he considers the inappropriate local usage (in place of "cistern"), and goes on to describe them as "large chambers or galleries deep in the rock rising up to ground level"[63]. Unfortunately, the quality of the water "is not of the purest [. . .] because the roofs and terraces are not always kept clean of rubbish and the conduits often become blocked". To remedy this, better off families have their *conserve*, "that is, small wells which draw off water from larger ones after the water has deposited earth and other extraneous matter". Despite these "minor limitations, the rainwater collected in these domestic reservoirs enjoys all the

61 *Ibid.*, p. 88 n.
62 D. Demarco, *La "Statistica"*, II, pp. 38–39.
63 *Ibid.*, II, p. 10.

qualities of good potable water, after it has been 'beaten', which is to say shaken, to rid it of foreign matter"[64].

The same is true of Terra d'Otranto. The provincial editor – the medical student Oronzo Gabriele Costa – bemoans the loss of important sources of domestic water in Lecce, an unforeseen effect of the Napoleonic reforms under the French regime, "with the abolition and limiting of the monks and friars the population has lost a great amount of rainwater, and of the most excellent quality"[65]. In Lecce only rainwater from rooftops is allowed into domestic cisterns, but elsewhere, such as in "Massapia [Mesagne] and in a few other towns, not only water from rooftops is allowed down into the cisterns but also the water that runs on the dirty and muddy streets of the town itself"[66]. This is obviously an undesirable practice, the editor comments, but it is in response to a precise need, given that "the rooftop of a small house can never be enough to capture a lot of water [. . .] and so the need to collect it from elsewhere"[67].

In the countryside of the southern Gargano (Capitanata) the inhabitants depend on water captured in so-called *piscine* (pools), which "receive water not from the roofs of houses but from public country roads", with the result that their water "is ordinarily turbid and muddy and barely suited to watering animals". Nor are they even effective, according to the same editor, given that "based on precise calculations, it is apparent that it requires at least five *linee* of water to saturate the country roads, such that if in a day seven *linee* of rain fall, only two remain for the benefit of the pools"[68]. It is the same case in the town of Gravina (Terra di Bari), where water is collected "from the streets"[69], a practice even more common in the rural areas of the province, where "a long time ago the practice began of building cisterns outside towns, at a lesser or greater distance" which "receive water from the streets, always full of dust and earth, of excremental and vegetable waste in decomposition" and from which "people and animals drink"[70].

The technologies for water provisioning vary according to the circumstances, making the most of local topographical realities to capture precious rainwater. The editor for Terra d'Otranto refers to the presence of a typology of "cistern of characteristic structure" for rainwater capture in the countryside, found "in Martano, Castrignano and other places": "these are dug out of a concave layer of clay, more or less at depth, conical in shape and covered in undressed stone" and "into which water drips, filtered

64 *Ibid.*, II, p. 39.

65 *Ibid.*, II, pp. 172–173. F. Mineccia, *Soppressione degli enti religiosi e liquidazione del patrimonio ecclesiastico nel Regno di Napoli (1806–1815)*, in "Itinerari di ricerca storica", 26, 2012, pp. 71–92.

66 D. Demarco, *La "Statistica"*, II, p. 172.

67 *Ibid.*

68 *Ibid.*, I, p. 390. The *linea* was a unit of measurement used in the kingdom.

69 *Ibid.*, II, p. 10.

70 *Ibid.*, II, p. 40.

through the clay-stone layer" or else "into which rainwater is channeled from the ground above"[71]. As to quality, "the water keeps very well"[72].

Although the editor does not name them, he is describing the *pozzelle* of the Greek-speaking part of Salento, small stone-built underground reservoirs built into Karst-like depressions, into which precious rainwater would filter and collect[73]. Similarly, in the Gargano plain (Capitanata), at Cagnano, the water "drips down into a small oblong basin; but it is of good quality"[74]. Nearby in Manfredonia, the lack of "spring water forced the ancient inhabitants to construct pools there, that is public rainwater reservoirs", the rain coming in "great storms from the northeast in torrents from the heights of the Gargano", then flowing "through a tortuous channel from the foot of the mountain towards these basins", the channel itself being three miles in length and "dug into layers of earth and rock of calcium carbonate"[75]. Finally, near the town of Rossano (Calabria Citeriore), near the sea, located "on a boulder surrounded by other crags", "because of the lack of spring water, rainwater is normally used, drawn basins commonly known as *wells*, kept clean and with care"[76].

Nothing is wasted in any case. Even brackish water gets used, whether to "water the vegetables" or for various "domestic uses", and "when the animals are accustomed to it they will drink it, if the salt content is not too high" (Terra d'Otranto)[77].

4 Water improvement techniques

To remedy limitations in water quality there exist various methods for improving it, according to our provincial editors. In the province of Molise, newly created in 1806[78], rainwater destined for cisterns "is captured in the eves troughs and filtered by passing either through silica sand or small round calcareous stones collected from rivers"[79]. Likewise in Oriolo (Calabria Citeriore), "the waters are filtered through sand and the reservoirs are cleaned often"[80]. The same technique is employed in Lecce (Terra d'Otranto);

71 *Ibid.*, II, p. 171.
72 *Ibid.*, II, p. 155.
73 A. Chiga / P. Durante / S. Giammaruco (eds.), *Conservare l'acqua. Le Pozzelle di Zollino tra memoria storica e indagini scientifiche*, Lecce 2015.
74 D. Demarco, *La "Statistica"*, I, p. 390.
75 Unfortunately, "the water when it comes is quite cloudy, of unpleasing taste, unable to wash soap away, not easy to boil, very heavy on the stomach and slowing digestion", *ibid.*, I, pp. 391–392.
76 *Ibid.*, II, pp. 330–331.
77 *Ibid.*, II, p. 173.
78 A. Spagnoletti, *Territorio e amministrazione nel Regno di Napoli (1806–1816)*, in "Meridiana", 9, 1990, pp. 86–87.
79 D. Demarco, *La "Statistica"*, I, p. 292.
80 *Ibid.*, II, p. 330.

in addition to which, "the comfortable and better off [. . .] do not allow the rainwater from summer and early autumn storms into their cisterns, but let it flow away by other conduits into the streets"[81]. In the Gargano (Capitanata) "a very few houses" have basins known as *purgatoi* "which rid the rainwater of foreign substances before it passes into the cisterns"[82].

In the Arienzo valley (Terra di Lavoro) the "cisterns are spherical in shape, in the middle of which is a small well, where all the extraneous substances and dissolved earths are deposited"[83]. In Abruzzo Ultra the cisterns "are cleaned with sponges and pebbles" (although the editor bemoans the small number of cisterns in the province, "found only in monastic cloisters and in the occasional private house"[84]). Another method, reported for Abruzzo Citra, is "to put live fish of the goatfish species in the cisterns, which purify the water, both because they eat the insects and other substances analogous to their normal diet and because their continuous motion keeps the water uncorrupted, helping to mix air particles into the water"[85]. In Miglionico (Basilicata) the inhabitants believe that the cistern water "is kept entirely pure by the movement made in drawing it"[86]. Evidently, this is not always enough. In the provinces of Terra di Bari and Terra d'Otranto "when [cistern water] assumes a bad smell, mastic branches are immersed into them"; unfortunately, "only seldom is this successful"[87] since the practice can only "hide the natural fetor of these waters"[88]. Another practice in such situations is to toss quicklime into the cistern[89].

When it comes to the quality of well water, in the province of Molise the waters "are purified by rest alone, which sometimes lasts a long time"[90]. When the well water is low, in Abruzzo Ultra, the wells "abound with small eels or other tiny red worms", the solution to which is to toss quicklime into them, believing that this will kill them. "And this is usually the effect", according to the editor[91].

In addition to this, it was common practice in the Kingdom of Naples, as throughout Europe, to store water in large earthenware vessels for household use. Not only was the water easily accessible, but "resting" it in this way allowed "foreign elements" to settle to the bottom as "sediment"[92]. In Calabria Citeriore – but probably everywhere – "the

81 *Ibid.*, II, pp. 154–155.
82 *Ibid.*, I, pp. 389–390.
83 *Ibid.*, IV, p. 146.
84 *Ibid.*, I, p. 13.
85 *Ibid.*, I, p. 210.
86 *Ibid.*, III, p. 129.
87 *Ibid.*, II, p. 10.
88 *Ibid.*, II, p. 172.
89 *Ibid.*
90 *Ibid.*, I, p. 292.
91 *Ibid.*, II, p. 10.
92 *Ibid.*, I, pp. 51–52.

jars (*giarre*) used for water" are made locally out of clay "which is the only earth used in their manufacture"[93]. The editor for Calabria Ulteriore goes further, suggesting that those dwelling along the costs use actual "filtering vases", "to purify their waters full of clay particles and stink of silt, as used by those living along the banks of the Thames"[94].

Even where local water quality is perceived as good by the editors, the fact of not treating it in any way is seen as a negative social indicator. Thus, in the words of the editor for Abruzzo Ultra II: "Nowhere in the province is there the practice of filtering the water before drinking it, whether out of laziness or ignorance of how to do it"[95]. The editor, with reference to the sulfurous water of the town fountain in Antrodoco, notes how "it is amazing that the town continues to use this water, when with not much expense it could supply itself with better potable water"[96].

But as the editor for Abruzzo Citra states, "if nature does not fatefully provide water good for digestion and suitable for other economic uses, generally the water is used as it springs forth, whether out of ignorance or to avoid the bother of filtering it artificially"[97]. The inhabitants of Villalago (Abruzzo Ultra II) are likewise criticized for their habit of drawing their water from a spring of Lake Pio, "and since dirty clothes are washed in the lake and all the town's rubbish ends up there, so the said spring also remains infected". And yet, as the same editor tells us, "Villalago has another fountain of good water which is called *della frescura*"[98]. Rather than a question of poor judgement, it is just as likely that the inhabitants are simply employing the two waters for different purposes.

The editors make a similar social criticism of the perceived laziness of the locals when it comes to sourcing their water, preferring poor-quality water that is close by to better water further away (I wonder how often the editors had to draw and carry their own water). Thus the editor for Terra d'Otranto, commenting on Galatina and Massafra, notes how "in town, the spring water is either bad or not very good, and in the surrounding country there is excellent water but at a distance of a half or full mile, and naturally the inhabitants drink the bad water and ignore the good"[99]. Similarly, the editor for Abruzzo Citra reports:

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93 *Ibid*., II, p. 504.

94 *Ibid*., II, p. 534.

95 Mind you, the editor contradicts himself just a few sentences later, commenting on how, with regard to the water of Lake Fucino, "there is no practice other than filtering it if it is cloudy or allowing it to rest and settle in wooden vessels". And the solution to water quality he proposes merely consists in "immersing a red-hot poker into it before drinking, in winter, and in summer dosing it with a small amount of mineral acid or larger amounts of vegetable acid". *Ibid*., I, p. 50.

96 *Ibid*., I, p. 51.

97 *Ibid*., I, p. 211.

98 *Ibid*., I, p. 51.

99 *Ibid*., II, p. 173.

> If it happens that in some towns use is made of water that is less healthy and more than often sludgy [*molle*] because full of clay, this is due to the laziness of the inhabitants who, to avoid having to draw it in faraway places, content themselves with threatening their health by using water which is full of harmful substances, only because it is close by[100].

5 Hydraulic hierarchies: multiple uses and privileged access

In the province of Naples more generally "all the perennial waters gushing out of the valleys in the branch of the Apennines are channeled from their point of origin and through stone conduits, mostly uncovered, arrive in the towns, where they serve for domestic uses and to power mills, and then the residual waters flow out at the sea"[101]. Communities practice a distinction between different water quality and uses. For instance, in Bolognano (Abruzzo Citra), "the townsfolk judiciously water the animals and other less important uses, reserving the good potable water, although distant, for drinking and the cooking of food"[102]. In the town of S. Marco in Lamis (Capitanata), where "they drink rainwater", "the cisterns are uncovered in the countryside and covered in town", and "the waters of the former are destined for the watering of animals, those of the latter for human uses"[103]. Different waters are used for different purposes, as in Potenza (Basilicata), where the inhabitants distinguish between "drinking water", "which is fountain water [. . .] and [which] is believed to possess all potable qualities", and water reserved "for cooking and other household uses", "for which they use the water that gushes into wells dug at a certain depth in town"[104]. Elsewhere, such distinctions are made more out of necessity, as in the towns of Schiavone di S. Felice, Ripalda and Montemitro (Molise), where "the waters are so bad, so little potable [. . .] that the [inhabitants] are forced to limit and reserve the only well providing mediocre water they have for the use of the sick"[105].

In contrast to this, at the other end of the spectrum, the editors elsewhere criticize a promiscuous use of water. In places where the only sources of water are "open fountains built like watering troughs", "people dip their hands in along with water pitchers of either wood or copper to draw water" and "animals also drink from them and sometimes water is also drawn there for the washing of dirty clothes"[106]. In Calabria Citeriore river water is reserved for animals and, "given their abundance, the

100 *Ibid.*, I, p. 210.
101 *Ibid.*, IV, p. 28.
102 *Ibid.*, I, p. 226.
103 *Ibid.*, I, p. 391.
104 *Ibid.*, III, pp. 68–69.
105 *Ibid.*, I, p. 299.
106 *Ibid.*, I, pp. 53–54.

owners of animals have not seen the need to build troughs and basins specifically for their use"[107]. The same is true in Principato Citeriore, where "waters are normally springs or flowing streams"[108].

But not everything is always as it seems. In Molise, the provincial editor Pepe – reformer, essayist and agronomist – tells us, "the people are not very careful in their choice of drinking water: they take it where they find it". And yet elsewhere in his report the editor notes that "to cook his legumes the peasant goes in search of cooking water, which easily soften them, waters which the people in local dialect call *cocevoli*"[109]. The fact that the local inhabitants not only went in search of such waters but had a specific word to indicate them, suggests they made evident distinctions regarding water use and were perhaps more "careful" than the editor was aware.

As this suggests, everywhere water is an essential resource, subject to a multiplicity of uses – sometimes complementary, sometimes in competition with one another. By way of example, the mineral spring "called the water of Crassano" (Terra di Lavoro), gushes out "in such quantity [. . .] that as soon as it appears from a chasm it powers a mill", after which, "in the summertime many people come here to use its waters, internally and externally" (that is, drinking and bathing in it), and then last, "linen and hemp are retted in its waters, acquiring an extraordinary whiteness"[110].

Water was not only necessary for life, for drinking and other domestic uses; in the form of flowing water it was also the most reliable source of power available to communities, as well as having other uses in industry and agriculture. But the supply was limited and so had to be portioned out. As a result, there was a hierarchy of water use, more or less regulated by local authorities. Each use had different, often competing, needs in terms of water power, volume/reliability, and quality. Thus, water for drinking and other domestic uses, such as cooking and laundry, needed purity; irrigation of agricultural land and retting of linen required reliability of supply above all. Reliability was also crucial for milling uses – grain, silk, fulling, paper, wood – although even more important was the force of water[111].

These competing needs for limited resources lead to a hydro-politics of a sort at the local level, only implied in the comments of the provincial editors. For example, even where significant infrastructure works have been undertaken, these can have a negative impact at the local level. A community may lose its waters when these are conducted elsewhere, given that the kingdom's hydro-politics privileges the city over

107 *Ibid.*, II, p. 359.
108 *Ibid.*, IV, p. 607.
109 *Ibid.*, I, p. 300.
110 *Ibid.*, IV, p. 106.
111 A. Guenzi / C. Poni, *Un "network" plurisecolare: acqua e industria a Bologna*, in "Studi storici", 30, 1989, 2, pp. 359–377; S. Ciriacono, *L'eau comme enjeu économique: l'irrigation entre époques anciennes et l'époque modern*, in S. Ciriacono (ed.), *Eau et développement dans l'Europe moderne*, Paris 2004, pp. 1–34.

the countryside. Acerra (Terra di Lavoro), whose nearby lake is the source of the Carmignano aqueduct which supplies the kingdom's capital, and which "passes by near the town", finds itself not benefitting "in any way" from it[112]. One part of a city may deprive another of water, especially when the former is the site of an important royal palace. Thus "old Caserta is entirely without water", according to the editor of Terra di Lavoro, because "the waters of the Fontanelle and Giove springs, although they gush forth in the valley where old Caserta lies [. . .] do not provide any water to the inhabitants, because [. . .] they were channeled into a covered aqueduct which leads to new Caserta"[113]. Thus a significant engineering achievement – the Caroline aqueduct designed by Luigi Vanvitelli and completed in 1762 (and today a UNESCO world heritage site) – warrants barely a mention in the *Statistica*, and this in a negative context.

Within towns, the arrangements for meeting different water needs can appear quite efficient. A hydraulic hierarchy is most evident where the infrastructure is at its most complex, the two Abruzzi provinces. Thus, in the town of Leonessa (Abruzzo Ultra), supplied with water by an aqueduct (as noted above), a branch of which "leads [. . .] to the beautiful fountain in the square", which in addition to its aesthetic qualities supplies water for domestic uses, and "then going down exits outside Porta di Regno to irrigate various vegetable gardens". Just as important, for the town's economic life, is "the other branch, greater in volume", which "serves to power seven mills", after which the water, "agitated and shaken by the action of the mill wheels, is collected in a large reservoir, from which it exits wending its way through various conduits inside the town, for the convenience of the private uses of the townsfolk". In the final two levels of Leonessa's hydraulic hierarchy, "what is left ends up in a trough at Porta de lo Stato used for watering animals and as washbasin for clothing", and finally, "it is channeled outside town to irrigate the farmland located below"[114].

Despite constituting a crucial part of the hydraulic infrastructure, washbasins (and indeed clothes-washing in general) are rarely mentioned by the provincial editors. In any case, we find a similar hierarchy in the town of Aquila, beginning at the Fonte della Novantanove Cannelle, where

> there are everywhere convenient basins or containers, where the water exiting from the second level of taps, is collected for the washing of clothes and other similar ordinary uses such as the watering of animals, and subsequently filtered goes further downwards to water vegetable gardens[115].

112 D. Demarco, *La "Statistica"*, IV, p. 159.

113 *Ibid*., IV, p. 141.

114 D. Demarco, *La "Statistica"*, I, p. 53. It is not as idyllic as it seems, since a few pages later the editor notes how outside the town "a good portion" of the aqueduct is "broken and exposed". Meanwhile, in the town, the conduits located under the streets leak because not well connected and there are piles of waste put there by the millers to regulate the flow of water (*ibid*., I, p. 55).

115 *Ibid*., I, p. 53.

Similarly, in the capital, the hydraulic infrastructure allows for a differentiation in water use. The waters "of the Carmignano, so called", after the aqueduct of the same name, "arrive [in Naples] divided into two branches", one of which "provides water to dwellings of the upper part of the city, the other powers many mills and various craft machinery, and after having served for the bleaching of cloths, flows into the Marinella in the area known as Fiumicello". The city's second aqueduct, the Bolla (or Volla) also divides into two branches upon its arrival in Naples. One "provides water to the lower part of the city and also serves to power manufacturing devices", the other "makes up the famous [river] Sebeto, which after having powered many mills, flows into the sea under the Maddalena bridge"[116].

In the Kingdom of Naples at the start of the nineteenth century, the machinery of manufacturing relied on the power of water, the most reliable source of energy, as it had done for centuries[117]. According to the editor of Calabria Ulteriore, "the flour mills, sawmills, fulling mills for the rough cloth of the common people are the mills powered by the waters of our rivers"[118]. Not without a note of pride he adds that "this province would seem to be born to unite all the means necessary to give the best of the wealth coming out of the earth"[119]. In Basilicata the Mount Vulture region is rich in streams which "spring forth in such abundance, especially the famous Fonte della Francesca, to power fulling mills and flour mills", while also serving to "irrigate vegetable fields" and for "the retting of linen"[120]. In the province of Naples the river Sarno has multiple uses, industrial and agricultural, serving "the royal armories, gunpowder mills and flour mills of Torre dell'Annunziata, after which along its whole course of some seven miles it irrigates many adjacent fields, including those belonging to the Crown"[121].

In Calabria Citeriore, although there are fulling mills "everywhere", their "imperfections prevent the best sort of production"[122]. This consists of the preparation of "heavy and coarse cloth, known as *arbascio*, and rough and poorly woven woolen flannels, known locally as *fiandine*"[123]. Indeed, when it comes to fulling mills in particular, an ideal functionality seems evident only in the town of Palena (Abruzzo Citra). Here "the machines are built as they should be, without having superfluous elements or lacking necessary ones; the water is well collected and conducted, so that it creates the most power possible, accomplishing the task with a notable time saving"[124]. But

116 *Ibid.*, IV, p. 23.
117 J. Sawday, *Engines of the Imagination. Renaissance Culture and the Rise of the Machine*, London 2007, p. 32.
118 D. Demarco, *La "Statistica"*, II, p. 520.
119 *Ibid.*
120 *Ibid.*, III, p. 22.
121 *Ibid.*, IV, pp. 29–30.
122 *Ibid.*, II, p. 496.
123 *Ibid.*, II, p. 493.
124 *Ibid.*, I, pp. 273–274.

Palena seems to be the exception. Even if every district in the province, according to the same editor, "boasts one or more fulling mills [. . .] not all of them are well suited to the preparation of wool manufactures, either because they are not well maintained or poorly built"[125]. This is exacerbated by the fact that reliance on water power in a Mediterranean climate comes with its own natural limitations, such as seasonality. In Abruzzo Ultra II, "with winter cold [the waters] acquire a certain degree of substance and heaviness", such that in the district of Amatrice "the mills rotate much less in winter than in other seasons"[126]. Not surprisingly, the opposite is more common: a diminution of water power during the summer months because of the lack of water, as in the case of the river Alento (Abruzzo Citra), which "can only power a few mills, that oftentimes in summer cannot function at all"[127].

The *Statistica* also provides examples of manufacturing decline. Along the river Verde (Abruzzo Citra), for example, activity "has declined to just a few mills, with the closure of the Fara S. Martino woolen mills"[128]. In Terra d'Otranto, the lack of rivers of any size means an absence of fulling mills, with the exception of those at Taranto "known as *battinteri*" which "made cloths for monks' habits"[129], now presumably no longer in use because of the Napoleonic "reform" of the religious orders. There are also missed opportunities when it comes to maximizing water use. The so-called Ceraso spring serves the town of S. Mango (Principato Citeriore) "to power many flour mills", and yet, according to the editor, "the inhabitants do not take the advantage of it that one might hope, since they could construct fulling mills, paper mills and tanneries, as well as set up regular irrigation"[130].

When it came to local manufactures, water was also an essential resource in the production of linen and hemp, in particular during the phases of retting and washing, where large quantities of stagnant water were needed. In Abruzzo Ultra "almost all the places if the province have lands given over to flax and hemp retting, especially where they can be easily irrigated"[131]. The statement could probably be extended to the entire kingdom, given that most communities produced their own linen and hemp, the main textiles, along with wool, before cotton became more widely available. As the editor of Principato Citeriore explains, "there is no town in which both sexes of the lower class are not engaged in [linen production], each according to their role". In fact – and this is one of the rare occasions in which gender is specifically addressed in the *Statistica* – the gendering of linen and hemp production meant that while "the men are normally tasked with the planting and cultivation, as well as the

125 *Ibid.*
126 *Ibid.*, I, p. 51.
127 *Ibid.*, I, p. 216.
128 *Ibid.*, I, p. 219.
129 *Ibid.*, II, p. 281.
130 *Ibid.*, IV, p. 672.
131 *Ibid.*, I, p. 181.

pulling, retting and breaking; the women are engaged in the manufacture, undertaking all of the tasks required"[132]. This would have included spinning, dying, weaving and sewing. The textiles produced could be marketed or consumed locally. Thus, in Avigliano (Basilicata) the linen "is of good quality and is sought after for purchase in Basilicata and in the provinces of Bari and Otranto"[133], whereas in Molise "every peasant, every poor woman cultivates it [flax], to patch her own rags and not to sell", in the words of the provincial editor Raffaele Pepe[134]. And yet, even in Basilicata there was room for improvement, as the editor notes with regard to the town of Castelgrande:

> the obstacles against the increase in these manufactures are that everything is done according poorly established practices, and in particular the retting of flax and hemp in waters that are full of clay, and piling up large stones on top of them, so that the retting is neither even nor is it evident when it is complete[135].

When it came to textile production, water was also important in the dying process. This was especially so when the water possessed special qualities, as at the Olmitella springs on the island of Ischia (province of Naples), which were used in "the manufacture of blue cloth, containing naturally occurring phlogisticated alkalis"[136].

The final use of water in the local economy concerned irrigation. In the province of Calabria Citeriore, according to the editor, "we have many irrigable lands and we generally practice irrigation in the cultivation of maize, cotton (*bambagia*) and legumes"[137]. At S. Giorgio (Basilicata) "irrigation is practiced in the vegetable gardens and in some places planted with maize"[138]. These two simple statements represent the exception; almost everywhere else irrigation represented something of a bone of contention for the provincial editors, which the local peasants never seem to get right. Indeed, Piero Bevilacqua has pointed out that contemporaries frequently failed to appreciate the specific uses of water in southern Italian agriculture[139].

In some areas there is too little: irrigation is presented as a missed opportunity. The editors recognize the natural limitations. To work well, according to the editor for Capitanata, "the need for irrigation" must be wedded to "a sufficient supply of flowing water", but all too often "it happens that just when adjacent cultivated lands need the

132 *Ibid.*, IV, pp. 657–658.
133 *Ibid.*, III, p. 484.
134 *Ibid.*, I, p. 332. Among Pepe's numerous activities, as a means of combating peasant poverty, was the encouragement of potato cultivation in his native Molise. D. Gentilcore, *Italy and The Potato: A History, 1550–2000*, London 2012, pp. 58, 67.
135 D. Demarco, *La "Statistica"*, III, p. 463.
136 *Ibid.*, IV, p. 28.
137 *Ibid.*, II, p. 420.
138 *Ibid.*, III, p. 442.
139 P. Bevilacqua, *Acque e bonifiche nel Mezzogiorno nella prima metà dell'Ottocento*, in "Studi Storici", 27, 1986, 2, p. 339.

water, the nearby stream has little or none"[140]. Available water supply and agriculture rarely seem to coincide, as the editor of Terra di Lavoro notes with regard to the rich Campania plain. If "it is without doubt the best and most fertile part of the province and one of the most beautiful areas of the kingdom", unfortunately "it can be said quite honestly that in very few sites the goodness of the land, the water and the climate are found all together [. . .]. If the land is fertile, the waters are mediocre and the airs tend towards insalubrity and damp"[141].

And this with regard to one of the few areas of the kingdom where irrigation was extensively practiced, even seeing an expansion during the course of the "French decade"! Not far away, in the Salerno plain (Principato Citeriore) irrigation was also widely practiced, extensively and more or less efficiently, according to Bevilacqua[142]. But for the cathedral canon and Salerno native Gennaro Guida, provincial editor for Principato Citeriore, there was far too much of it. "Wherever there are irrigable lands, wherever water can be brought in, even from far away, irrigation is practiced". He even complained that the fruit and vegetables "would taste better if the fields were not irrigated with water"[143]. Guida also objected to the fact that "continuous irrigation", accompanied by "much manure", was used to grow vegetables in the fields located all around Salerno, "causing the development of poisonous gases which render the air unhealthy and pestiferous"[144].

Elsewhere, it is not the "right" kind of irrigation. Thus the editor for Abruzzo Ultra, the patrician and agronomist Alferi Osorio, points out that there are towns "which have abundant water and could take full advantage of it, but by the abuse they make of it they render the land infertile rather than nourish it". This is due to poor irrigation practices, which cause "these beautiful farmlands" to be "exhausted and removed of their humus or loam, reduced to a mass of stones and pebbles as a result of the frequent flooding". Alas, Osorio concludes, "there is no way of disabusing or persuading those peasants otherwise"[145].

Finally, there were missed opportunities when it came to irrigation, according to the provincial editors. In the province of Molise, where "all the good lowlands on the banks [of the river Biferno], as of those on the [river] Trigno could be irrigable; they are veritable thirsty Tantaluses surrounded by water", as the editor Pepe comments

140 *Ibid*., I, p. 383.
141 *Ibid*., IV, p. 173.
142 P. Bevilacqua, *Acque e bonifiche*, pp. 338–340.
143 D. Demarco, *La "Statistica"*, IV, p. 550.
144 *Ibid*., p. 556. The latter point was certainly a legitimate one, given the contemporary association between miasmatic air and disease. I explore this link more fully in my companion piece, *"La qualità delle acque"*.
145 *Ibid*., I, p. 137. Osorio refers here to the case of a certain Bonanni, "worthy member of Aquila's Istituto agrario-economico", who "in vain sought to introduce and promote the use of canals horizontal and parallel to rivers, as practiced in China".

in a flight of lyricism[146]. And in Abruzzo Citra the editor – the teacher and former Piarist priest Paolo d'Aquila – proposes the canalization of river water as the solution. As it stands, the benefits of the river Pescara are limited to the powering of "a few mills", whereas if its waters were channeled they could serve "to irrigate the fields which make up this province's wealth"[147]. He makes the same point with regard to the river Sangro, the waters of which could provide the province with "many benefits", in particular "the irrigation of the farmland on both of its banks"[148].

Hitherto in this section we have discussed distinctions in water use; what about access to that water? On a European level, water was often characterized as a "universal good" in legislation; but in reality water access was not the same for everyone in society[149]. The basic fact of the social elites not only having many more possibilities when it comes to water access, but also jealously guarding their own privileges often at the expense of the wider community, is seen by Monticelli as part and parcel of the kingdom's economic decline. It is also amply borne out by the *Statistica*. In Diano (Principato Citeriore), "the persons of means normally make use of rainwater captured from the rooftops of their houses and stored in cisterns" while "the common people make use of the little water that flows from springs, and when this is lacking they are forced to use water from a river one mile distant from the town". The editor concludes that "Diano is rather infelicitous is this regard"[150] – although one is not sure whether this refers to the class distinction in water access or the shortage of water more generally. If the townsfolk of the low-lying towns of Oriolo and Bollita (Calabria Citeriore) are forced to utilize cisterns for rainwater storage – a great shame as far as the provincial editor is concerned – he also notes how "the well-off have the waters they need drawn from the nearby mountain, leaving to the multitudes without this possibility the use of town waters"[151]. In Principato Citeriore, "in addition to spring water, there are dug wells [*pozzi artificiali*] [. . .] and these belong to private landowning families"[152]. The same is true in Castellamare (province of Naples), where "many private landowners prefer to have the benefit of spring water

146 *Ibid.*, I, p. 293. The reference here is to the mythological figure Tantalus, punished by being made to stand in a pool of water beneath a fruit tree with low branches, but unable to access either.

147 *Ibid.*, I, pp. 213–214.

148 *Ibid.*, I, p. 218.

149 U. Sowina, *Water, Towns and People. Polish Lands Against a European Background until the Mid-16th Century*, trans. by J. Woldanska, Frankfurt 2016.

150 D. Demarco, *La "Statistica"*, IV, p. 585. The marshy valley (Vallo di Diano) was drained in an ongoing public works project during the first half of the nineteenth century, not without local opposition. P. Bevilacqua, *Acque e bonifiche*; C. D'Elia, *Supplicanti e vandali. Testi scritti, testi non scritti, testi scritti dagli storici*, in "Quaderni Storici", 31, 1996, 2, pp. 459–485.

151 *Ibid.*, III, p. 330.

152 *Ibid.*, IV, p. 540.

wells in their houses, which are commonly found in most places"[153]. In the old part of Caserta (Terra di Lavoro), "entirely without water", as we have seen, an aqueduct passes "through the hilltop on which it is built [. . .] used only by the wealthiest people, who alone can afford the expense of having their water drawn from it"[154]. The better-off can afford to have their water brought from greater distances, which allows them to access better quality water, also the case for the wealthy of the hamlets of S. Felice (Terra di Lavoro), who have their water drawn and brought to them from "a small spring popularly known as the Fontana di Capo di Conca"[155]. Even the use of water jars, referred to above, has its social limitations (and one wonders how widespread throughout the kingdom these were). Thus, among the inhabitants of Castelvolturno (Terra di Lavoro), forced to use poor quality river water, "some of the better off put it in large earthenware vases, in which it rests, slowing depositing the impurities with which it abounds, and then decanted as needed it would seem to acquire a degree of clarity making it potable and less harmful"[156].

Despite this social distinction in terms of water access, it is very occasionally members of the same local elites who have necessary hydraulic infrastructure works undertaken. For instance the "Fiumarello, or canal of the count of Sarno, which the former baron S. Pietro had done for the population of his feudal estate with its mediocre potable waters" (Principato Citeriore)[157]. More commonly, however, the elites take full advantage of their powers. Monticelli writes of how the large landowners and the well-off are wanting in this regard, with their generalized aversion to "rural cares", due to a mixture of ignorance and private business interests[158].

This is also evident in the *Statistica*. In S. Bartolomeo (Capitanata) "there is a beautifully built fountain, which would supply abundant water to the whole population if the egoism and bad faith of an arrogant family of the town had not fraudulently conducted all the water to itself"[159], an event which, for greed and betrayal, recalls the plot of Marcel Pagnol's 1952 film (and later two-part novel) *Manon des sources*, set in the parched hills of Provence. In other cases, spring water is jealously guarded by its owners, as those of the Fontana di S. Angelo, on the outskirts of Capua (Terra di Lavoro), which is "used by its owners to water their extensive vegetable gardens". As the editor comments, the family could cede a portion of the spring's water to the town, which could certainly use it, "but the owner's obstinacy is invincible, and only the authority of

153 *Ibid*., IV, p. 25.
154 *Ibid*., IV, p. 141.
155 *Ibid*., IV, p. 146.
156 *Ibid*., IV, p. 165.
157 *Ibid*., IV, p. 573.
158 T. Monticelli, *Sulla economia delle acque*, p. 43, note 26.
159 D. Demarco, *La "Statistica"*, I, p. 393.

the government could bring about this cession"[160]. A similar story on the outskirts of Orsogna (Abruzzo Citra), where there is a spring of brackish water, possibly due to the salt mines nearby, the water of which is highly prized to water vegetable gardens. But, the editor notes, "the owners of the land have maliciously dug the spring over, to exempt their estates from any subjugation"[161]. A final dispute is recounted by the editor of Terra di Lavoro. "Around 1750", he writes, "the feudal lord Buoncompagno" attempted to revive the use of the Catane springs, only to meet with "the opposition of the town authorities, whose land it was"[162].

The issue of mineral bathing springs brings up a final characterization of decay and decline, as the provincial editors highlight the lack of suitable establishments and structures for what is still a widespread medical (and indeed social) practice. The springs at Catane (Terra di Lavoro) "are today abandoned due to a reprehensible negligence", but "from the ruins of buildings and mosaic floors near the springs, it is evident that in ancient times they must have been very busy"[163]. In Calabria Ulteriore the thermal springs are still much used despite "the total lack of buildings to protect the sick from the impact of the airs above", with the result that "the sick, if they want to use them, are forced to build temporary protection from plant materials themselves or else run the risk of possible chills from being exposed to the open air". The provincial editor, the doctor Giuseppe Grio, wonders how it is possible "for the sick to cure themselves of one illness without coming down with others"[164]. In Terra di Lavoro the waters of Montetto could be "of greater usefulness" if "the doctors of the surrounding areas took greater care in prescribing the sick in their use and if, in the vicinity, there was some covered building and properly built baths to protect the sick from the inclemency of the air"[165].

The decay is most evident at the thermal springs of Bagno della Rogna (Terra di Lavoro), which translates as the not very attractive sounding "Scabies Springs", but is an indication of its importance as a site for treating afflictions of the skin. Located near the "small ruined convent of S. Antonio", one can "see evidence of bath-houses, including among the many some double ones, the water passing from one to another". However, "these have been buried under fallen buildings, so that one cannot stay for

160 *Ibid.*, IV, p. 142.
161 *Ibid.*, I, p. 212.
162 *Ibid.*, IV, p. 74.
163 *Ibid.*
164 *Ibid.*, II, p. 517. Grio was a native of Polistena and a mathematician, planner and philosopher, in addition to being a doctor. Secretary of the provincial agricultural society, he introduced treatment for typhus in the province and was charged with the division of the waters of the rivers Sciarapotamo e Jerapotamo.
165 *Ibid.*, IV, p. 159.

long". The same provincial editor concludes his discussion asking "by what fatal destiny these health-giving waters were abandoned, which are perhaps among the best in the kingdom". The answer may lie, he suggests, "in the insalubrity of the climate due to the proximity of the Minturna marshes, the pestiferous exhalations of which extend all around and which are deadly at precisely the same time of year when the mineral waters should be most visited"[166].

6 Conclusion

What the views of the provincial editors of the *Statistica* reveal is a kingdom divided by its hydraulic infrastructure, from areas of sophistication in the Abruzzi provinces and Terra di Lavoro to areas of quite basic standards in the Calabrian provinces, to areas of scarcity in Molise. There is a tendency to concentrate on what is lacking rather than what works: decay, abandonment and poor maintenance are frequent themes. Despite this, what is also striking is the ability of local communities throughout the kingdom to achieve a level of self-sufficiency, making a virtue of necessity by growing and milling their own food (with or without the aid of irrigation), producing their own cloth (linen, wool), and treating their own illnesses (mineral springs).

If both Monticelli and the contributors to the *Statistica* had a tendency to look back to the past in their evaluation of the present, what about the future? And what impact did they have on hydraulic infrastructure in the kingdom of Naples during the nineteenth century?

In terms of looking forwards, we might consider what proposals they make to rectify the present ills, as they saw them. As a general solution to difficulties linked to the "economy of the waters", Monticelli proposed undertaking three "great things": i) restoring the "ancient healthiness" of the coasts and plains by draining stagnant water, ii) reforesting the mountains, and iii) furnishing arid zones with water reservoirs[167]. In a similar vein, some of the provincial editors also propose specific solutions to local problems linked to water resources.

However, the only one to provide broad solutions is the editor of the Terra di Lavoro submission, Perrini, "because it is now well known that the diminution of disease, good digestion, personal vigor, fresh skin color, whiteness of teeth largely depend on the use of good and limpid waters"[168].

His solutions pertain to four water sources: aqueducts, fountains, wells and river water. In terms of aqueducts, Perrini argues that it would be important that "the

166 *Ibid.*, IV, p. 184.
167 T. Monticelli, *Sulla economia delle acque*, p. 42.
168 D. Demarco, *La "Statistica"*, IV, p. 211.

appreciation of aqueducts was reborn among the people, which signal the progresses of civilizations and announce the affluence and wealth of a people". For fountains, one would need "to oversee the cleanness of fountains, to use conduits to remove water (*purgatoi*) from cisterns and other rainwater receptacles". When it came to wells, one should "prohibit the digging of wells in waterlogged land and always at a set distance from sewers, burial grounds, sites which attract rain water and places where hides are cured, and all wells to be equipped with corresponding ventilation". And, finally, in terms of river resources, it would be necessary "to construct at public expense machines for filtering river waters and to teach in a gentle way those populations forced to drink unhealthy and stagnant water the methods already proposed by Messers Ami, de Iusti and Porzio". Here Perrini goes so far as to refer to "the basin with vertical divider proposed by Mister Foderé, following details derived from Porzio's military medicine (*Igiene pub.ca*, tom. VII, pag. 56, Ediz. Napol.na)"[169]. This water filter would be especially useful to "all harvesters and farmers who work in the fields during the dog days of summer and the heat of the afternoons", a long way from town, such that "the weary peasant, drinking in search of refreshment, does not instead find a poisonous potion which attacks the very source of life"[170].

It is a long list, and an ambitious one. That said, the words of the provincial editors of the *Statistica*, as well as of Monticelli himself, did not fall on deaf ears. If Monticelli has an heir, it is the figure of Carlo Afan de Rivera, although they were virtual contemporaries (and may not have seen eye to eye)[171]. Afan de Rivera combined both intellectual studies of the kingdom's infrastructure and its requirements, hydraulic and otherwise[172], with a significant technical role as state official. From 1825, under the restored Bourbon dynasty, which followed the decade of French rule that produced the *Statistica*, Afan de Rivera was director general of the office of "Ponti e Strade, Acque, Foreste e Caccia", a corps of engineers in charge of public works concerning bridges,

169 Perrini names the originators of various water filtration devices, such as the Neapolitan military physician Luca Antonio Porzio (1639–1723) and the Savoyard forensic and public health doctor François-Emmanuel Fodéré (1764–1835). *Ibid.*

170 *Ibid.*

171 G. Foscari, *Teodoro Monticelli*, pp. 114–117.

172 Taking his lead from Monticelli, Afan de Rivera identifies the barbarian invasions, followed by Saracen incursions along the coast, as the beginning of the kingdom's decline. C. Afan de Rivera, *Memoria intorno alle devastazioni prodotte dalle acque a cagion de' diboscamenti*, Napoli 1825, p. 7. His ideas concerning the previous natural wealth of the kingdom, the subsequent decline as a result of poor water management and deforestation, as well as solutions to remedy them were more fully developed in his major work, published eight years later: C. Afan de Rivera, *Considerazioni su i mezzi da restituire il valore proprio a' doni che ha la natura largamente conceduto al regno delle Due Sicilie*, 2 vols., Napoli 1833.

roads, waters, forests and hunting. The "Acque" (waters) in the title extended to waterways, canals, ports and land reclamation. In this guise he was able to implement some of the infrastructure projects proposed in earlier decades, in addition to undertaking new ones, even if the full promise of his role was not realized – but that, as they say, is another story[173].

173 G. Foscari, *Prassi amministrativa e attività pubblicistica a tutela del territorio: l'opera di Carlo Afan de Rivera nell'Ottocento borbonico*, in "Clio", 30, 1994, 2, pp. 223–255, and S. Conti, *Il problema delle bonifiche e del diboscamento nel pensiero di Carlo Afan de Rivera*, in *Carlo Afan de Rivera e la scuola napoletana di ponti e strade*, Napoli 2020, pp. 9–21. On the kingdom's hydraulic issues and solutions, in particularly regarding land reclamation and flooding, see: P. Bevilacqua, *Acque e bonifiche*, pp. 335–357; A. Di Biasio, *Politica e amministrazione del territorio nel mezzogiorno d'Italia tra settecento e ottocento*, Napoli 2004, pp. 213–270; and W. Palmieri, *Natura, uomini e dissesti. Le alluvioni di Nola agli inizi dell'Ottocento*, in "Società e Storia", 32, 2009, 126, pp. 615–633. On administrative reforms and public works, see: N. Ostuni, *Riforme amministrative e viabilità nel Regno di Napoli durante il periodo francese*, in *Villes et territoire pendant la période napoléonienne: France et Italie*, Roma 1987, pp. 161–181, and A. Spagnoletti, *Territorio e amministrazione nel Regno di Napoli (1806–1816)*, pp. 79–101. Finally, on the wider context, see F. D'Angelo, *Scienze e viaggio: ingegneri e architetti nel Regno delle due Sicilie*, Villasanta 2014.