Water in the Making of a Socio-Natural Landscape

How would the history of an urban area look if water were at the center of analysis? *Water in the Making of a Socio-Natural Landscape* explores the transition from early modern to modern water management in late nineteenth-century Rome. It merges local water management with national water policies aimed at promoting irrigated agriculture, industrial processes, and public health. It investigates perceptions and conceptualisations of water, changes in the water law, engineering projects, medical knowledge and practices, the value of water in different productions, and the needs and uses of local stakeholders. From this derives that water infrastructures are the complex outcome of the clash between different users and uses of water as well as the dynamic interaction between different levels of power. This book builds upon Maria Kaika's *Cities of Flows* and Erik Swyngedouw's *Liquid Power* to introduce a new dimension to the analysis of urban water: the interaction among the three main uses of water: drinking, agriculture, and industry.

Water in the Making of a Socio-Natural Landscape is written for a specialist readership with an interest in environmental and urban history and science and technology studies, but it can also be used by master's and PhD students.

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Water in the Making of a Socio-Natural Landscape

Rome and Its Surroundings, 1870–1922

Salvatore Valenti

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Abbreviations

ACS	Archivio Centrale dello Stato, Rome
ASC	Archivio Storico Capitolino, Rome
ASR	Archivio di Stato di Roma, Rome
b.	Busta (envelop, internal identifier for archival resources)
CPAM	Consorzio Privato dell'Acqua Mariana
DGA	Direzione Generale dell'Agricoltura
MAIC	Ministero Agricoltura, Industria e Commercio
SAPAM	Società dell'Acqua Pia Antica Marcia
SPQR	Rome city council

Introduction

In the report of Julius Sextus Frontinus – Superintendent to the waters of Ancient Rome (*Curator Aquarum*) – over the management of the ancient Roman aqueducts (*De Aque ductu Urbis Romae*) written at the end of the first century CE, Roman water infrastructures not only represented a product of technical expertise and technological development but also embodied power, economic prosperity, and culture of the Roman civilisation.[1] During the Renaissance, an age of turmoil in which papal authority went into crisis, Roman religious and civil authority found in a project of urban renewal a way to re-establish its prestige and to redevelop Roman social and economic life; this involved the creation of new aqueducts and public, private, and monumental fountains.[2] In September 1870, a few days before the conquest of the city by the Italian troops – which signalled the end of papal temporal power – Pope Pius IX attended his last public ceremony, namely the inauguration of the first modern Roman aqueduct, which was named after him.[3] This was the last attempt of the papal authority at reviving the magnificence of Baroque Rome and at reaffirming its prestige.

These are only a few examples of the relevance of water in the history of Rome and how this element could be a good entry point – particularly in periods of intense social change – to understand the complex cultural, political, social, and economic dynamics which shaped the Eternal City and its territory. After September 1870, Rome entered one of these periods of transition. In fact, Rome became the capital of the young Italian state; nonetheless, no infrastructural, economic, and social assets could justify this choice. To some extent, this choice was a product of the relevance that the idea of Rome had in the political discourse of the Italian *Risorgimento*. This meant that the city, whose real conditions were more similar to those of a big rural town rather than those of a great European capital, had to be elevated to the level of the political ideals of the Risorgimental class. On one hand, this took the shape of a monumental plan that changed the historical topography of the city.[4] On the other hand, the infrastructural, economic, and health conditions of the city had to be modified according to European standards. Water was a key element of this latter process.

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Embanking the River Tiber, making municipal aqueducts safe, improving the water distribution system, constructing new sewers, generating hydropower, and providing water for irrigation were some of the tasks of the new public authorities in Rome and its surroundings. In order to cope with all of these functions, local and national public authority had to extend their control over the water resources available in the Roman area (Figure 0.1). Because the subject of this monography is water, by Roman area, here, I mean the lower basin of the River Tiber as it is highlighted in the map. It comprised the city of Rome, the surrounding countryside, and the main Roman water 'reservoir'. The last of these spanned Tivoli and the Tiburtine Mountains from which flowed the River Aniene east to Rome (top right corner in Figure 0.1) and the Alban Lake and Hills (bottom right corner in Figure 0.1) southeast of Rome. The territory comprised in this area, in a range of 25/30 kilometres from Rome, was a plateau with a gentle slope towards the River Tiber, interspersed with valleys dug out by surface watercourses. It was not by chance that nine out of 11 ancient aqueducts of Rome had their springs and routes in this area. Furthermore, the hydrographic surveys of the late nineteenth century focused on the water resources within these boundaries.[5]

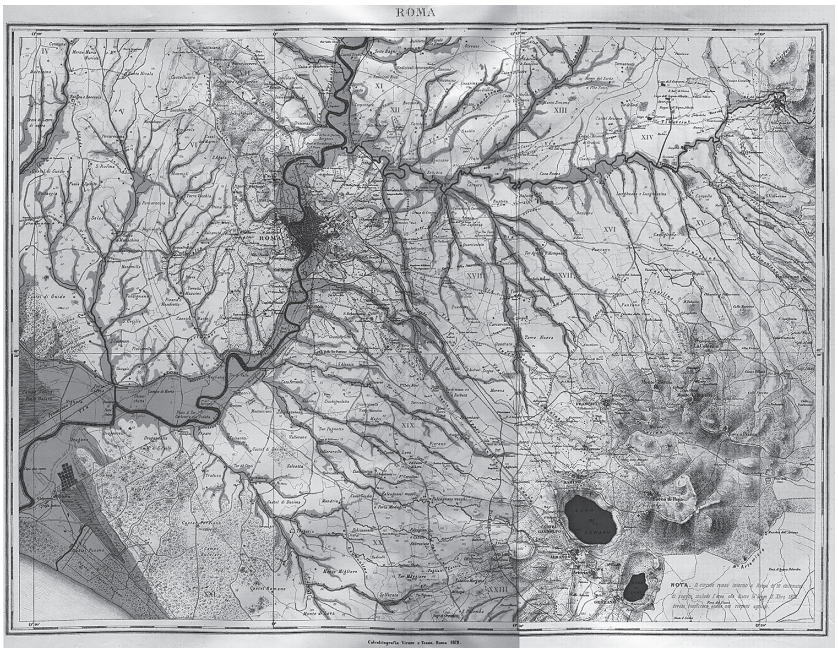

Figure 0.1 The hydrography of the Roman area.
Sources: MAIC, DGA, *Carta Idrografica d'Italia. Il Lazio* (Rome: 1892).

In short, the flows of water around and towards Rome provide the geographical boundaries of the research. In this way, I intend to reveal the conflictual dimension for water access, distribution, and use. In fact, water as a life-sustaining element and as part of many social processes of production is also used from the springs and along its route before entering the main city. This meant that the construction of modern water infrastructures was not something given but, conversely, was the product of a social struggle for water control. In addition, the agencies of the users of water along the route of a watercourse and the uses of water flowing towards Rome had an impact on the making of the city and its surrounding territory.

The period I consider, 1870–1922, reflects an established tradition in the study of modern Rome and refers to the time the city was the capital of the Liberal Kingdom of Italy. Liberal, here, refers to the political organisation of the Italian state, whose centre was the parliament; to the political culture of the Italian elites, which envisioned a deep connection among private property, market economy, and liberty; and to the subsequent legal framework regulating the relationships between state and society. The Fascist seizure of power in October 1922 signalled the end of that period. Moreover, the period of 1870–1922 was one of transition for the conceptualisation of water, for modern Italian water legislation, for the technical application of water like hydroelectricity, for the medical understanding of water, and for market-oriented practices. I argue that these social processes were interlaced in the making of the Roman territory and in the urbanisation of the Roman area, a process that following the flows of water was particular evident on the east side of Rome.

Water, a neglected topic in the histories of modern Rome

In order to analyse the role of water in the process of urbanisation of the Roman area (1870–1922), it is necessary to outline the main approaches adopted so far by scholars in dealing with the cultural, economic, political, and technological patterns of the growth of Rome. First and foremost, to what extent was water a relevant element in the histories of modern Rome? Indeed, there are many books about the ancient Roman aqueducts, and to a minor extent about the aqueducts restored during the Renaissance, but few books are about the modern aqueducts. There is no extensive study of the cultural, economic, political, legal, technological, medical, social, and material aspects of water in modern Rome.

In fact, the history of modern Roman aqueducts has been written by hydraulic engineers and architects. As a result, it is very rich in technical details, but sometimes it flows into an apologetic view of human progress.[6] Despite this weakness, the data given by these works about the realisation of modern Rome aqueducts are relevant. However, some historians have tried to move towards more nuanced interpretative

approaches about the role of water in the making of the city. Stefano Battilossi, for instance, wrote a book about the major Roman municipal company, the ACEA.[7] The municipalisation of services such as energy, urban transport, and then water was a success of the first Liberal coalition that governed the Roman Municipality in the years 1907–1913.[8] Battilossi follows the struggle of public powers to balance the influence of private companies in managing such services. The result of this policy was the establishment of a duopoly for the production and distribution of energy and, from 1938, a duopoly for the distribution of water.[9]

Another point of view is provided by the French scholar Denis Bocquet, who criticises the urban planning–centred histories of modern Rome.[10] He proposes a different angle to approach the well-known issues of Rome's urban growth. Bocquet asks questions such as who leads the technical offices and what were the relations between different offices depending on various institutions? Who supervised the construction yard, and according to which criteria? What kinds of pressures were exercised in the practical construction of the space?[11] His aim is to observe the struggle between local and national institutions, which fought for 'the acquisition of a technical jurisdiction over the urban territory', in order to reveal a spatial dimension to the political conflicts.[12] From this viewpoint, the flood of River Tiber in Christmas 1870 and the works to embank the river were used by the state to establish its jurisdiction – by means of the Civil Service – over a central space of the city in order to balance the powers of the municipal authority and its technical offices over the urban space.[13] Also, the Civil Service had a jurisdiction over the Roman countryside, though in the early twentieth century the municipal offices tried to gain power over this space.[14]

However, these works, well documented and detailed, remain in the field of the institutional approaches to water. This is to say that in the books by Battilossi and Bocquet the cultural perceptions of water by the Italian Liberal elite, the conceptualisation of water resources by the Italian engineers, the shifts in the water law, the epidemiology of water, and some of the economic and material aspects of water remained hidden. By contrast, the present research aims at shedding light on these aspects. Before we proceed, it is worth understanding why water has had little space in the histories of modern Rome, by contrast with those of Rome from earlier periods. A first aspect which the works of Battilossi and Bocquet are linked refers to the 'institutional' approach. The main tools of such an approach are the close readings of municipal deliberation as well as parliamentary acts.[15] The image of the relationship between state and municipality that emerges from these analyses is complex and articulated. According to Marco De Nicolò, for instance, in 1870s the Italian governments not only did not define the jurisdictions between these two authorities but also did not financially support the enterprise of building the capital, in order to control the Roman City Council as

needed.[16] In the subsequent decades, a series of derogation laws were promulgated by the Italian Parliament in order to define the jurisdiction of the state in the material construction of the city.[17] These laws established some works at the expense of the state, like the courthouse and the general hospital, whose construction passed progressively under the supervision of the Public Work Department.[18] Even so, the material support of the state in the building of Rome remained episodic and discontinuous.[19]

A further aspect analysed by historians of modern Rome is the cultural and aesthetic value the city had for the Italian ruling classes, for the Italian patriots who fought and died to reconnect it to the new nation-state, and for the European cultural elite. For example, Vittorio Vidotto points out that a good part of Rome's recent history could be seen as the passionate rise and dramatic fall of a bundle of illusions and ambitions which Rome carried within.[20] As a result, his analysis focuses on the political and symbolic role of Rome in coordinating the new state.[21] Vidotto tries to overlap the key moments of Roman historical change with a survey of the rituals, myths, and various tools of self-representation of the political classes. Hence, the realisation of monuments, which embedded the Italian political discourse of the late nineteenth and early twentieth century, assumes a heuristic value in his analysis. According to Vidotto, the fracture inside the political Roman world, particularly between Catholics and Italian Liberals, took the shape of a battle over symbols, such as the sculpture of Giordano Bruno, which was erected in Campo de' Fiori in 1889.[22] In general, aesthetics became the normal way of expression of the Italian ruling classes. This was even more evident during the *Maggio Radioso*, May 1915, when Rome was the theatre of several demonstrations led by the Italian poet Gabriele D'Annunzio, whose aim was that of pushing the country into the Great War. In short, from that point, Rome became the political and symbolic capital of Italy since what happened in Rome conditioned the national political life, something that would be confirmed by the Fascist march on Rome.[23]

The symbolic role of Rome was also analysed by Alberto Caracciolo, the forefather of the Marxist approach to the history of modern Rome.[24] However, he focused on the chasm between the high ambitions cultivated by the Liberal elite and the poor conditions of the city. His work underlines the ambivalent emotional and practical relationship that the Liberal Italian classes had towards Rome. Overall, they fluctuated between the rhetorical glorification of its history in order to exalt the national pride and the weak initiatives undertaken to modernise it.[25] In Caracciolo's view, the Eternal City was the only one that could be accepted by the other big Italian cities as the political centre of the new state, but Italian Liberals approached Rome with a mix of attraction and repulsion since it was at the same time an object of desire and the location of the historical enemy, the Pope. Moreover, the conquest of so

prestigious a capital was seen as a precondition for a respected entrance to the assembly of the European Powers. These ambitions clashed with the real situation of a city which appeared poor in infrastructure and with a weak bourgeoisie. According to Caracciolo, the Liberal classes deliberately did not promote the industrial development of the city, in order to avoid concentrating working masses into the capital.[26] This, in turn, compromised the economic development and urban growth of modern Rome, which remained a parasitic city, dependent on its political role but unable to completely fulfil it.[27]

Caracciolo's interpretation had a durable impact on the Marxist approach to modern Rome, particularly on the historiography of the material fabric of the city. The Marxist historiography of urban Rome has focused on the powers, represented by the coalition of aristocratic land rentiers, speculative bourgeois, and finance world, particularly Vatican finance, which controlled the Rome City Council. In such a view, these groups were responsible for the speculative and inorganic urban growth of Rome. The difficult work of reclaiming the vast, marshy, sparsely populated, and malarial countryside around Rome, which from 1870 to 1950s accompanied the history of the city, had, in this perspective, the only result of preparing dry terrain for speculative urban growth.[28]

This was the case of a milestone of such a line of study, *Roma moderna, un secolo di Storia Urbanistica* written by the urban planner Italo Insolera, first published in 1962. The image of the Italian capital given by Insolera provided a detailed analysis of the Roman master plans and projects since its unification into the nation-state as well as the reconstruction of the political orientations inside the municipality. According to Insolera, since 1870 Rome was a city at the mercy of the landed aristocracy, land tenants, and national and foreigner speculators. As a result, Rome developed in a disorderly manner and stretched in every direction, without a plan and in some cases without the necessary infrastructures. Hence, the aristocratic gardens inside the Aurelian Walls disappeared under concrete and the surrounding countryside was compromised by illegal building business.[29]

A further insight into the socio-economic conditions that allowed the development of land speculation in Rome since 1870 is given by Piero and Roberto Della Seta in an investigation into the structure and the distribution of land property.[30] They conclude, quoting an Italian economist of the nineteenth century, Ghino Valenti, that 'the value of building areas is not pushed above their cost by natural causes, but by artificial ones. It is not their relatively scarcity that make them costly, but the silent coalition of property owners that possess them.'[31] Hence, the socio-political bloc of the landowners in the Roman countryside controlled the market of building areas. As a result, this was a hindrance to regulatory policies and urban planning.

As we might see, the Roman countryside has had a relevant role in the urban studies of modern Rome. Probably, this was the result of the chasm between the project of renewal of the Agro Romano which took place since the 1870s and the practical urbanisation of vast areas of this countryside from the early twentieth century. Clearly, land speculation played an important role in such a process. However, these works do not examine the possible alternative causes, like the role of infrastructures and the agency of the migrants that constructed a part of Rome in the countryside. In short, why did some areas urbanise instead of others? What was the role of a life- sustaining element like water in this process?

A first attempt at considering the role of urban infrastructures in the process of making of the Roman region was undertaken by Lidia Piccioni, though her interests are in the cultural identity of the local communities. Indeed, she underlines the role played by railways in structuring and enhancing the relations between Rome and its closer surroundings, in a range of 25–30 kilometres, the Castelli Romani and Tivoli, hilly urban settlements, placed respectively at the southeastern and eastern boundaries of the Roman countryside.[32] However, the closer relations established by the railways did not sweep away the identity of such minor urban settlements, as happened for the surroundings of other European capitals, such as London and Paris.[33] Conversely, railways in the Roman area made the existing relations between Rome and its surroundings tighter. People from the surroundings went in Rome for business, study, health, and religious fests, whilst Romans went to the Alban Hills and Tivoli on holiday during weekends and summers.[34]

A further point of view of urban infrastructure has been developed by the scholars of the University of Roma Tre, who have investigated the urban development of some specific quarters of the city, particularly Ostiense, the 'industrial' area of Rome. According to this line, the policies to industrialise that area in the first decades of the twentieth century were contradictory and ambiguous, since Ostiense was also subject to the laws of land drainage and reclamation, which would promote the development of a modern agriculture.[35] In this way, agriculture, industrial, and commercial enterprises and residential initiatives conspired to define a hybrid configuration of Ostiense and a mixed land use in the first decades of the twentieth century. Despite this consideration, it could be affirmed that in the 1920s this zone became a nodal point, which connected the city with the broader national and international circuits of production and distribution, while the establishment of a factory for the production of gas and a thermoelectric station ensured a relevant stock of energy for the increasing needs of the Italian capital.[36]

Significantly, the above-mentioned research does not consider the technical aspects as something that could influence the material form of the city and shape the daily life of Rome's dwellers. The authors are attracted by the analysis of the economic, political, and cultural identities of the

urban settlements around Rome or remain anchored to the idea that the engines of urban transformations were political debates around urban policy and the conflict it raised. In conclusion, the historiography on modern Rome about the period of 1870–1922 has investigated mainly the symbolic role of the city, the institutional conflictual dynamics between the state and Rome's municipality, the institutional initiatives to modernise the city, the process of land speculation, and to a minor extent the local identities. All of these are valuable topics, which we encounter also looking at water in the Roman area.

Nonetheless, urban studies of modern Rome have so far been bound tightly to the idea that the actors of urban change are the institutions and, in some cases, interest groups able to control the political agenda. This is testified to by the fact that many of these works pay very close attention to political debates, municipal deliberations, and parliament acts and more generally to the entire bundle of institutional relations and to the influence exercised by powerful groups in the places of decision-making. In Steven Lukes's terms, the Italian historiography on Rome in the Liberal period (1870–1922) has moved between one-dimensional and two-dimensional views of power.[37] As a result, the construction of the space of the Italian capital and its surroundings has been described hitherto as a top-down dynamic, in which social and spatial patterns were moulded by institutions and powerful land rentiers. As regards the social context of the process of urbanisation of modern Rome, the Marxist historiography has followed the Gramscian analysis of the Italian unification process, which he considered a 'passive revolution', unable to really industrialise and modernise the country and its masses.[38] This was evident in the debate around the lack of industrialisation of the Eternal City. I think that analysing the relationships and interactions of a society with water offers a more nuanced and deeper understanding of how social change happens. How water was perceived and conceptualised, how water access was regulated, and how it was used and why embrace all the topics analysed so far by the historiography on modern Rome. However, placing water at the core of the research means that these topics are interwoven and analysed in their dynamic interactions.

Taming water: a national enterprise

Water and water infrastructures of some Italian cities, by contrast with the Roman case, have been deeply studied. This interest for urban infrastructure could be partially seen as the product of the recent establishing of a tradition of environmental history in Italy.[39] These studies are helpful in drawing the national context in which the making of Liberal Rome's socio-natural landscape developed. The case of nineteenth- and early twentieth-century Milan, for instance, has been investigated by Simone

Neri Serneri.[40] During the 1800s, the Milanese canals, the Navigli, were used for transport (mainly of building material and wood) in synergy with irrigation uses. In the last two decades of the nineteenth century, the former role of the canals was challenged by the development of the railways. Furthermore, in the city, the health conditions of the surface waters became dangerous because of the discharges of many industrial products; this, together with the high demand for land to build residential, office areas, roads, and railways, led the city administration to cover up part of the Navigli.[41] The leading rationale for these covering works reflected the principles of the maximisation of resource exploitation. As a result, large areas were drained, and canalisation made water circulation faster. However, this meant simply transferring the polluted water outside the urban fabric, into the wider circuit of territorial waters. In conclusion, this water policy laid the foundation of the environmental crisis that affected the Milanese area in 1950s.[42]

Following this line of thought, other Italian scholars have investigated the relations between the natural environment and cities in Italy at the turn of the twentieth century. As an example of this, Maria Luisa Ferrari and Michela Morgante focused on the public health and environmental problems caused by industrial development and urban growth in some of the major cities of the Veneto in the last decades of nineteenth century.[43] Ferrari analysed the relations between industrialisation and water pollution and the consequent policy based on watercourse drainage, coverage, and diversion, which was similar to most of the Italian cities of that time,[44] whereas Morgante described the realisation of the sewers in Verona, based on a system that conveyed all the wastewater from domestic, industrial uses and rainwater in the same culvert and the consequent embankment of the River Adige.[45]

Another important contribution to the history of water management in Italian cities during the Liberal period, and more generally to Italian urban history, is given by Frank Snowden.[46] Moving from a history-of-medicine perspective interlaced with aspects of social history, Snowden analysed two cholera epidemics that affected Naples in 1884 and 1911.[47] One of the factors that exposed the dwellers of the lower zones of Naples to the risk of cholera was the inadequate supply and bad quality of water.[48] According to Snowden, the cholera epidemic of 1884 'was a measure… of the failure of the Liberal regime to address the "Southern Question"…'[49]As a result, the Italian Government reacted adopting a new policy and spending a large amount of funds to sanitise Naples. A new aqueduct was built; entire neighbourhoods were demolished in order to reduce population density and to construct large streets which according to the miasma theory were essential to prevent infection.[50] Despite these attempts, the rebuilding and renewal of Naples failed in its target and left unsolved the social and medical problems of the city and consequently cholera broke out again in 1911.[51]

In conclusion, these examples – derived from different approaches – testify to the various attempts made by the Italian Liberal regime at modernising and sanitising the cities of the Italian peninsula. Corona and Neri Serneri argue that these attempts were the result of a process involving state building, diffusion of technical and scientific culture, national market unification, and industrial development.[52] It could be argued that the last phenomenon was not widespread in Liberal Italy and that even during the economic boom of the 1960s most of the Italian regions were not industrialised.[53] Indeed, an Italian frame of *longue durée* is the continuous interplay between urban settlements, human activities, and water, which has determined most of the physical aspects of the Italian territory, as Piero Bevilacqua points out.[54] In particular, in central and northeastern Italy, the territory was shaped by the dynamic interaction between small and medium cities, which were centres of private sector activities on commerce, the professions, crafts and small industrial productions, and the surrounding countryside.[55] In the late twentieth century, this dynamic led to a peculiar urban sprawl.[56] I argue that early twentieth-century Rome showed precocious signs of this phenomenon, not least because of the attempts at reorganising the Roman countryside and the ways that water was managed.

A further element to consider is the culture of the Italian ruling classes of that time. Snowden, for example, emphasised that the process of sanitation of Naples challenged the 'claims of the *Risorgimento* to embody progress and social improvement.'[57] In other words, the Italian Liberal classes had to legitimate to the international community, to the internal opponents, and to the Italian society their rule over the Italian peninsula.[58] Italian elite used science and technology to rationalise, industrialise, and sanitise the Italian space to face this political urgency. In conclusion, these works show the relevance of water for modern Italy and the possibilities of understanding and writing the history of the Italian peninsula through the complex interactions between society and water.

Looking for an approach to the nature–society interactions

In the previous section, we have seen that the interactions between water and society can be a valuable topic to explore the history of modern Italy. A further point to refine and to clarify is the definition of the theoretical aspects of the research and of an approach able to grasp the complex, overlapping, and heterogeneous dynamics which shaped the peculiar configuration of the space of the modern Roman area. A first aspect to consider is the interplay between urban settlement and environment. These have been considered as two interrelated and interdependent fields of research by historians only from the late 1980s and early 1990s. In that period, scholars like Martin Melosi, Joel Tarr, and William Cronon made claims for a renewed urban environmental history that paid more attention to the relations between cities and nature.

Melosi, for instance, explicitly criticised the 'agro ecological' perspective suggested by Donald Worster, arguing that such an approach was based on an arbitrary separation between nature and culture.[59] The identification of a pristine nature separated by human action is a theoretical mistake because 'isolating the "natural world" in such an unnatural way denies the powerful holistic quality of environmental history which demands inclusion more than exclusion.'[60] The most influential example of this new line is Cronon's seminal work focused on the explosive force of the urban growth of Chicago.[61] Cronon investigates how the expansion of the greatest city of the Midwest between the nineteenth and twentieth century completely reshaped the surrounding territory and the main water sources – such as lakes and rivers – for its own purposes. In this way, Cronon demonstrates the possibilities of an integrated and overlapping approach to the history of cities and environment. Nevertheless, *Nature's Metropolis* does not completely overcome the boundaries between nature and society/city. Actually, Cronon recognises that 'nothing in nature remains untouched by the web of human relationships.'[62] However, he defines two kind of nature 'first nature', original and pre- human, and 'second nature', commodified and transformed by humans.[63] This distinction still reflects the conceptual abstraction that distinguishes human and nature, which, as we see below, neo-Marxist scholars consider a product of the rationality and of the political discourse of modernity.

These pioneering North American works of urban environmental history found fertile ground among European historians of different countries. Since the mid-1990s, European scholars have developed a set of frameworks such as social metabolism and the colonisation of nature, in order to give more cohesion to this interdisciplinary field, which draws from the history of science and technology, urban planning, urban history, and environmental history, to name but a few. Social metabolism concerns the set of inputs and outputs among biosphere, geosphere, and society, while the colonisation of nature is defined as the sum of the deliberate alterations of the natural system in order to make it useful for society.[64] Consequently, the city can be seen as a living organism; as such, it needs a continuous inflow of elements from outside (water, food, energy, building material, etc.) and an outflow of waste produced by urban processes, towards an ever widening hinterland.[65] Despite the unquestionable merits of this literature in broadening the horizon and the range of visual angles of the urban studies, it seems to remain on the threshold of the nature–society dualism. More precisely, this approach has proven worthy in defining the features of the increasing flow of nature (food, water, energy, raw materials) towards and away from modern cities, but it tells us little about the reasons for such a process. In short, the question of how social change happens remains in the background in this literature.

A stronger interpretative line to the processes that manufactured modern society and nature could probably be found by looking in fields

contiguous to history, like historical geography and social science. The reflections of historical, neo-Marxist geographers in the last 20 years have produced and refined useful tools for the historical analysis of urban processes, particularly for whoever is interested in illuminating the contested phenomenon of production of space. According to Matthew Gandy, for instance, organicist metaphors, such as that of urban metabolism, are the product of the functionalist account which is unable to grasp the complex ways in which the urban space has been produced.[66] Thinking of cities as a human body, he argues, is linked with the paternalistic image of the city as a whole that could be shaped and governed by a rational human will. That image excluded conflicts and tensions, which conversely were an essential element of the process of urbanisation.[67] In short, this model of urban metabolism should be 'replaced by a historically driven conception of urban nature which is rooted in the political dynamics of capitalist urbanisation as a contested and multidimensional process of urban change.'[68]

Erik Swyngedouw's work on the Spanish *regeneracionismo* pushes the understanding of the nature/society dynamics further.[69] He emphasises that Spanish society was shaken by the loss of its last colonies in 1898; this caused an urgent debate among Spanish intellectuals about the ways the Spanish nation could revive.[70] This task, which involved both a material and a spiritual regeneration, took the shape of a geographical project of modernisation through the implementation of a programme of hydraulic improvements that transformed the territory of the country.[71] This example demonstrates how nature and society are not separable and it would be better to talk of the production of nature in terms of a historical-geographical process that has a specific spatial and temporal dimension. This produced nature 'embodies chemical, physical, social, economic, political, and cultural processes in a highly contradictory but inseparable manner.'[72] According to Swyngedouw, this perspective could permit a better grasping of the complex bundle of relations between capitalism, environment, space, contemporary social life, and modernity.[73] In order to weave together all of these elements, Swyngedouw uses multiple narratives to analyse the relations of power inscribed in the discursive, ideological, cultural, material, and scientific practices through which the Spanish waterscape was reshaped as a socio-natural space which mirrored the contested modernisation process of that country.

Similarly, for Maria Kaika, water and water networks represent a privileged entry point to describe the historical geographical process at the basis of the modern nature/society dualism. Kaika aims at unpacking the perception of the world as a series of insulated, sealed, and autonomous 'space envelopes': the home, the city, and nature.[74] According to Kaika, the nineteenth and the twentieth centuries have been characterised by the implementation of the modern 'Promethean project' of 'taming and controlling nature through technology, human

labour and capital investment… (in order to render) modern cities autonomous and independent from nature's whims.'[75] This emancipatory dream took the shape of a series of networks which were part of a project to construct urban spaces as nodal points, the 'nexus of entry-exit points for a myriad of interconnected circuits and conduits.'[76] Technology networks, Kaika argues, are the material expression of the continuous and interdependent relationships between nature and the city, which have to be considered a socio-spatial continuum, a hybrid neither purely natural nor purely human. Kaika also analyses the aesthetic and cultural dimension of urban networks. In fact, the 'Promethean project' of modernity carried within it the ideology of progress and the belief that human emancipation inhered in being connected with technology.[77] Moreover, networks embody the reification of social relations and obscure the process of exploitation of natural resources and human labour; in addition, as Walter Benjamin said, they are the aesthetic representation of an emancipatory dream and so objects of desire.[78]

Hence, neo-Marxist scholars focus on explaining the relations between power, space, nature, and society. A further point of view in this line of thought is that of Stephen Graham and Simon Marvin. They describe cities as points of intersection between local/global dynamics of power and natural resource exploitation.[79] In their view, the present, ongoing social and material urban fragmentation, which they call 'splintered urbanism', is sustained under the influence of neoliberalism by the unequal distribution of large infrastructure networks.[80] Moreover, infrastructure networks are the topological connectors that link places of production with places of consumption; in that way, they underpin a specific geometry of power based on a geographical configuration of places and connecting flows. For this aspect, technology networks have to be considered as socio-technical assemblies that embody capital, know-how, technology, geopolitical power, and cultural meanings. Graham and Marvin analyse infrastructure networks building and working over the last century and a half in different historical and geographical patterns. In that period, they argue, there has been a shift from an era of mainly standardised infrastructures to one of splintered, private, and separated infrastructures, which serve powerful and affluent users and space and bypass less wealthy ones.[81] The period between 1850 and 1960, which partially covers that of the present research, was characterised by the widening power of nation-states and the rise of the urban planning movement, which imagined space as a neutral object that could be rationally manipulated. Practically, a series of standardised networks were realised in order to envelop all the spaces of the modern city; in this way, the emancipatory dream inherent in mass production, distribution, and consumption was materialised.[82]

A further understanding of the socio-constructed boundaries between nature and society is provided by the work of political theorist and

historian Timothy Mitchell.[83] His target is to turn over the ground on which the interpretative categories of social sciences have been built since the nineteenth century, through an investigation of a specific case study in the Egypt of mid-twentieth century. The practice of science, particularly economics and social sciences in Mitchell's account but also engineering, partially works as a new form of calculation that made the world measurable; but it also relies on the construction of boundaries, exceptions, distinctions, and exclusions such as nature/technology, tangible/intangible, national/foreign, and many others.[84] These binary oppositions, Mitchell continues, are not the result of a disembodied reason but have been forged in the political process in order to constitute the field for the operation of the modern experts of technology, engineering, and the social sciences. To sum up, Mitchell argues that the claims of these experts are constituted in the politically constructed dichotomy 'opposing nature to technology, reality to its representation, objects to their value, and the economics to the science of economics.'[85]

Hence, attempts at explaining modern policy and the development of technical bodies should try to clarify how nature and society were conceptually separated and to interpret the role of infrastructures in mediating social power. A further point of view under this aspect is that of Frank Trentmann.[86] He suggests adopting a more user practice-oriented approach to infrastructure in order to enrich our understanding of the material culture, a *Dingpolitik*, in which ordinary people have to be considered co-producers of systems of provision.[87] According to Trentmann, daily practices 'are useful for reconnecting consumption to the study of things, materials, and technologies without falling into the trap of technological determinism.'[88] Products, he argues, have been designed for a particular use but they are also subject to local patterns of use.[89] As an example of this, Trentmann and Vanessa Taylor follow the uneven and disputed shift from intermittent to constant water supply in Victorian Britain, adopting mainly the point of view of the consumers and their behaviours and battles towards water resource allocation and pricing.[90] They conclude that the flow practices and technologies of power are not one-directional: the former react and influence in various and articulated ways the external impositions of the latter.[91]

To conclude, the approach of historical geographers and those of Trentmann and Mitchell allow scholars to overcome the nature/society dualism, which could be considered, as Mitchell suggests, a product and a means of the growth of government. In the end, nature and society could be better understood as a unique socio-technical process of construction of the space. As a result, the process of defining the use of natural elements like water represents a privileged entry point to analyse the complex, multifaceted social making of the space.

Water, Roman area, and the making of the space: an analytic proposal

At this point, the reasons for the neglected position of water in studies about modern Rome should be clearer. In brief, the symbolic, political aspects on one hand and the mechanism of land speculation on the other hand have polarised the attention of historians. Nonetheless, in regard to Italy, there are good examples that testify to the significance of putting water as a subject of historical research to understand Italian history.

Moreover, the theoretical background suggests that urban infrastructures might be understood as socio-technical assemblies that embody politics, economics, technology, culture, and nature. Their main action is to hierarchically structure space, which could be viewed as the hybrid product of nature/society's multiple interactions and the prime arena of conflicts among different social groups. As a result, the struggle for water resource access, use, and distribution is a privileged entry point to analyse the mechanisms of urban growth which involved the creation of a cultural discourse that could unify the targets of various reforming policies, providing a justification for the actions of the components of the Italian state and of the Italian technical elite, a new conceptualisation of water as a resource separated by the local context, capitalist expansion, diffusion of science and technology, and local patterns of use. The adoption of this viewpoint, therefore, could enhance the making of modern Rome and of the surrounding area given in the historiography as a process enacted by a singular mechanism such as economic speculation or political measures.

Hence, the concept of socio-nature adopted in the present research refers to three main nuances of the interactions between human and non-human elements. First, the notion of nature is contingent and historically determined by social actors. As evidenced in Chapter 2, the concept of river basin as the 'natural' space of water was a prerequisite for the centralisation of water management. Second, the natural features of water such as overall flow, seasonal fluctuations, and topography limit its possible social uses.[92] For example, the difficult (and, in the end, impossible) simultaneous coexistence of industrial, agricultural, and civic uses on the same body of water in the Roman area is a main argument of the book. Third, the very materiality of human life, from health to waste disposal, from energy to any material productions, is tightly entangled with the physical and chemical properties of water.

The book analyses the roles played by the different actors – state departments, local communities, and private companies – to establish how and why the supply of water to Rome evolved in the way that it did and, in turn, to reveal how water distribution and uses were crucial determinants in the physical expansion of Rome. In terms of spatial boundaries, considering the works of human geographers, the research goes beyond established administrative boundaries to consider the city of

Rome, the vast surrounding countryside, and neighbouring towns such as Tivoli, Frascati, and Marino in a comprehensive perspective, based on hydrographic criteria and on the close interrelations relating to the management and use of water resources.

In brief, this book is organised around the following questions: What was the place of water in the discourses of the Italian 'reformers' during the nineteenth and early twentieth century? How was water conceptualised by the Italian hydraulic engineers at the turn of the twentieth century? How did the Italian water law make sense of the struggle for water access, distribution, and use at the period? How did medical conceptualisation of water and methods of assessing water quality change in the late nineteenth century? What was the economic value of water in the Roman area? What were the practical applications of water in the Roman area at the period? What was the impact of all of these dimensions on the struggle for water resources in the Roman territory in the period of 1870–1922? Was the Roman case unique or did it have some similarities with the experiences of Mediterranean capitals such as Madrid and Athens?

In order to reply to these questions, the book is organised thematically. Consequently, each chapter seeks to explore one of the aspects involved in the struggle for water. The analysis follows a multi-scalar approach; thus, from Chapters 1–5, the focus shifts from the national level to the regional, the urban and the peri-urban, and finally to the neighbourhood level. These various strands of the research are separate, but they dialogue with each other. In particular, Chapters 5 and 6 are the points of intersection of the various strands of the research. As a result, in the first chapter, I analyse the composition of the Italian elites, particularly its modernising fringe, and their vision(s) of Italian modernity in relation to the uses of water. In brief, this chapter is about the cultural glue of the composite Italian elites and the cultural underpinnings of their attempts at modernising Italy and particularly the Roman area.

The second chapter is about the new conceptualisation of water given by the engineers of the Hydraulic Department of the Italian Ministry of Agriculture from the 1890s in the *Carta Idrografica D'Italia* (Hydrographic Map of Italy) and the creation of the concept of river basin as the space of an appropriate technical, centralised water management. This concept struggled to find acceptance in the local context. This was exemplified by the battle amongst various engineers and companies for the exploitation of the resource of the River Aniene in Tivoli, some 25 kilometres east of Rome, in order to produce hydroelectricity and to irrigate part of the Roman countryside. I also analyse how the Italian courts arranged a new water right in order to make sense of the dynamic between state agencies, private entrepreneurs, local communities, and private water owners.

However, engineering and law were not the only professions that were moulding new concepts of water access, distribution, and uses. Medicine

played a relevant role in this at the turn of the twentieth century as well. As a result, the third chapter examines the waters of Rome by means of the shifting understanding and practice of the Italian medical establishment at the turn of the twentieth century. In fact, the impact of cholera epidemics and the 'bacteriological revolution' changed the perception and the monitoring of water quality.

A further aspect of the research is the economic value of water and the relations between private stakeholders of water and public authorities. In the fourth chapter, I seek to explore the financing and construction of the first modern and market-orientated aqueducts of Rome, the Marcio aqueduct, the aims of the private company that managed it, and the complex relations between this and Rome municipality. Furthermore, I analyse the commercial strategies of a private consortium of water, which managed the Acqua Mariana canal. This was the most ancient canal for irrigation and industrial production of the Roman area. At the turn of the twentieth century, the strategies of the Private Consortium of Acqua Mariana interacted with the project of renewal of the Roman countryside, on one hand, and Rome's urban expansion in the southeastern sector, on the other.

Furthermore, water is an element that enables people and objects to accomplish tasks.[93] As a result, material uses of water are an element that must be considered a determinant factor in shaping the space. Consequently, the fifth chapter tries to show the multifarious uses of water made by the local population and consequently its 'molecular' agency over the territory. In the end, new suburbs grew in the space where an irrigated countryside was planned by state authority. More precisely, from the 1910s, a mixed landscape, urban/rural, came up from the complex social struggle over water resource access, distribution, and use in the territory southeast to Rome.

Once the patterns of the Roman case study have been clarified in these chapters, I analyse it in comparison with the cases of Athens and Madrid. The aim of the sixth chapter is to understand how cities and societies that experienced similar geographical, cultural, and political patterns engaged with the multiple dimensions of water. In short, here, I examine the trajectories of these three cities from an early modern to a modern water management looking for mutual patterns and local peculiarities. Finally, in the conclusion, I summarise the answers to the research questions and how the book engages with the literature.

Because I assume that the interactions between water and society were multiple and involved various dimensions, the sources I selected are various. Parliamentary debates and acts and technical reviews are the sources used to reconstruct the cultural horizon, discursive tools, and practical targets about water resources of the composite Italian elites. The hydrographic mapping of the Roman area is a valuable tool to examine the conceptualisation of water as a natural resource

separated from the local context of use. The political/administrative process for the implementation of some technical projects for water infrastructures are used to analyse how engineers tried to present themselves as the actors of an optimal, neutral, and efficient water management and how a local community reacted to these. Legal trials on the ownership of some water springs in the selected area are analysed in order to reconstruct the evolution of the Italian legal water framework and its influence over the allocation of water resources in the specific context of the research. Early printed books and articles are analysed in order to reconstruct the role of water for medicine, while the practical elements of health policy about water in the Roman area are analysed using the holdings of the local regional medical authority and various medical reports about the health conditions of the local population and territory. The holdings of a private water consortium (Private Acqua Mariana Consortium), which contain the administrative structure of the consortium itself, the minutes of general assemblies, daily management of the stream, the relationships with local and national institutions and personalities, grants on new water springs, legal trials, balance sheets, and a collection of maps, are used to describe the strategy of this local stakeholder and how this tried to retain its control over water and to develop a strategy of capital accumulation exploiting this resource. In addition, these files are useful to reconstruct the uses of water in the selected area and how these changed over time. Also, a collection of documents produced by the private water company that realised the first aqueduct of modern Rome is analysed to understand the financial and technical aspects of that enterprise, the aims of the water company, and the relations between this and the municipal authority.

Also, the Rome Historical Archive (*Archivio Storico Capitolino*) holds a variety of documents valuable to the research. Though the documents are scattered in several holdings, the recent implementation of a user-friendly digital catalogue allowed a detailed census of various document series. The principal dossiers are about the activities of the hydraulic office of the Roman municipality and concern its struggle to improve the quantity and quality of water to the municipal aqueducts and enlarge the distribution network of the Roman private water company in the countryside as well. More generally, these files contain details of the attempts made by this authority to find water resources for the operation of the public health system (aqueducts, sewers, washtubs, public fountains) and to produce energy.

The research also relies on some visual materials such as maps and pictures, which requires an appropriate contextualization. The data has been collected and analysed mainly through a qualitative textual analysis, in order to reconstruct the context of the text components, underlying as well as explicit meanings and to establish linkages within the various

sources. Quantitative research analysis will be used in some cases to integrate, where possible, the findings. Since the focus is on a process as a whole, the sections should be understood as dialoguing with each other, so that any point of intersection that emerges from the fieldwork between the different dimensions is underlined.

In the end, this variety of sources and methodologies will allow me to follow the aims and targets of the various agents involved in the ordering of water access, use, and distribution in the Roman area at the turn of the twentieth century. Moreover, they will enable me to explore the cultural, political, technical, legal, medical, economic, and use dimensions of water, relating the various dimensions and agencies with each other. This could transform the present historiographical understanding of the making of the Roman space as something enacted by a few powerful groups or singular mechanism. On the contrary, the process of urban change will appear as the unforeseen product of a multifaceted assemblage of socio-natural elements.

Notes

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3 Francesco Amendolagine (ed.), *La rinascita di un mito. Acque sorgenti, acquedotti e imprese finanziarie. Documenti e storia della Società Acqua Pia Antica Marcia* (Venice: 1997).
4 Bruno Tobia, *Una patria per gli Italiani, spazi, itinerari, monumenti dell'Italia unita, 1870–1900* (Rome: 1991); Bruno Tobia, *L'Altare della Patria* (Bologna: 1998).
5 Pace, *Gli Acquedotti di Roma*; MAIC, DGA, *Carta Idrografica d'Italia. Il Lazio* (Rome: 1892). A visual explanation of this could be found in Katherine W. Rinne, *Aquae Urbis Romae: the waters of the city of Rome* http://www3.iath.virginia.edu/waters/first.html [accessed on 11 June 2020], which is a cartographic history of the water system of Rome since 753 BCE. This includes rivers, streams, canals, swamps, aqueducts, fountains, bridges, public baths, reservoirs, sewers, and drainages.
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7 Stefano Battilossi, *Acea di Roma 1909–1996. Energia e acqua per la capitale* (Milan: 1997).
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9 Battilossi, *Acea di Roma*. See also Amendolagine (ed.), *La rinascita di un mito*.
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11 Ibid., 108.
12 Denis Bocquet, *Rome ville technique (1870–1925), une modernisation conflictuelle de l'espace urbaine* (Rome: 2007), 3.
13 Ibid., 149–150.
14 Ibid., Chapter 9.
15 See, for example, Andrea Ciampani, 'Municipio capitolino e governo nazionale da Pio IX a Umberto I', in Vittorio Vidotto (ed.), *Roma Capitale* (Rome: 2002), 37–71; Marco De Nicolò, 'Il Campidoglio liberale, il Governatorato, la Resistenza', in Vidotto (ed.), *Roma Capitale*, 73–123.
16 Marco De Nicolò, 'Città multipla Città dimezzata: la capitale tra Stato e amministrazione locale', *Roma Moderna e Contemporanea*, no. 1–2 (1999), 57–82.
17 For a complete discussion over the laws for Rome, promulgated between the 1880 and the 1911, see Leone Cattani, Giuseppe Ceccarelli, Guglielmo Ceroni et alii, *Le leggi speciali per la città di Roma dal 1870 ad oggi* (Rome: 1956).
18 Ibid., 64–67. See also Ciampani, 'Municipio capitolino e governo nazionale', 65.
19 Ciampani, 'Municipio capitolino e governo nazionale', 69.
20 Vittorio Vidotto (ed.), *Roma Capitale*, xi.
21 Vittorio Vidotto. *Roma Contemporanea*, 2nd edn. (Rome and Bari: 2006); Vidotto (ed.), *Roma Capitale*; Bruno Tobia, *Una Patria per gli Italiani*.
22 Vidotto, *Roma Contemporanea*, 92.
23 Ibid., 142.
24 Alberto Caracciolo, *Roma Capitale. Dal Risorgimento alla crisi dello Stato liberale*, 5th edn. (Rome: 1999)
25 Ibid., 296.
26 Ibid., 249–256.
27 Ibid., 298–301.
28 See, for example, Lando Bortolotti, *Roma fuori le mura. L'agro romano da palude a metropoli* (Rome and Bari, 1988); Italo Insolera, *Roma moderna. Un secolo di storia urbanistica* (Turin: 1962); Leonardo Benevolo, *Roma oggi* (Rome and Bari: 1977); Leonardo Benevolo *Roma dal 1870 al 1990* (Rome and Bari: 1992).
29 Benevolo, *Roma dal 1870*, 53–57.
30 Piero and Roberto Della Seta, *I suoli di Roma, uso e abuso del territorio nei cento anni della capitale* (Rome: 1988).
31 Ibid., 20.
32 Lidia Piccioni, *I castelli Romani. Identità e rapporto con Roma dal 1870 a oggi* (Rome and Bari: 1993).
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34 Piccioni, *I castelli Romani*, 119–122.
35 Anna Laura Palazzo, Biancamaria Rizzo, 'La destinazione industriale del quadrante Ostiense: difficoltà e contraddizioni di una politica urbana', *Roma Moderna e Contemporanea*, no. 1–2 (2004), 127–144.
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37 For a synthesis on the different views of power, see Simon Gunn, *History and cultural theory* (London and New York: 2014), 83–106.

38 For the historical debate on this point, see, for example, Emilio Sereni, *Vecchio e nuovo nelle campagne italiane* (Rome: 1956). Rosario Romeo *Risorgimento e capitalismo*, 3rd edn. (Rome and Bari: 2008).
39 See, for example, Piero Bevilacqua, *Venezia e le acque: una metafora planetaria* (Rome: 1998). This work, based mainly on the period of the Venetian Republic, interlaces various aspects linked with the protection of the Venetian Laguna, such as physical phenomena, economic uses of water, and water policy over a period of five centuries. For an approach of environmental history to the Italian context, see Gabriella Corona and Simone Neri Serneri (eds), *Storia e ambiente. Città, risorse e territori nell'Italia contemporanea* (Rome: 2007); Salvatore Adorno and Simone Neri Serneri (eds.), *Industria, ambiente e territorio. Per una storia ambientale delle aree industriali in Italia* (Bologna: 2009). For a more general history of water in modern Italy, see Piero Bevilacqua (ed.), *Storia dell'agricoltura Italiana in età contemporanea*, volume I: Spazi e paesaggi (Venice: 1989).
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41 Ibid., 151.
42 Ibid., 159.
43 Maria Luisa Ferrari, 'Trasformazioni urbane e igiene nell'industrializzazione ottocentesca di Verona, Vicenza e Padova', in Corona and Neri Serneri (eds.), *Storia e ambiente* (Rome: 2007), 55–85. Michela Morgante, 'Il metabolismo idrico urbano nell-età della modernizzazione. Interessi industriali e governo della cosa pubblica a Verona', in Corona and Neri Serneri (eds.), *Storia e ambiente*, 86–103.
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45 Morgante, 'Il metabolismo idrico urbano', 91–94.
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48 Snowden, *Naples*, 26–27. The average supply of water for person was of 45 cubic metres; moreover, water flowed into open canals for kilometres across the countryside of Campania. As a result, water was exposed to several pollutants, such as laundry waste, human and animal excrement, and even animal carcasses.
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50 Carla Giovannini, *Risanare la città: l'utopia igienista di fine Ottocento* (Milan: 1996), 109–118.
51 Snowden, *Naples*, 220.
52 Corona and Neri Serneri (eds.), *Storia e ambiente*, 16.
53 Francesco Bartolini, 'Back to a future civilisation: cities and countryside in the 'Third Italy', *Urban History*, no. 48 (2021), 108–124.
54 Bevilacqua, *Venezia e le acque*, 12.
55 Bartolini, 'Back to a future civilisation', 12.
56 Ibid., 14–16.
57 Snowden, *Naples*, 360.
58 Giovanni Sabbatucci and Vittorio Vidotto (eds.), *Storia d'Italia*, volume 2: il nuovo Stato e la società civile (Rome and Bari, 1995), v–vi.
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72 Ibid., 447.
73 Ibid., 449.
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75 Ibid., 5.
76 Ibid., 28.
77 Ibid., 28–29.
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81 Ibid., 35–55 and 137–177.
82 Ibid., 52.
83 Timothy Mitchell, *Rule of experts: Egypt, techno-politics, and modernity* (Berkeley, Los Angeles and London: 2002).
84 Ibid., 9.
85 Ibid., 15.
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88 Ibid., 297.
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1 Water, experts, and modernity

In this chapter, I analyse the composition of the elites of Liberal Italy (1860–1922), its modernising fringes, and their rhetoric on Italian modernity in relation to the uses of water. In brief, this chapter addresses the cultural premises and discursive tools of the Italian elites' various attempts at modernising Italy, particularly the Roman area. In fact, as shown later in this chapter, Rome and its surroundings represented a good showcase of the Italian territorial policies at the turn of the twentieth century. Hence, here I show the underlying cultural reasons and discursive justifications for legal measures, infrastructural projects, and material attempts at managing water in Rome and its surroundings between 1870 and 1922.

More precisely, this chapter aims to explore the place of water in the discourses about Italian modernisation at the turn of the twentieth century, particularly in the debates of medicine and engineering. In addition, I briefly explore how these discourses on the role of water in promoting Italian modernisation drew and reassembled the forms of the political discourse of the Italian *Risorgimento*. In detail, I focus on the reuse of the frames of moral and physical regeneration of Italy and its population developed by the Italian patriotic movement, in the discourses on Italian modernisation.[1] This is a relevant aspect in order to understand how these discourses worked as a cultural glue of the composite social bloc that perceived water management as the key factor to reshape Italian society and territory.

In fact, as early as the 1780s, Italian intellectuals, imbued with Enlightenment ideas – probably influenced by the stereotypes about Italians that were present in the vast literature of the Grand Tour – complained about the 'deadly torpor', the 'inertia', and the atmosphere of negligence and indolence of the Italian peninsula.[2] However, images of decay cohabited with the claims of an indisputable moral and cultural supremacy of Italy as 'mother nation of mankind.'[3] As a result, Italians had to redeem their vices in order to reacquire their ancient greatness and their place among other nations. This involved a moral and intellectual revolution that would have eventually led to the movement for an independent nation-state.[4]

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I argue that the discourses of the *Risorgimento* provided the grammar, a mutual language shared by the small though influential and educated fraction of the Italian population that actively took part in the Italian unification process. As a result, the rhetoric of Italian modernity, created by different social groups in the second half of the nineteenth century, was based on this shared linguistic patrimony. Moreover, these discourses embodied the idea that the pursuit of Italian modernity was the logical outcome of the *Risorgimento*. Indeed, a central theme of this chapter is the idea that the plans to reform the Italian society and territory, which were created by various agents during the late nineteenth century, were presented by means of a rhetoric focusing on moral and natural aspects while avoiding directly questioning the social order. With this in mind, the central questions of this chapter are as follows: What was the social composition of the elites in Liberal Italy? How did the most dynamic fringes of Italian society – namely doctors, engineers, and political reformers – transpose these discursive tools from the struggle for independence to the struggle for water at the turn of the twentieth century? What did these discourses aim to do? What was the place of Rome and its territory in this context?

The aim of this chapter is to scrutinise the cultural element of the struggle for water access, distribution, and use in the Roman area at the turn of the twentieth century within the broader Italian socio-cultural context. Consequently, in the first section, I show the social composition of the Liberal Italy elites, of some of the most dynamic groups of the Italian society of the late nineteenth century and the challenges the new state faced. In the second and third sections, I explore how doctors and engineers tried to define their social role and mission by adapting the forms of the political discourse of the *Risorgimento* to the debate about water resource access, distribution, and use. In the fourth section, I examine these discourses with respect to some projects of water management in the Roman area at the turn of the twentieth century. In the last section, I provide some evidence of the conflicts that arose inside the modernising bloc of the Italian society about the visions of the optimal use of water.

Risorgimento or the Italian path(s) towards modernisation

'What was being described from as early as 1840s as the age of Italy *Risorgimento*, or 'rebirth', was in essence Italy's appointment with modernity.'[5] In this way, John Antony Davis tries to summarise the dramatic process that led to the creation of a nation-state in the Italian peninsula in the period of 1848–1870. In brief, starting in the late eighteenth century, the aspirations to a more civilised society, the principles of a market economy, and those of liberalism had gained consensus among a significant fraction of educated Italians, who perceived that only the creation of an independent nation-state could help reach these

targets.[6] However, when Italian unification was accomplished by means of a fortunate combination of diplomatic ability, audacious political and military actions, the fervour of thousands of militants, and a set of political contingencies, the challenges of modernisation and state building were just the beginning.[7] In fact, the new Italian Kingdom comprised several former states, each with its own unique social, cultural, legal, and political conditions.[8] Even more, unification carried within it a fracture between the new Liberal regime and the Catholic Church, whose values and organisation represented a binding force for the Italian people and the refusal of the new state in the southern regions.[9]

The challenges of modernisation, state formation, and building a consensus about the new Liberal regime all came at the same time. As Lucy Riall argues, these needs were in many respects contradictory since the process of state building was a centripetal one.[10] In fact,

> To be effective, the state had to be able to deprive local elites of their traditional privileges, to mediate between groups competing for a share of the newly created privileges and to control or discipline the least privileged members of society.[11]

On the other hand, the demands for political representation and legal limitation of state power represented a hindrance to these targets. Raffaele Romanelli describes these contradictions as 'the impossible command', which undermined the social basis of the Italian Liberal state.[12] As a result, the art of compromise was the only viable policy for the Italian Liberal elite.[13]

Nonetheless, among many differences and peculiarities, the various Italian regions shared a mutual feature: hydrogeological instability. In fact, as Marco Armiero argues, 'from 1860 to 1922 Italy experienced more than 1,400 landslides and floods and practically no Italian province was immune from this problem.'[14] Consequently, taming water became a central theme of the territorial policies of the new state.[15] As Stefania Barca points out, in the pre-Unitarian Italian states, discourses about the 'disorder of water' had been built from early nineteenth century to support policies aimed at disempowering common uses and the local community of their control over natural resources.[16] In brief, those who expressed these discourses wanted to criticise the social organisation of production processes, assuming that common property of water and land resulted in overexploitation of nature, which caused deforestation, soil erosion, and landslides in the mountains as well as marshes and floods in the plains.[17] The agents who built these discourses saw the liberalisation of the land market and the privatisation of water, which would have allegedly led to the rationalisation of water uses, as a way to restore water harmony.[18] In detail, the taming of water involved a variety of processes, such as reforestation and reclamation, the engineering of rivers

to keep their flow regular and steady. These measures would have promoted more productive uses of land and water.

However, who were the actors supporting the 'disorder of water' rhetoric and what were their relative positions within Italian society? In some cases, they were part of the Italian national elite that had been able to embrace the principles of liberalism and to lead the process of social change. This was a cohesive social bloc of landed aristocracy, which 'produced a kind of symbolic capital within which the concept of nobility interwove with the notion of a natural order deeply embedded in land and agriculture.'[19] In addition, because throughout the nineteenth century investments in agriculture ensured a good income in Italy as well as elsewhere in Europe, industrialists, financers, and professionals purchased rural estates, thus becoming part of these elites and assuming a noble-like lifestyle.[20] In many cases, the landed elite was dynamic and showed a market-oriented mentality. For example, an increasing exploitation of land, favoured by the reclaiming and colonisation of 'new lands' in the Po Valley, 'accentuated the entrepreneurial mentality of the landed elites of Northern Italy and thus helped to sustain the process of industrialisation.'[21] From a political point of view, this social bloc can be identified with the *Destra Storica* (Historic Right) which led the Italian governments from 1861 to 1876.

In the late nineteenth century, new Italian elites were in formation, particularly in the ranks of the professions: lawyers, notaries, physicians, pharmacists, engineers, and architects. Indeed, social and political circumstances allowed the professions to acquire power in nineteenth-century Europe; they created new services, products, markets, and sources of income. In general terms, in all of nineteenth-century Europe, the professions were the 'most active driving forces of the modernisation process.'[22] Nonetheless, some peculiarities of the professions in Italy made these social groups a very unstable element within Italian society. First and foremost, the professional marketplace of late nineteenth-century Italy was overcrowded.[23] For example, with respect to lawyers and attorneys, Italy had the highest ratio of professionals per 10,000 inhabitants in Western Europe (8.1) but had almost the same ratio of doctors per 10,000 inhabitants as England and Wales (6.7 for Italy, 6.8 for England and Wales). Nevertheless, the demand for health care, both public and private, in Italy was affected by the low income of most of the Italian population, which could not cope with such a health system, which was primarily private until the late 1880s. As a result, 'new Italy, the society that had arisen from the struggles of the Risorgimento, was overrun by a swarm of lawyers, attorneys, doctors and engineers', who competed to secure a share of a scarce clientele.[24] Hence, these social groups demanded an expansion of the role of the state in the society partially because they perceived the expansion of the administrative functions of the state as a source of employment and income.[25]

However, this was not the only reason that led Italian professions to become the bearers of modernisation by means of a rational and technical management of people and resources acted by the state. Also, there was something more that explains the self-consciousness of these social groups, which were otherwise divided by conflicts of interest, disparate levels of income, and cultural differences.[26] The belief that they had a social mission – perceived as a continuation and evolution of the *Risorgimento* – reduced these differences. In short, in late nineteenth-century Italy, a new professional elite was establishing its role and influence in the Italian state. The language of fall and regeneration allowed these elites to discuss projects of space and society reform in a neutral way, without questioning the social order. In the next section, I focus on one of these professional groups: doctors. Indeed, we see some concrete examples of the role of water in the political discourse of Italian doctors in order to understand the self-consciousness of these social groups in relation to a modernising mission and their contribution to the 'disorder of water' rhetoric.

Physical and moral regeneration: water in the medical debate

In the opening speech of the first congress of the *Associazione Medica Italiana* (Italian Medical Association), held in Milan in September 1861, the president of the assembly, Luigi Giannelli, briefly presented the programme of the Italian medical establishment.[27] The professional association of Italian physicians pursued many targets: regulating medical training and practices, extending the reach of health care to the poorest social groups, improving the Italian hospital system, and particularly promoting the public health legal framework and physicians' role in public health administration.[28] The social mission of the association was to protect human life since this was

> The dearest and often only good of a vast part of the humanity; and the love of property is the first source of civic spirit. (Moreover) In return for the hardiness of their inhabitants, the cities and the countryside offered strength and labour, which represents a nation's wealth. (Furthermore) The brotherly respect for human dignity creates concord in the societies that are in need of public spirit.[29]

Consequently, the medical establishment aimed at presenting itself as an element of social stability and economic wealth and as an upholder of private property. In brief, as happened in France, several efforts to reform Italian society had the mutual aim of forging the provident worker/small owner and a conflict-free, hierarchical social order.[30] Giannelli's speech can be seen as part of attempts by Italian doctors to find an audience in the Italian political elite and institutions. In the

following three decades, this quest was successful to some extent, considering that since the 1880s members of the central and local administrative institutions regularly attended the biennial *Associazione Medica Italiana* congresses. During the 1887 congress, Giulio Bizzozero, Provost of the Faculty of Medicine at the University of Turin at that time, was appointed delegate of the Ministry of Interior.[31] This was a sign of the growing interest that Italian institutions had in medicine research and practice, which in 1888 led to a public health reform that in Adrian Lyttelton's terms represented a watershed for the medical profession in Italy and reinforced the confidence of Italian doctors in their social mission.[32] Bizzozero, in his speech as delegate of the Italian Ministry of Interior at the 1887 Congress, explained what public powers were looking for in these medical congresses, namely some guidelines for a national health policy.[33] Unsurprisingly, the brief speech of Bizzozero focused on hygiene.[34]

What did this discipline concern in nineteenth-century Italy? In the words of Professor Alfonso Corradi, Provost at the University of Pavia from 1875 to 1878 and first president of the *Società Italiana d'Igiene* (Italian Society of Hygiene), this branch of medicine was the collection of medical practices that helped prevent the cause of illness and

> Maintain health, to make physical life prosperous and improve the morale of both the individuals and the peoples. Society will be a promoter of teaching hygiene as a part of popular education… (Hygiene seeks) the harmonious development of all our faculties, which provides vigour to the limbs, nourishment to the mind, purity, and nobility to feelings.[35]

Hence, using the modern classification of sciences, nineteenth-century hygiene was a blend of preventive medicine and social pedagogy. Hygiene, in nineteenth-century Europe, already had an established place among the movements for social reform. For example, in 1829, France established one of the most important journals in this field, the *Annales d'hygiène publique et de Médecine légale*.[36] This was not only an academic journal; rather it was a space for discussion that linked the systematic study of statistics, medical knowledge, and social reform.[37] The *Annales* intended to provide the administrators with a vast repository collecting the most innovative medical findings about health matters, which they could use to inform legislation and public measures concerning health issues.[38]

In 1879, probably bearing in mind the French example, some influential members of the *Associazione Medica Italiana* established the *Società Italiana d'Igiene*, whose journal, the *Giornale della Società Italiana d'Igiene*, was modelled on the *Annales* and shared the same objectives. Many members of the *Società Italiana d'Igiene* were deputies or senators,

while others were professors of the faculties of medicine of the Italian universities, particularly those of Padua, Pavia, and Rome.[39] In short, this association was representative of the Italian medical elite of the late nineteenth century, which was able to dialogue with Italian governments in order to create a new health-care system and to promote the role of doctors in the public administration.

What were the elements to manage first, according to the Italian Medical elite, in order to achieve the protection of human life, the promotion of a stronger, more resilient population and the improvement of its morality? In December 1878, during the opening lecture of the First Assembly of the *Società Italiana d'Igiene*, Corradi had a few doubts:

> O, how vast a part of our Italy still awaits the plough to excite her fertility, how vast a part still to be purified from malaria, to be redeemed from the licentious flow of the waters![40]

Corradi's lecture proceeded with some Darwinian metaphors about the gradual perfection of the species and concluded that the *Società Italiana d'Igiene* relies on

> The life-giving association of all the forces striving for the noble enterprise, to which we devoted ourselves; (namely) to preserve the life for working, to make labour harmless to life, wherefrom derive the physical and moral prosperity of the people and the civic greatness of the Nation.[41]

These excerpts make it possible to infer some of the key elements of the medical rhetoric of water in relation to the renewal of the Italian population and some elements about the self-consciousness of physicians as actors of civic progress, too. Primarily, Corradi identified a huge field of intervention for physicians, namely the whole of the physical, mental, and moral faculties of the Italian population. Second, he provided a set of viable targets such as the increase of arable land, the struggle against malaria, and – more generally – the taming of water. Hence, in his view, water represented the entry point of a political economy governed by medical principles. Consequently, it was necessary to engineer water in order to turn it from an element of 'disorder' into a productive one.

In 1880, a scientific article on the chemical and hygienic aspects of drinkable water by two other prominent members of the *Società Italiana d'Igiene* – Giuseppe Sormani, professor of hygiene at the University of Pavia, and Francesco Mauro, professor of chemistry at the University of Rome – confirmed this line of thought.[42] The authors supported their arguments with several references to contemporary international publications about drinkable water, asserting that

> private and public hygiene assigns the greatest importance to the purity of drinkable water…Italy, which in this field – and in other branches of the civil progress alike – had anticipated the other nations (as the grand Roman aqueducts testify), has to learn nowadays from other peoples, which outdid her in the path of civilisation.[43]

They went on to argue that

> Italy counts cities and towns well provided with potable water, but it is especially so for a generous gift of nature, (conversely) where … care, zeal, funding were necessary to improve its quality …there has been negligence. However, regenerated Italy has to pay utmost attention to such a very important branch of public health.[44]

These two statements condense a recurrent trope of the Italian public debate about water and of Italian political discourse in general, namely the use of biblical images of fall and regeneration. First, Ancient Romans were assumed to represent the noble ancestors of the Italian Kingdom. Second, they had been the vanguards of human progress, while Italians had fallen from the altar of civil progress because of their vices, such as laziness and unproductivity. As a result, in order for the Italian Kingdom to really embody such regeneration, it had to proceed along the path indicated by physicians.

Professors Gaetano Pini and Carlo Zucchi, in 1886, commented on a proposal of health reform articulated by Agostino Bertani, giving another example of this trope. They stated that hygiene 'is considered the most solid and the most reliable way to improve our race and to secure an increase of its prosperity and productivity.'[45] Hence, the claim for a health policy inspired by medical principles was indeed a claim for a new way to access, distribute, and use water since

> The health of the dwellers (of a city) improves in proportion to the ease and abundance of water supply… The more water is available the more it is used. Water abundance generates the need and the habit to the cleanliness of both individuals and objects. In addition, there is evidence that alcohol abuse spreads where water is insufficient.[46]

This short overview of discourses about water in the medical establishment provides some elements to ponder. As we have seen, the medical discourse about water was full of words like regeneration/redemption, which expressed the concept that the eradication of Italians' main vice, laziness, was the way to restore Italy's glorious past. However, physicians added a new dimension and a different target to this long-established and long-lasting framework: the regeneration of the Italian people involved not only moral and intellectual faculties but also physical ones. In order

to obtain this regeneration, Italian doctors created an imagery that separated the allowed, hygienic uses of water from the 'deviant', unhealthy ones. In short, the reasons for the poor living conditions of the Italian population were to be sought in the physical and moral dimensions, not in the social structure. Consequently, protecting the Italian population from some lethal diseases like malaria, cholera, typhus, and gastroenteritis, which could be the source of social unrest, required a different arrangement of nature and society. Engineering water in aqueducts, sewers, irrigation, and drainage canals allowed it to be preserved from pollution and contamination by faeces or other agents; thus, the population could drink fresh running water rather than relying on wells, cisterns, and open watercourses. Italian physicians perceived modern water infrastructures as a way to govern people, particularly their bodily practices in an indirect way. Similarly, in Victorian Britain, infrastructures such as sewers, aqueducts, streets pavements, and lighting were realised to favour the formation of a liberal subjectivity.[47]

In conclusion, these discourses can be read at several different levels. At a practical level, the Italian medical establishment looked for the recognition of its role inside late nineteenth-century Italy. At an aesthetic level, these discourses were built on the wider cultural background of the Italian elites, which are the images of fall and regeneration and the 'disorder of water' topic. These revealed the Italian doctors' self-perception, in the late nineteenth and early twentieth century, as the Apostles of a social mission, namely the physical and moral redemption of the Italian population from the original sin of laziness. This emphasis on the morals was a way to discuss social reform without altering the social hierarchy. Furthermore, these discourses worked as a binding force within the medical establishment and as a common ground between doctors and other intellectuals. In fact, at the end of the nineteenth century, doctors were not the only social group looking at water as a key element to reshape space and society, as the next section indicates.

Physical and material regeneration: Engineers at the conquest of modernity

Engineers had a strategic role in modernising Italy. In fact, in 1860, the country had no industrial system, and its infrastructures were in poor conditions. Thus, both the industrial system and the infrastructures had to be improved in order to gain administrative control over such a vast territory. Italian roads had fallen in disrepair, the rail system covered only a limited part of the country, ports were not able to cope with the technological naval progress, and a great part of the country was covered by marshes.[48] Moreover, the deans of the various schools of engineering and architecture were eminent men 'who had been closely involved with the *Risorgimento* and then emerged as authoritative members of the ruling

political class of the new Italy', particularly at a regional level.[49] However, these groups were internally divided by personal and regional rivalries, and mutual support was rare.[50] As a result, it is difficult to find a shared professional journal allowing us to examine the contribution of engineers to the public discourse about water and their self-perception with regard to water management. For these reasons, I focus on the publications of the *Società degli Ingegneri e Architetti Italiani* (Society of Italian Engineers and Architects), namely the *Yearbook* and the *Bulletin*. In fact, the contributors came from all the Italian regions and bridged the separation between the Civil Service and private professionals. In addition, since 1866, these reviews hosted a huge variety of contributors, mainly engineers but also geologists, agronomists, and – of course – physicians. As a result, these reviews were a relatively open space for discussion, sometimes for harsh controversies, over the sensitive themes of Italian modernisation and the practical forms to be adopted during this process.

Hence, how did engineers envisage their role in Italian society and what aspect of water suited this role? In September 1887, Professor Domenico Turazza – one of the Italian pioneers of modern hydraulics who established the Application School of Engineering of Padua in 1848 – during his speech at the sixth congress of the *Società degli Ingegneri e Architetti Italiani* in Venice – outlined a range of targets to direct the activities of the engineers' community.[51] According to him, the work of the engineers was guided by science, which

> With a friendly hand, lead us along the course of our waters, in order to supply our cities, to make our lands more fruitful by means of irrigation, to build new and bigger factories… The honest workers… expect (to get from you) modest and salubrious houses, where – with their limited resources – they can bring up their families in cleanliness and order, because the home itself is a powerful teacher of morality; and cleanliness and order are a compelling spur to virtue.[52]

These few lines condense a set of themes already encountered in the previous section. Primarily, both engineers and doctors considered the management of water – according to scientific principles – as the key element in order to improve the material life of the Italian population. Engineering and medicine also shared some practical targets in water management, namely providing the population with fresh, drinkable water and realising irrigation channels to increase the Italian agricultural yield.

More extensively, Amerigo Raddi, an independent engineer and a prolific writer on urban infrastructures who worked for many Italian city councils, in a discussion at the Congress of the *Società Medica Italiana* held in Siena in 1891, outlined the focus of the engineering professions in relation to urban spaces.[53] He stated that 'the health of a population relies on…building salubrious houses, draining and reclaiming soils,

(building) sewers, water pipes, hospitals…'[54] He argued that 'human life is more in the hands of the engineer than in the doctor's ones, (indeed) medical science can do little when a man lives in an unhealthy environment.'[55] The role of engineers in sanitising urban spaces was vital since preserving a robust physical health in the Italian population was essential in the competition with the other Western powers.[56] Hence, engineering water was the cornerstone in the creation of a healthy environment.

Furthermore, on the eve of the twentieth century, technology opened up a new horizon to Italian engineers and the chance to add an independent contribution to the narration of the optimal use of water resources. In the 1880s, applied engineering had made amazing progress since the first practical application of electricity production and distribution realised by Thomas Edison in Menlo Park and in Pearl Street, New York.[57] During the International Exhibition of Turin, in 1884, engineers Gaulard and Gibbs installed their transformers to light up the exhibition buildings, Turin railway station, and the Turin royal palace (Venaria Reale). Following this sensational event, some Italian businessmen, engineers, and politicians envisioned the great potential of producing and distributing hydroelectricity.[58]

One of the main proponents of the hydroelectric question was Francesco Saverio Nitti, journalist, Professor of Finance at Naples from 1898, deputy in the Italian Parliament from 1904 to 1924 for the Radical Party, Minister of Agriculture, Industry and Trade 1911–1914, Minister of the Treasury 1917–1919, and Prime Minister in the tumultuous two-year period of 1919–1920.[59] In his book, published in 1905 – whose eloquent title was *La Conquista della Forza* (The Conquest of Strength) – Nitti stated that all the different issues of Italian modernisation, namely boosting industrial development, promoting a mechanised agriculture, and redeeming the country from malaria, interconnected with the management of water.[60] As a result, Italian governments had to pursue the control of water access, distribution, and use in order to disentangle the intricate bundle of Italian modernisation. In fact, according to Nitti, a rapid substitution of steam energy with hydroelectricity was vital for the Italian economy since Italy had almost no coal but conversely had a hilly topography and abundant, well-distributed waters. He enthusiastically wrote that 'electricity bends, splits, feeds the humble lamp and the hugest engine, descends from the mountains to the plain, it is motive force, it is light, and it is heat.'[61] This form of energy disclosed a 'new, grand horizon to the Italian life…'[62] Nonetheless, this was not enough, '… it is a larger activity… a more ardent desire for renovation and a different orientation of education, which have to integrate the new models (of life) and the unclosing of a new civilization.'[63] As a result, according to Nitti, hydroelectricity was the ultimate tool for the redemption of Italy.

Engineers supported this point of view not only by providing accurate surveys, projects, and reviews of the technical applications of such a

technology but also by contributing to the creation of an optimistic vision of the fate that Italy could expect from this technology. For example, in May 1917, Luigi Luggi, President of the *Società degli Ingegneri e Architetti Italiani* and chief inspector of the Civil Service – with the First World War raging at the Italian northeastern boundaries – opening a conference about the uses of water, stated that

> The future of Italy – I would dare to say – depends on the use of water… And even more, on the use we will be able to make of that water nature pours yearly over our mountains, of which we only exploit a small part. … This is the big problem that we, the Italians, have to face firmly and to study now – even if the war is raging at our frontiers…. In this way, when our valiant soldiers like the Roman legionnaires – who were indeed peace and civilisation makers – will come back home, they will be able to direct their actions to the works of peace and civilisation, comprising water works. In this way, they will be able to participate in the economic redemption of Italy as they cooperated to its political redemption.[64]

Luggi, before starting a very accurate technical analysis of the practical means to fully exploit Italian hilly topography and its numerous waterfalls, precisely defined the role of water in the process of Italian modernisation

> It is by disciplining waters, now almost savage and devastating, by their methodical use for land reclamation, irrigation, and industrial processes, that Italy will draw those additional economic energies she needs to reach her high ideals of a great Nation.[65]

In conclusion, in the professional debate of both medicine and engineering, there were few doubts about the fact that water was the central element to manage in order to promote Italian moral, intellectual, physical, and material regeneration. However, since Italy had a long tradition of water management, these discourses indirectly questioned the existing owners and users of water. Indeed, as Nitti stated in 1905, the rational and centralised management of Italian water had encountered several obstacles and resistances, not least those exerted by the local populations who lived near the watercourses. Those people

> Generally took a certain dislike to power transportation, both nearby and far away. Most of all, they fear to lose their resources, at least partially. In addition, they argue that there is a useless dispersal of energy (due to transportation) …mountain people are suspicious and often exaggerate difficulties and risks.[66]

In short, engineers and physicians were creating the intellectual categories of a rational, scientific, and natural management of water, as opposed to the existing irrational, social, and historical one. In this narrative line, the technical and rational management of Italian surface waters, informed by the principles dictated by medicine and engineering, became the path leading to the regeneration/modernisation of Italian society, which was one of the promises of the *Risorgimento*. This language was part of the tools used by the social groups who wanted to accelerate social change and it accompanied their struggle against the resistance to these changes exerted by many parts of Italian society. In the end, the engineering establishment's discourses on modernity aimed at excluding the local, human, historical relationships with water from the new Italy. As Chapter 2 explains in more detail, over the centuries the local communities had already built infrastructures for water management according to their own regulations and uses. Irrigation, industry, and civic uses of water were already regulated accordingly. Hiding this fact or considering it a cause of the 'disorder of water', which affected the Italian economy, was a first step in a process of disempowerment of local communities over water access, use, and distribution.

Redeeming Rome and its surroundings

In this section, I examine the involvement of the Roman area in the discourses on Italian modernity. When the Papacy lost its international defender with Napoleon III's defeat at Sedan on 2 September 1870, the new Italian state took the opportunity to seize Rome and its territory in order to complete a phase of the territorial unification process.[67] Even though the capture of Rome, on 20 September 1870, ended a long period of struggle for Italian independence, it also created a huge fracture within Italian society. In fact, Pope Pius IX refused any agreement with the new rulers; he 'refused to acknowledge the legitimacy of the new state or to call for the Catholics to participate in it.'[68] As a result, the new rulers had a lack of legitimacy in their own new capital.[69] This process took the shape of a set of multiple attempts at modernising Roman society, economy, and infrastructures.

The new State's modernisation policies in the Roman area focused not only on the city itself but also on the over two hundred thousand hectares of countryside around it. Owing to its desolation, the latter appeared to the new ruling class as 'something similar to the River Don's steppe.'[70] A few members of the Roman aristocracy owned this vast area, organised in large latifundia and inhabited by only 3,000 people.[71] These vast plots had been leased to the *Mercanti di Campagna*, a group of contractors, who in turn sublet the land to sheep and cattle breeders. Only one-fourth of the surface area was dedicated to wheat cultivation.[72] Thus, the productivity of the Roman countryside was limited. In addition, the Agro

Romano was scattered with water meadows that made malaria a serious concern from May to November, both in the countryside and in Rome.[73]

As a result, the Agro Romano became the laboratory to experiment with the implementation of a policy to populate the uncultivated Italian lands. The Italian elites saw this measure as a way to create a social group of small landowners, which would have extended its legitimacy and reduced social unrest in rural Italy. As Senator Fedele Lampertico, an eminent member of the Italian conservative group of the ruling class, said in 1882 during a parliamentary debate about the extension of suffrage, the Italian small landowner was 'the last stronghold of the feeling of property… there is no more efficient barrier to communism than the tenacious farmer protecting the harvest of his hard work.'[74] However, the Italian landed aristocracy was not the only group interested in the settlement in the apparently abandoned lands. Many members of the urban bourgeoisie, too, upheld that the appropriate, technical management of these supposedly unproductive lands was a means of economic rebirth.[75]

As a result, on 20 October 1870, one month after the entrance of the Italian troops in the city, the Minister of Agriculture, Industry, and Commerce and the Minister of Public Works appointed a committee of prominent Italian engineers, agronomists, and deputies with an expertise in land reclamation.[76] The aim of the *Regia Commissione per il Risanamento dell' Agro Romano* (Royal Committee for the Reclamation of the Agro Romano) was to study 'a set of legal, administrative, technical and economic measures in order to promote …the reclamation of the Agro Romano.'[77] In the following 50 years, also during the Fascist regime, the reclamation of the Roman countryside occupied a central place in the territorial policy of the Italian governments.[78]

However, what is important here is to understand the cultural foundations of such a policy. For example, during a parliamentary debate, in 1902, Guido Baccelli, director of the Medical Clinic of the University of Rome, at that time Minister of Agriculture, Industry, and Commerce, stated that the conditions of the Roman countryside were

> a huge economic damage and a national shame… deforested hills, plateaus eroded and slashed by waters, latifundia covered with thorns and weeds, marshlands… come between the city (of Rome) and Italian people…moreover (malarial) fevers rule.[79]

Thus, the Roman countryside was a place of untamed wildness. In particular, this wildness was the result of the disordered water regime dominating that area. The Italian elites had to give order to that chaos by means of hygiene, engineering, and the introduction of rational agricultural practises.[80] This process was perceived as the restoration of the water regime that was assumed to have existed in the times of Ancient

Rome. For example, Qurico Filopanti, patriot and technical counsellor of Giuseppe Garibaldi, professor of mechanics and hydraulics at the University of Bologna, deputy from 1876 to 1895, in a parliamentary debate, in November 1878, stated that

> Evidence that Latium has been salubrious for several centuries is in the fact that… (Once), the cities were at an average distance of 7.5 kilometres from the rising city of Rome. The fields of Latium supported a not only copious but also free population that was able to stand up against the bellicose Rome for two or three centuries. Thereafter, (this population) blended in that of Rome, became the conquering breed of a vast portion of Europe, Africa, and Asia. Do you think that the current, poor herdsmen of Latium would be able to conquer the world? Hence, I think that this region's sanitary conditions were different from now.[81]

A proposal to drain all the swamps and engineering all the springs in the Roman countryside, in order to restore the harmonious water regime of this area, accompanied these speeches.[82]

Given the prestige and the economic relevance of land in nineteenth-century Italy, this attention to the Roman countryside was unsurprising. Nonetheless, at the turn of the twentieth century, Rome and water were related not only with regard to the city's countryside. Since 1872, the hydraulic service of Rome was aware that the municipal aqueducts had fallen into disrepair and their distribution network was inadequate to support the urban growth of the Italian capital.[83] However, the technical proposals drafted to improve the three Roman municipal aqueducts (Vergine, Felice, and Paolo) clashed with the limited financial resources of Rome's city council.[84] Moreover, the construction of a new sewer system required a large amount of water. Angelo Vescovali, chief engineer of the Roman Hydraulic Service from 1870 to 1895, in an official report in the mid-1880s, stated that

> When we will have completed the sewers, we will have to deal with (the) water (provision), which is an essential element to (maintain) health. (Water is a) "great natural purifier", as the English journal *Engineering* calls it talking about the Roman sewers… We, gentlemen, must desire that an underground river of water pass into the net of sewers of the city.[85]

As a result, he proposed to engineer all the springs and underground water veins, which were abundant in the eastern Roman countryside.[86]

Furthermore, in the last two decades of the nineteenth century, Rome and its surroundings experienced an early development of the practical application of hydroelectricity. In the mid-1880s, three projects were

drafted to supply Rome with this form of energy.[87] All of these projects aimed at using the waterfalls of the River Aniene in Tivoli, 25 kilometres east of Rome.[88] One of them was drawn up by Raffaele Canevari, a well-known personality in the Roman technical and political environment since – among other accomplishments – he had designed the projects for the embankment of the River Tiber and the new building of the Ministry of Finance.[89] Canevari had also been a member of the *Regia Commissione per Il Risanamento dell'Agro Romano*. In that role, he carried out a detailed hydraulic and topographic survey of the Roman countryside.[90] He aimed at 'turning the copious, rich amount of water resources, which at the present time – due to their large extent – are being neglected and unused, in favour of agriculture and industry.'[91] However, the waters that Canevari assumed to be neglected and unused had been actually managed and used for centuries by the local community of Tivoli.[92] Canevari and the private company he represented were aware of this given that in May 1885 they wrote to the Italian Ministry of Agriculture, Industry, and Commerce to ask for the Minister's moral support 'in the battles we have to fight to overcome the hindrances that always confront any grandiose work, any daring and fruitful initiative.'[93]

Indeed, few of the Italian waters were abandoned. On the contrary, many local communities and private stakeholders in Italian mountains, hills, and valleys relied on water as a staple resource for their economic life. The Roman area was not an exception. Thus, a key point in the discourses of the Italian modernising elites was to neutralise the resistance of these local owners and users of water. First, this cultural process started with the creation of a rhetoric of decline and decay over the contemporary situation of Italian water resources, depicted as 'erosive', 'devastating', and 'savage' and as the source of an unhealthy swampy environment. Second, the reasons for such a situation were to be found in the lack of rational water management. As a result, these discourses erased the references to the water rights of many local communities and stakeholders or, even worse, made them appear irrational and pernicious. Consequently, water had been taken out of its practical, historic, and social context, so that doctors, engineers, and politicians could impose their own visions about its optimal use.

In conclusion, the Roman area in the period of 1870–1922 was a showcase of attempts by the Italian elites at reshaping spaces, societies, and economies by means of a new water policy. The actual projects of this policy spanned from land reclamation to irrigation, from the purification of urban spaces through rivers of water to the use of hydroelectricity. The rhetoric accompanying these projects emphasised the fact that the inertia of the local population, who had abandoned the rational water management practised by Ancient Romans several centuries before, caused the Roman area to fall from a mythical golden age to an almost

stone age. Thus, this area needed the reintroduction of some principles of rational water management. Nonetheless, the vision of the optimal use of water was not monolithic. The next section presents some examples of the conflicts that arose between the groups with a different vision of water modernity in the Roman area at the turn of the twentieth century.

Conflicting water modernity

Hitherto, I have stressed the coherence of political discourses on modernity in Italy and the cohesion of the variegated social bloc upholding it. Indeed, those discourses aimed to create social cohesion around a reform of the water policy. In this section, I explore the possible alternative tasks that the Italian government and elites had to deal with on the way to modernity and the instability of the reformist bloc.

We can take France under the Third Republic as an example of the possible alternatives to water management as a means to pursue modernisation, as Liberal Italy was politically and administratively similar to it. In France, according to Paul Rabinow, 'philanthropic and scientific reform efforts through the 1870s focused on the articulation of spaces of discipline and moralisation. Their common aim was to form a (provident) worker, a monogamous family and a conflict-free, hierarchical social order.'[94] In short, the problem for French reformers was to organise power, space, and society in order to support the emergence of a new society.[95] Some of the elements of this new organisation were tested in French colonies like Indochina, Sudan, and Madagascar. There, a new social and political order was instituted, not only through military power but also through the construction of roads, railways, hospitals, and markets.[96]

These infrastructures were also relevant to Italian reformers and their conception of a productive, cohesive, and healthy social environment. Nonetheless, I argue that water was the lynchpin of these designs. First, because if in France, at the turn of the twentieth century, the stimulus to organise the different aspects of social life in a coherent space gave rise to modern French urban thought and policy, many Italian reformers had still in mind a mainly rural country. Second, they perceived transport, such as railways, as an element of social cohesion, but water was still a prerequisite to improve railways. General Afan de Rivera, a military man and a member of the Italian parliament in the 1890s and Minister of Public Works for a short period in June 1898, was a case in point. Indeed, he thought of railways as a state defence tool but also as a factor for social cohesion. In fact, 'any time I saw recruits carried by our railways from distant parts of our peninsula, I thought that those good, simple-minded, uncouth guys would have come back to their lands, at the end of the military service, a bit less uncouth and a bit more Italian.'[97]

However, the purpose of his pamphlet was mainly to talk about the crucial role of water in boosting the Italian economy and improving the

railways. Indeed, Afan de Rivera was soon criticised as a minister because of a ministerial circular he wrote to prefects and chief engineers of the civil service, to clarify that the concession of water to private actors had to be limited in quantity and that public uses of water, which came before, had to be closely examined.[98] The criticisms that de Rivera received are only one example of the instability of the modern discourses about water management and of its actual targets. Moreover, the example of de Rivera proves that the matter of water covered the spectrum of the attempts to manipulate space and society in Italy. In a social perspective, the example of de Rivera – a career soldier who came from a noble family of the former Kingdom of Naples – exemplifies the variety of the components of the Italian elites and of the social bloc that, on a discursive level, tried to coalesce around the modernisation of Italy. Indeed, this variety was one of the reasons for the continuous instability of aims and targets of the discourses of rational water management.

For example, in a parliamentary debate on the water law, in 1902, Silvio Crespi, speaking against the ministerial circular of de Rivera, argued that in order to ensure the optimal allocation of water, particularly its application to hydroelectricity, the government had only to 'let the industrialist or the professional work', in accordance with the existing law.[99] Crespi was a cotton industrialist and a prominent member of the rising industrial bourgeoisie of the North. He upheld the private control on water as opposed to the control of the state and the priority of the industrial uses of water over the other ones. Another good example of both the instability of the discourses on modernity and the composite social bloc that upheld them can be found in the Roman case and the reclamation of the Agro Romano. Physicians and engineers debated whether the main purpose of this enterprise should have been to achieve a malaria-free environment or to increase the land productivity. In 1904, Angelo Celli wished

> That the hygienist, the hydraulic engineer and the farmer proceed more closely in such a great work of economic, sanitarian and civic redemption of our Italy…in order to…free – with all our efforts – our territory from the scourge of malaria.[100]

Unfortunately, 'sometimes the farmer – led by his personal interest – compromises the work of the engineer.'[101] However, 'fortunately, where both the engineer and the farmer fail, the hygienist must be successful.'[102] These statements summarise the weakness of the land reclamation project as an antimalarial tool since the interests of the keeper of the territory, the farmer, could diverge from those of the physicians.

Moreover, Davide Bocci, a prominent civil engineer and a member of the Italian Board of Public Works, argued against the view of Angelo Celli. He said that before complaining about the poor progress made by the reclamation process in the Agro Romano

> Your Excellency and your colleagues should tell us why the anopheles in Bientina and Fucecchio are harmless and why is not possible to break the circle the protozoa make from man to anopheles and from anopheles to man and thus suppress the infection, as nature has done in Bientina and Fucecchio.[103]

In fact, Bocci was convinced that agriculture in the Agro Romano, particularly in the summer, suffered from a lack of water, not an overabundance of it. In his view, accelerating the flow of water in the Roman countryside, as doctors demanded in order to prevent the biological reproduction of mosquitos, would have hindered effective cultivation and settlement.[104]

Harsh controversies over the optimal use of water went beyond the projects about the Agro Romano. Even the projects for the use of the River Aniene in Tivoli, drafted in the mid-1880s, divided the supporters of Italian modernisation, in this case the engineering community. The next chapter examines the details of the projects to engineer the waters of the River Aniene. Here, I analyse an example of the debates that accompanied that struggle.

In particular, I analyse the projects drafted by Raffaele Canevari and Angelo Vescovali, two of the most prominent engineers who worked in the Roman area at the end of the nineteenth century. Francesco Brioschi – provost of the University of Pavia, professor at the Technical University (*Politecnico*) of Milan, director of the technical review *Il Politecnico*, and senator – intervened in the dispute between these two engineers.[105] He argued that the project of Vescovali implied a waste of the hydraulic potential of the River Aniene and, even worse, that it could not be implemented 'because it is based on (wrong calculations) about the available quantity of water; it requires the construction of a huge dam in a possibly unsuitable and dangerous place.'[106] Conversely, the project of Canevari was designed to respect the norms of hydraulic engineering and reflected the most advanced knowledge about hydroelectricity production.[107] Angelo Vescovali replied that Brioschi, in his own pamphlet, had acknowledged that he had not studied the hydrology and the morphology of the specific area; therefore, 'he does not know anything of what must be known in order to provide a sound judgement.'[108]

In conclusion, at the turn of the twentieth century, several disputes over targets and practical means to achieve the modernisation of water management in the Roman area animated the composite modernising elements in the Italian elites. Physicians considered water to have a prominent role in sustaining human life and the biological reproduction of the population. By contrast, many engineers and, more generally, local stakeholders prioritised those uses of water that could produce economic value in different ways, like irrigation, hydroelectricity, and industrial processes. At a more general level, a variety of social groups upheld the discourses

on the optimal, rational, and 'modern' management of water, namely industrialists, liberal landowners, nobles with a great confidence in the role of the state, urban bourgeoisie, and intellectuals. Each group had its own vision of the methods, aims, and targets of the 'modern' management of water.[109] As a result, the use of water was controversial and the projects for irrigation, drinking water, and hydroelectricity often overlapped and conflicted with each other.

Conclusion

In this chapter, I have provided some elements to reconstruct the cultural horizons of the composite political Italian elites at the turn of the twentieth century and to help understand their approach to the main problems they had to face: on the one hand, the construction of a modern country, starting from a condition of scarce financial and, more generally, material resources; and, on the other, the need to get a wider consensus for the new regime. Water played a relevant role in this process. Indeed, in the discourses of the Italian elites, reshaping water access, distribution, and use according to scientific principles would have rendered Italy a more modern country. Three strands in the usage of water can be identified as part of this process.

First, as a direct consequence of the agriculturally based Italian economy through the Liberal period, Italian political and technical elites were committed to increasing the agricultural yields. In addition, small landowners were perceived as the stronghold of social order. Therefore, land reclamation projects aimed at increasing the arable land, at making agriculture more productive by means of irrigation, and at providing self-employment to many Italian peasants. Second, water was seen as a key element to purify urban and rural spaces in order to make human life – and, in turn, social order – safer. The central concern of the Italian elites was the use of pure water for drinking and washing and for disposing of waste. Finally, water was a central element in industrial processes. These latter aspects increased the relevance of water in the rhetoric of modernity from the beginnings of the twentieth century, when hydroelectricity offered a feasible and powerful alternative to coal in the rising industrial movement in Italy.

Hence, these discourses aimed at creating a social front, 'a life-giving association of all the forces', in the words of Corradi quoted above, which was called to lead Italy on the path to modernisation. Nonetheless, the social groups that Corradi looked at were not cohesive. Certainly, the culture of modernity acted as a bridge between liberal landowners, industrialists, professionals, intellectuals, and even nobles who held different levels of power. However, these were the strengths and weaknesses of the modernising discourses. In fact, divisions arose in the practical attempts at reframing nature, space, and society during the late nineteenth and early

twentieth century. The Roman case, in the period of 1870–1922, offered some good examples of the complicated coexistence of these three elements and of the practical conflicts that could arise from an overabundance of interests and principles with respect to a limited set of water resources. Moreover, attempts at water management had to face the existing users and uses of it. Indeed, the discourses on modernity questioned the existing, historical, and social context of water usage. The line dividing the scientific and the natural from the historical and the social was a rift that contributed to fierce controversies about practical projects for water management in the Roman area at the turn of the twentieth century.

Notes

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4 Patriarca, 'Indolence and regeneration', 407.
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6 Ibid., 6.
7 Giovanni Sabbatucci and Vittorio Vidotto (eds.) *Storia d'Italia*, volume 2: il nuovo Stato e la società civile (Rome and Bari: 1995), v–xi.
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20 Ibid., 50.
21 Ibid., 56.
22 Hannes Siegrist, 'The professions in nineteenth-century Europe', in Kaelbe (ed.), *The European way*, 68–88.
23 Alberto Banti, 'Italian professionals: markets, incomes, estates and identities', in Maria Malatesta (ed.), *Society and the professions in Italy: 1860–1914*, Adrian Belton (transl.) (Cambridge, UK: 1995), 223–254.

24 Ibid., 223.
25 Ibid., 224.
26 Adrian Lyttelton, 'The middle classes in Liberal Italy', in John A. Davis and Paul Ginsborg (eds.), *Society and politics in the age of the Risorgimento* (Cambridge, UK: 1991), 217–250 (249).
27 Associazione Medica Italiana, *Atti del congresso costituente della Associazione Medica Italiana, tenutosi in Milano nei giorni 1, 2, 3, 4, e 5 Settembre 1862 preceduta da cenni storici circa la fondazione dell'associazione stessa* (Milan: 1863), 26–36. Affiliation to Italian Medical Association never represented more than 27% of doctors; see Banti, 'Italian professionals, 249.
28 Associazione Medica Italiana, *Atti del congresso costituente*, 4–5.
29 Ibid., 35. All translations are my own unless indicated otherwise.
30 Paul Rabinow, *French modern: Norms and forms of the social environment* (Chicago and London: 1989), 115.
31 Associazione Medica Italiana, *Atti del dodicesimo Congresso della Associazione Medica Italiana tenuto in Pavia nel Settembre 1887*, volume 1 (Pavia: 1888), 15–16.
32 Lyttelton, 'The middle classes', 242.
33 Associazione Medica Italiana, *Atti del dodicesimo congresso*, 16.
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35 Alfonso Corradi, 'Della società Italiana d'igiene e de' suoi intendimenti', *Giornale della Società Italiana d'Igiene*, no. 1 (1879), 4–13 (10).
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37 Rabinow, *French modern*, 86.
38 Ibid.
39 See 'Invito agli igienisti per la costituzione d'una società italiana d'igiene', *Giornale della Società Italiana d'Igiene*, no. 1 (1879), 124–126.
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50 Ibid., 192.
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52 Ibid., 390–391.
53 Raddi Amerigo, in *Dizionario Biografico degli Italiani*, volume 86 (2016).

54 Amerigo Raddi, 'Sull'importanza dei moderni studi riflettenti l'ingegneria sanitaria', in Associazone Medica Italiana, *Atti del quattordicesimo congresso della Associazione Medica Italiana tenuto in Siena dal 16 al 20 Agosto 1891* (Siena: 1893), 335–351.
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2 Mapping, engineering, law, and the struggle for water control in the Roman area

In May 1906, during a debate on water legislation at the Italian Chamber of Deputies, Carlo Schanzer, who would be Minister of Finance and Treasurer from 1919 to 1920 and Foreign Officer Minister in 1922, stated that local

> Populations consider water as their own natural wealth, and they believe they have almost historical rights to its ownership. From a strict juridical point of view, one could argue against these rights, but these are deeply rooted in the feelings of the population, as turmoil frequently accompanies private demands for large water concession…[1]

This passage conjures up the idea of a disjunction between the reformist elements of the Italian establishment, their attempts at expanding state control over water resources on one hand and local elites and populations on the other hand.

As evidenced in Chapter 1, taming and disciplining water to reduce natural disasters and diseases, to increase agricultural productivity of agriculture, to sanitise urban spaces, and to produce hydroelectricity were relevant political targets of the Italian establishment. However, the concrete realisation of this control over water required a complex set of legislative measures, financial resources, and technical expertise, besides large logistical efforts. Moreover, territories and water were not abandoned as the discourses analysed in Chapter 1 assumed but instead had been managed for centuries by local populations who were accustomed to different legal traditions, long-established uses of water, and different cultures and social structures. The Roman area became part of the Italian state 10 years after the proclamation of the Kingdom of Italy in 1861. Consequently, the echoes of papal regulations and perpetual water concessions to individuals and communities were strong and provided a legal justification to mental habits and practical uses that proved hard to change.

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Following from these premises and from the chronological and spatial boundaries of the present case study, the chapter addresses the following questions: How did the Italian state try to materialise its control over water resources in late nineteenth-century Italy and specifically in the Roman area? How did the local Roman population and private stakeholders react to these attempts? How was Italian water legislation adjusted in response to this dynamic between an expanding state and local users of water who tried to defend their own understandings and uses of water?

In brief, the aim of this chapter is to explore the local articulation of a national process, namely how the reformist members of the Italian elites tried to materialise their discourses about water in concrete explorations of the territory, in regulations of water access, distribution, and use by means of legal measures and engineering projects. To do this, in the first section, I examine the *Jacini Inchiesta* (Jacini Survey) on the conditions of Italian agriculture and a number of volumes of the *Carta Idrografica D'Italia* (Hydrographic Map of Italy) relating to water resources in the Roman area. In this way, I provide a first picture of the spatial boundaries of the research and of the water resources involved in the making of the socio-natural landscape of the Roman area, on one hand, and details of the professional elite's attitudes towards water resources on the other. In the second section, I analyse the struggle to engineer one of the main hydraulic resources of the Roman region, the River Aniene, in the late nineteenth century. In the third section, I scrutinise the evolution of the Italian legal framework on water from 1865 to 1922 by means of some concrete examples of legal disputes over water access and use in the Roman area.

The conceptualisation of water as a 'natural resource' in late nineteenth-century surveys

According to Sara Pritchard, the notion of nature and society and of the divide between technology and nature is contingent and historically determined.[2] In this section, I explore the conceptual abstraction of water from its social context in national and local late nineteenth-century surveys. For example, the *Inchiesta Agraria e Sulle Condizioni della Classe Agricola* (Survey on Agriculture and the Conditions of the Rural Class), better known as *Jacini Inchiesta* from the name of the president of the committee who supervised the works, namely the rural conservative count Stefano Jacini, was an ambitious undertaking.[3] Indeed, the promoters of this survey came from two different political cultures. On one hand were the conservative landowners of centre and north Italy – represented by Jacini – and members of the democratic left, which had a certain consensus in the professions – represented by the physician Agostino

Bertani. In the intentions of Bertani, this survey aimed at 'repairing the mischief and at preventing the damages to the social order that the unease of the numerous rural classes could cause.'[4] On the other side, landowners focused on the fact that Italian agriculture languished because of the high taxation that blocked investments.[5] The first chapter of the volume that collected the results of the *Jacini Inchiesta* for the Roman region focused on the meteorology, geology, and hydrology of the area. In particular, these elements were interlaced with a description of the incidence of malaria in the Roman area.[6] Indeed, these physical conditions were assumed to be the prerequisites of the 'desolation and squalor that stands in contrast with the place of one of the most ancient centres of civilisation and capital of the kingdom.'[7] Hence, the water regime of this area had to be restored.

However, any concrete attempts at reshaping the socio-natural relations in the Roman area had to answer a preliminary set of questions: who governed water, for what purposes, and on what basis? These questions related to the legal and the administrative dimensions. The legal system which informed the government of water is discussed in the last section of this chapter. As regards the building of the conceptual foundations of a new water management, here I scrutinise an apparently neutral technical tool – the *Carta Idrografica D'Italia* (Hydrographic Map of Italy). According to Alice Ingold, 'mapping a watercourse is making an inventory of the rights on water, denouncing water misuses and frauds, defending established users and admitting new users.'[8] The project of the *Carta Idrografica D'Italia* started in mid-1870s and lasted for almost 40 years. This was the product of heterogeneous institutional initiatives that overlapped and interlaced with each other.[9] Usually, the hydrographic map of an area was accompanied by an illustrative statement that had to make the map intelligible. Until 1890, these illustrative statements were drawn up by provincial panels whose members were local engineers of the civil service, powerful local stakeholders, counsellors of the local institutions (provincial and urban authorities), local scholars and professors, and – in North Italy – delegates of irrigation consortia.[10] As a result, the illustrative statements that came up from these panels focused on the history of waterworks on the established uses and users of water. In short, water resources appeared as the product of historically layered rules and rights, of complex negotiations between the pre-Unitarian Italian states and local communities.[11]

As an example of this, the hydrographic map of the Province of Bergamo, in Lombardy, outlined in detail the 'most ancient origins of the water derivations… (And) the history of waters that conducted by human hands improved and preserved the harvest of our lands.'[12] The analysis went back to the Middle Ages, singling out the Peace of Constance of 1183 – signed between the Emperor Frederick Barbarossa and the Lombard League – as a turning point in the history of water management

in Lombardy.[13] Indeed, the Peace of Constance declared that urban authorities acquired rights on water management. The report described the centuries-long process of the realisation of canals for irrigation, milling, and civic uses. Moreover, the report detailed the legal title, usually a municipal act or a seigniorial benefit, for the existing water concessions.[14] There was no reference to any 'natural' feature of water such as length, overall flow, and springs.

Another example is the hydrographic map of Piedmont.[15] In this case, there was a short introduction on some natural features, but both analysis and terminology were not scientific. For example, the first section was titled 'water and terrains' instead of a more scientific 'hydrography and geology'. However, the largest part of the discussion focused on the history of water management in the region. Two sections were called 'Traditions before 1785' and 'Traditions after 1785'.[16] Thereafter, the volume described the construction of many waterworks, which in some cases went back to the fifteenth century.[17] Irrigation was the main use of these waterworks, while the uses for motive force 'were dependent on the needs of irrigation.'[18] That is to say that industrial uses of water were subordinate to the agricultural ones. In general terms, these illustrative statements summarised the civic pride of local communities and local authorities, which boasted centuries of expertise in water management, claiming impressive results in these fields.

Conversely, from 1891, the maps and illustrative statements of the *Carta Idrografica D'Italia* were drawn up entirely by a group of engineers working in the Hydraulic Department of the Ministry of Agriculture.[19] The volume on the River Aniene, in 1891, signalled a robust theoretical and practical change in the understanding of water in Italian administrative practice.[20] In fact, that volume was structured around a new conceptual space – a space that was independent from political administrative boundaries, which did not respond to any previous socio-political regulation of water, namely a river basin. The River Aniene was described in terms of 'natural' features like orography, geology, and hydraulic regime; the descriptions of springs, water flow, slopes, rainfall, tributaries, and hydraulic energy were extremely detailed. Hence, the engineers of the Hydraulic Department of the Ministry of Agriculture extracted the River Aniene from its socio-historical context, in order to provide a stable, organic picture of the river as a natural element with its own natural operating rules. Nonetheless, the scope of the mapping of the River Aniene was political. In fact, the volume on the River Aniene was drawn up to guide the judgement of the 'Government on the water concessions from that river, since there are already many applications.'[21] Indeed, three different projects competed to obtain water from the Aniene in Tivoli, and owing in part to the strong resistance of Tivoli's local community, the decision-making process took eight years, from 1884 to 1892, to come to a conclusion. The relevance of the River Aniene for Rome was clearly

stated by engineer Giuseppe Zoppi, the main author of the report.[22] He stated that

> The River Aniene is very important for the capital of the Kingdom. Its copious springs provide (Rome) with the best quality and most abundant drinkable water. It is the only watercourse that can provide Rome with a considerable motive force for its industrial development. Finally, the waters (of the River Aniene) can irrigate a vast portion of the Roman countryside.[23]

Nonetheless, similar to the rivers and artificial canals of North Italy, the River Aniene had been managed and used for centuries by local communities, which were proud of their accomplishments in taming and managing the river for social purposes. As a result, presenting the River Aniene as 'natural' was a political choice. Water was naturalised in order to neutralise existing rules and procedures of water access and distribution; in this way, new uses of water could be planned and imposed over the assumed innate physical qualities of the river.

In 1892, this conceptualisation of water in terms of 'natural resource' was confirmed in the volume on the rivers Nera and Velino, which were part of the upper basin of the River Tiber.[24] On the one hand, the discussion involved an accurate technical analysis of the natural features of the basins of these two rivers, their minimum water flow, their hydraulic potential, and an explanation of the practical issues of calculations. On the other hand, the social context of the rivers remained unexplained. It is worth noting that these rivers had already a great social relevance, particularly for the city of Terni, where from the late 1870s a set of industrial activities were established using the motive forces provided by the rivers Nera and Velino.[25] In conclusion, during the 1890s, the engineers of the Hydraulic Department of the Ministry of Agriculture transposed the political discourses about water disorder and national rebirth that have been analysed in Chapter 1 in the ambitious undertaking of the *Carta Idrografica D'Italia*. These engineers played down the socio-historical context in which water resources had been hitherto managed. Focusing on the natural features of water resources, they suggested that these watercourses had their own internal physical operating rules, independent of any social form of water appropriation like existing rules and infrastructures. Hence, watercourses formed a natural unity. As a result, the Italian administration had to guide it in the decision-making process on water concessions according to the nature of a specific watercourse. In fact, only in this way could the Italian state gain the most from the use of water. This meant that local interests in water had to be replaced by a superior public interest, that the private concessional system based on layered seigniorial rights over water had to be displaced by a centralised

national system, and that a new conceptualisation of water bodies as 'natural resources' had to be incorporated in the Italian law.

The Roman surroundings

In addition to drawing up the hydrographic map of the River Aniene, in 1892 the engineers of the Hydraulic Department of the Ministry of Agriculture drew up the *Carta Idrografica D'Italia* of the Roman area.[26] This map focused mainly on the irrigation of the Roman countryside. The style of the map (Figure 0.1) followed the new conceptualisation of rivers and of water as 'natural resources' since the analysis focused on the minor watercourses that formed the lower basin of the River Tiber. In the intention of the engineers who drafted the map, the numerous streams that crossed the Roman region had to form the frame of a network of canals for the irrigation of the Roman countryside. In fact, after an introduction on the geology and orography of the area, the illustrative statement deeply engaged with the matter of irrigation.

According to the authors, in the Roman countryside only 1,000 of over 200,000 hectares received some form of irrigation. Parts of the irrigated lands were in the peri-urban belt of Rome. There, the aqueducts of Rome (Marcio, Felice, Vergine, and Paolo) supplied a few litres per day of drinkable water, which in some cases was also used to irrigate 'some stretches of vegetable gardens. However, what is more important is the (high) cost of this water…in addition, the main uses of this water would be domestic hygiene and watering animals.'[27] We can deduce two consequences from these statements. First, in the peri-urban belt of Rome, irrigation was ancillary to more relevant uses of water. Second, water was costly. Were these signs of a general lack of water in this area or of a lack of a specific irrigation infrastructure? According to the authors of the report, a more complex system of irrigation was practised only in the southeastern quadrant of the Roman area by means of the Acqua Mariana canal. This was a perennial watercourse managed by a private consortium that used water mainly as motive force 'but in some hours of the day it distributed water for irrigation. The overall water flow for irrigation conceded (by the consortium) was almost negligible but its cost was very high.'[28]

Nonetheless, the rational use of the minor watercourses of the Roman countryside could help the development of irrigation in this area. In fact, the engineers proceeded to argue that

> We have seen how irrigation in the Roman region is of little extension, badly regulated, and so irregular that the benefits have been fewer than could be expected. Now, it is time to see if and in what measure it is possible to regulate and extend irrigation.[29]

According to the authors of the document, at least 2,000 hectares of land could be irrigated by using the secondary watercourses of the lower basin of the River Tiber; this would have been 'a significant advantage to the public health and a relief to the working classes who in this way could find a stable employment.'[30] This passage showed how this project was linked with the Italian rural strand of modernity and the attempts at preventing the social unrest of the rural population.

However, irrigation was not the only target of the engineers of the Hydraulic Department. In fact, in the same survey, there was a section on the water springs of the Alban Hills, 20 to 30 kilometres southeast of Rome.[31] The survey sought to count and analyse the various springs in the Alban Hills in order to supply the population of that area with fresh drinkable water. Among the main springs they identified were the Squarciarelli springs (Figure 2.1). According to Thomas Ashby, the Aqua Iulia – one of the waters of ancient Rome – had its origins in these springs.[32] In the 1890s, these were the main springs of the Acqua Mariana canal. Hence, the hydrographic survey on the Roman region incorporated competing uses over the same water. The tensions between these two different uses were at the core of the legal trials that opposed the *Consorzio Privato dell'Acqua Mariana* (CPAM) to the town councils of Frascati and Marino, which are scrutinised in the third section of the chapter.

The authors of these reports were likely aware of these legal disputes but were completely silent about the historical rights of the CPAM. The

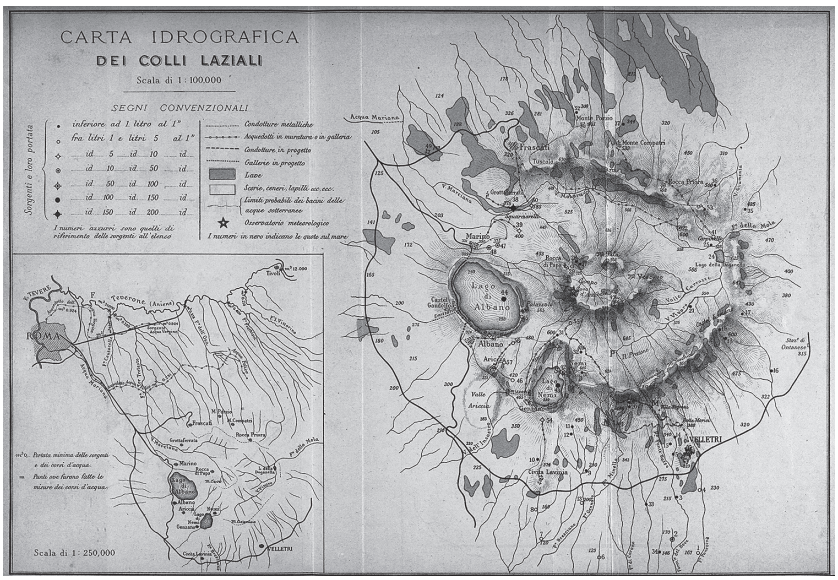

Figure 2.1 Hydrography of the Alban Hills.

technical nature of the report obscured the social context of use of the springs of the Alban Hills. However, organising a different system of water access, distribution, and use in the Roman area involved dealing with the existing social practices and perceptions of water, incorporating or excluding these from a new design. The practical realisation of infrastructural projects in the Roman area brought existing practices and regulations of water management to the fore.

Engineering water: local communities between historical uses and the dream of modernity

In the previous section, we saw the great relevance the River Aniene had for the projects of renewal of Rome and its surroundings. In particular, the engineers of the Hydraulic Department focused on energy uses of the River Aniene in Tivoli and to a lesser extent on the creation of a canal for irrigation of the Roman countryside. At the turn of the twentieth century, Tivoli was a manufacturing town of 13,000 people situated on a rocky outcrop 25 kilometres east to Rome (Figure 0.1).[33] In the fifteenth century, the local community had built a barrage to protect the town from the floods of the River Aniene. During the Renaissance, the water of the river had been progressively canalised in a complex underground network that conducted water to private and public fountains and to various water mills mainly to grind grain and olives, but also to two ironworks, a gun-powder factory, and a paper mill.[34] This made Tivoli the main manufacturing town of the Roman area in the early modern period. In 1826, a devastating flood of the River Aniene in Tivoli caused many casualties and the collapse of many buildings.[35] As a result, the papal government provided funding and technical expertise to accomplish an ambitious infrastructural project. This involved the diversion of the River Aniene into two tunnels dug into the mountain overlying Tivoli; there the overflow of the river was discharged upstream to the urban settlement into an artificial waterfall by means of a set of sliders.[36] In short, a very complicated, multilayered set of infrastructures, regulations, and uses governed both the River Aniene and the local community in Tivoli.

However, since the first century CE, the River Aniene and its springs were the main sources of water supply of Imperial Rome.[37] This close relationship between the River Aniene and the city of Rome was severed by the Goths besieging Rome in 537.[38] For the following 13 centuries, the aqueducts that connected Rome with the River Aniene remained drained. Only in 1870 did Rome again receive that water, by means of the modern Marcio aqueduct.[39] This was the beginning of a renewed attention of various Roman actors towards that river.

For example, in 1881, the Italian government conceded to Rome City Council three cubic metres of water from the River Aniene upstream to

Tivoli.[40] This water had to be used in Rome as motive force to develop industrial activities.[41] However, this measure remained a dead letter, partially because of the costs of the waterworks but also because of the strong opposition of Tivoli's city council.[42] Indeed, that concession of water undermined the flow rate of the river to Tivoli's mills, factories, and gardens.[43] Tivoli's city council was sensitive on this point, particularly because according to this authority the overall flow of the River Aniene had already been diminished in the space of a few years as a result of the creation of the modern Marcio aqueduct.[44]

Although the Rome city council was unable to put into effect the concession of three cubic metres from the River Aniene, this triggered further projects and the proposal to carry the hydraulic force of the river from Tivoli to Rome. The first project was outlined in its basics from 1878 by the engineer Angelo Vescovali, who was the chief engineer of the hydraulic service of the Roman urban authority.[45] However, as we have seen, the Roman urban authority could not or would not bear a financial enterprise of this sort. As a result, Vescovali looked for private founders, and in 1884 his project was accepted by James Wilson, a member of the Chamber of Civil Engineers of London, who offered his financial support to realise the waterworks.[46] The essential elements of this project were as follows: Vescovali aimed to use 21 cubic metres of water downstream of Tivoli. He planned to collect and lift this water to 100 metres above sea level by means of a dam 50 metres high and 200 metres wide.[47] In this way, Vescovali aimed to provide water to irrigate 14,000 hectares of the Agro Romano and to produce 7,000 horsepower (Hp) of hydraulic energy in various hydraulic stations between Rome and its countryside.[48] The intake point for Vescovali's project was after the *Cascatelle* (Little Waterfalls) at Vesta, a socio-natural beauty created by the fall of the River Aniene after its water had passed into the underground network of tunnels that distributed water to the users in Tivoli.

At the same time, the chief engineer of a private Roman company, the *Società per le Forze Idrauliche* (Hydraulics Forces Company), Raffaele Canevari, formulated a concurrent project to Vescovali's to derive water from the River Aniene in Tivoli. Canevari's project involved a water intake at 164 metres above sea level, upstream of the *Cascatelle*, by means of a canal that had to collect 12 cubic metres of water a second.[49] A canal would have carried this water near the rural towns located in the Alban Hills in a range of 25 kilometres from Rome.[50] Thereafter, the canal would have a fork in the countryside between Marino and Ciampino. Here, an industrial canal would have powered various hydraulic stations between Ciampino and Rome, producing almost 10,000 Hp of energy. Another project was drafted by the *Società Italiana Condotte d'Acqua* (Italian Water Conduits Company) and even accepted by the chief engineer of the civil service of in charge for the Roman countryside.[51] However, the complexity of the decision-making process and the

resistance encountered by the various projects to use the River Aniene for agriculture and industry convinced this company to turn its attention to more secure investments, such as that of the Villoresi canal in the Milanese area, as described below.

One obstacle to the realisation of these projects was the fact that the community of Tivoli stood against these attempts at realising new water networks over the old ones. Political meetings attended by members of the Italian parliament were organised, municipal acts were deliberated, and pamphlets were published.[52] In brief, all the legal tools to manifest discontent in a liberal society were used. The core argument of the local community was that

> In the past, the old Aniene had been the terror of Tivoli; it devastated fields, it destroyed buildings, it caused many casualties. Now, that our city has… tamed it with enormous sacrifices it is right and proper that (the Aniene) must be used for our ideals, for the hopes of our forefathers…of becoming the Italian Manchester.[53]

In brief, the local community perceived these projects as an injustice, as an illegal dispossession of their historical rights and as a breaking of the socially constructed relations between the local community and the river. Hence, the question was 'would the Italian government allow the dispossession of what the papal government had preserved to Tivoli's manufactures and arts?'[54] The local community raised a matter of legitimacy of the acts of the Italian Government about the River Aniene.[55] This was an example of the difficult coexistence between expansions of the administrative prerogatives of the Italian state with the necessity of the Liberal regime to gain a wider consensus.[56]

However, there was a breach in the armour of the Tivoli community. If they wanted to become the Italian Manchester (or at least a regional industrial town), they had to accept a reframing of their relations with the river in order to exploit all its potential motive force. This meant that the river had to be engineered according to the new technologies available. This reframing of the river was expensive and out of the financial reach of a small community. Hence, engineering projects and the private companies that sustained them represented not only a threat to Tivoli but also an opportunity to fulfil their dream of modernity. Hence, the local community moved between repulsion and attraction, the fear of dispossession and the hope for the fulfilment of a promise of emancipation and economic progress. Indeed, in 1888, the Tivoli city council established the terms of its acceptance of the projects in question.[57] One of the central points was that 'a huge amount of water should be ensured to the creation of a very important industrial centre in Tivoli, since this represents the foundation of the city's hopes, future, and resources.'[58]

This could be seen as a result of the discourses on modernity analysed in Chapter 1. The dream of economic progress, the ideal of a desirable model of social production paved the way to an exchange between historical rights and uses of water with the promise of a prosperous economic future. Indeed, this argument was widely discussed in the political meetings that occurred about this matter. For example, Menotti Garibaldi – the eldest son of the hero of the Italian Risorgimento – who was deputy at the Italian Parliament, in a political meeting hold in Tivoli in June 1888 supported this view. He stated that

> The problem is to study the way of using the (hydraulic) forces for industrial purposes …in and for the benefit of Tivoli without altering its natural beauties…Rome, our love, knows that it cannot grow at the expense of the cities of its crown. The aim of this meeting is that of understanding the criteria and hopes of the population of Tivoli… since becoming the Italian Manchester or the Italian Le Creusot is the destiny of Tivoli.[59]

The comparison with Le Creusot, one of the most articulated examples of urban planning inspired by the principles of social paternalism in France, was significant.[60] This testified that some members of the Italian establishment were looking for methods to organise nature, space, and society according to the principles of industrial civilisation. Engineers were the likely professionals that could achieve this. Consequently, how did the engineers and companies that aimed at appropriating the hydraulic power of the River Aniene cope with the opposition and expectations of the local community? On one hand, Angelo Vescovali strongly emphasised that his project aimed at collecting all the water available downstream from Tivoli, since this 'does not hurt the rights, and does not offend the hopes (of Tivoli).'[61] More precisely, his project respected the rights of the existing users, protected the little waterfalls of *Vesta*, and did not take away the hydraulic potential of the river from the local community, but rather included the use of this potential in the territory of Tivoli.[62] Moreover, he abandoned the agricultural part of his project focusing on the hydropower aspect.[63]

On the other hand, Canevari and the *Società per le Forze Idrauliche* opted for a different strategy. In fact, Canevari added the creation of a waterway between Rome and the dock of Civitavecchia to its original plan.[64] In addition, the president of the company and Canevari himself wrote to the Minister of Agriculture underlining the various economic benefits that could derive from the realisation of such a complex water network.[65] In their words, the project Canevari would have brought about 'the transformation of the agrarian and economic conditions of the Agro Romano between Rome and the Alban Hills, in this way the desert

that wrapped the metropolis of the Kingdom of Italy will be turned' into an active rural and industrial district.[66]

In brief, on the one hand Vescovali opted to accept the existing socio-natural relations between the local community and the watercourse, with a project respecting the local population's dream of modernity. On the other hand, Canevari approached the matter from the theoretical principles and linguistic tools of the Italian modernising elite. Hence, Canevari imposed over the local interests a view of 'superior' national interests represented by the maximisation of the natural features of the watercourse.

The authority that had to decide on the concession of water in the Roman area was the Prefect of Rome. The volume of the *Carta Idrografica d'Italia* on the River Aniene was drawn up precisely to provide a reliable guidance to the Prefect to solve this controversy. As we have seen, the rationale of that volume suited Canevari's project more and its understanding of water as natural resource. This was not a surprise since Canevari had been one of the promoters of the Hydraulic Committee inside the Ministry of Agriculture as early as 1866 and in the mid-1880s had actively worked to order the materials produced by various institutions on the mapping of the Italian watercourses.[67]

Nonetheless, in August 1892, the Prefect awarded the concession of water from the River Aniene to the Vescovali project because this 'does not damage the interests of Tivoli since the water intake is…after the water falls and the *Cascatelle*'.[68] To be more precise, the Prefect established that Vescovali could use all the water '[t]hat runs from the great falls and from the Cascatelle into the downstream river bed, after having been used by the previous, legally recognised users.'[69] The Prefect's decision was based on the Italian water law of the late nineteenth century, which was still favourable to the recognition of historical uses of water. As we see below, changing the legal framework on water was a prerequisite to putting the designs of 'rational', 'scientific' water management into effect.

However, the Prefect entitled the *Società per le Forze Idrauliche*, which in the meantime had been absorbed by the powerful Anglo-Romana Gaslight Company – the provider of gaslight in Rome from 1854 – a concession of four cubic metres of water from the River Aniene upstream of the *Cascatelle*.[70] Indeed, in the 1880s this company had bought some plants in Tivoli. These plants used and were allowed to benefit from that water by previous papal regulations.[71] As a result, the *Società per le Forze Idrauliche* simply inherited that concession of water. With this water, in July 1892, the Anglo-Romana Gaslight Company moved nine Pelton hydraulic turbines which powered six single phase generating modules producing 1472 KW/h.[72] This stock of alternate, single-phase electricity was conducted to Rome, at a distance of 26 kilometres.[73]In this way,

Rome became one of the first Italian cities to receive a constant supply of hydroelectricity.

Conversely, the long decision-making process had caused Vescovali troubles, particularly around the raising of the financial resources necessary to realise his project.[74] When Vescovali died in 1895 his project existed only on paper.[75] Finally, in 1899, the Anglo-Romana Gaslight Company bought from Vescovali's heirs the water concession he had gained in 1892.[76] In this way, in 1899, the Anglo-Romana Gaslight Company was able to build in Tivoli a new power station that was supplied with a greater volume of water than had been the case for the power station built in 1892.[77] Hydroelectricity allowed a more rapid connection between Rome and Tivoli by means of an electric railway and Tivoli became one of the most important industrial centres in the Roman area at the turn of the twentieth century.[78]

In conclusion, hydropower proved to be the use of water most suited to balancing the interests of the private companies, the energy needs of the Italian capital and the interests of the local community. Conversely, the project of an irrigation canal was abandoned because the water flow of the River Aniene in Tivoli in the 1890s was lower than the two projects assumed.[79] Moreover, part of the public health institutions considered the creation of a canal of irrigation in a malarial area risky.[80] Fully grasping the reasons for this turn of events and how it impacted on the making of the Roman area is difficult, but a look at the broader Italian context of late nineteenth century will help.

The Villoresi Canal and the Milanese area

As we have seen in the previous section, in the 1880s the Italian Water Conduits Company was one of the competitors for the water of the River Aniene. However, it abandoned the struggle in 1885 and focused its financial and technical resources on the realisation of the Villoresi Canal. This was an irrigation water network 86 kilometres long that ran from the River Ticino across the scarcely irrigated countryside north to Milan before flowing into the River Adda.[81] A partially submerged 280-metre-large dam could divert from 40 to 70 cubic metres of water into the canal. From this, in 1901 an industrial canal was built that supplied one of the largest hydroelectric power stations in the Europe of that time: Vizzola sul Ticino.[82]

Nonetheless, as with the projects on the River Aniene, the Villoresi canal was likewise the result of a complex and lengthy process. The project had its origins in 1863, when the engineer Eugenio Villoresi submitted a project for the construction of a canal to irrigate the countryside north of Milan to the Public Works Council.[83] The irrigation of that area was an idea widely discussed in the professional establishment of Lombardy at least from the 1820s. In 1868, after a process

of technical adjustment that also involved a change in the source of water, from Lake Lugano and Lake Maggiore to the River Ticino, engineer Villoresi obtained by Royal decree a concession of 44 to 70 cubic metres of water from the River Ticino.[84] However, the decision-making process was only a first step in the realisation of this infrastructure. Financing the enterprise was the most difficult task. In fact, the estimated cost of 12 million Lire discouraged private investments, even if the Province of Milan guaranteed a grant of five million Lire to realise the Villoresi canal.[85] Also, the landowners in the area north of Milan did not participate in the funding process and in many cases did not sign up to any contract to ensure a certain water demand from the Villoresi canal. Furthermore, the landowners feared that such a huge infrastructure could damage the balance between agriculture and sericulture that was a lynchpin of the area's economy. As a result, both project and Royal decree remained only on paper. This situation changed in 1880, when the Italian Water Conduits Company took over the River Ticino water concession from the Villoresi's heirs and entirely financed the completion of the waterworks.[86] In few years, the dam, the conveyance works, and part of the main canal were realised and in 1884 the new infrastructure was inaugurated. However, this engineering enterprise brought no financial gains to the company, and only the investment in hydroelectricity in the late 1890s compensated the investment. Finally, in 1918 the company sold the canal to a new consortium of users for a sum of 8 million lire.[87]

Nevertheless, the countryside north of Milan had a large irrigation canal, which progressively irrigated 60,000 hectares of land, transforming the socio-natural features of this area.[88] What were the differences between the Roman and the Milanese case? First and foremost, the jurisdiction of the state over a shipping river like the River Ticino was uncontested, as we see in the third section. As a result, in the case of the Villoresi canal the decision-making process lay with the national authorities like the Ministry of Public Works, while in the Roman case this was up to the local prefecture. Moreover, the idea of an irrigation canal and its route on the Milanese area had been already discussed for decades, continuously adjusted to cope with criticisms, before finally gaining the support of local institutions. By contrast, the projects of water derivation from the River Aniene to irrigate part of the Roman countryside could not benefit from this kind of historical stratification of ideas. Moreover, the fierce competition that opposed Vescovali and Canevari prevented the building of a general consensus towards a single technical project. Finally, the example of the Villoresi proved that the profitability of large investment in irrigation infrastructures in late nineteenth-century Italy was doubtful. Conversely, the rapid progress made by applied engineering in the production of hydroelectricity offered a more reliable and rewarding investment.

As a result, the project of renewal of the Roman countryside was undermined by the lack of a large infrastructure exclusively directed at the development of irrigated agriculture. Consequently, only minor watercourses and local sources of water remained available to those who aimed at improving the yields of Roman agriculture. Nonetheless, even minor watercourses and water springs were already used. Extending public authority and technical control to those watercourses required the adjustment of the Italian water law.

Defining water: local disputes and the making of the Italian water law

The example of the decision-making process in the Canevari and Vescovali projects demonstrate that the late nineteenth-century Italian legal framework was still informed by the principles of historical and social water management. Nonetheless, in the same years, the legal conceptualisation of water was changing but before scrutinising this process, an overview of the existing water legislation in late nineteenth-century Italy is necessary.

Italian water legislation from Unification up to the late 1910s was based on three different legal measures. The first two were the law of 20 March 1865 n. 2248 on the *Unificazione Amministrativa* (Administrative Unification Act) and the Civil Code valid from 1 January 1866.[89] The former was organised into six separate laws, each of which regulated a specific segment of Italian administration. The last of these laws (*Allegato F*) regulated public works and established criteria of classification, building, maintenance and control of streets, docks, and watercourses. These criteria had to establish the jurisdiction over infrastructures of various public powers of different levels (state, province, and urban authorities) and that of private owners.[90] In brief, this law established that all Italian watercourses were public and subject to public authorities for control and management.[91]

On the other hand, the Civil Code established that only lakes, borders rivers, navigable rivers and canals were state property, while the other watercourses were private. In addition, articles 540, 542, and 545 of the Italian Civil Code disciplined the rights over water springs. These articles linked water property with land property.[92] Thus, water springs were in the hands of the landowner where water poured from the earth. Hence, these articles allowed a large private domain over water resources. Indeed, according to Fulvio Cammarano, the Italian Civil Code expressed 'a model of juridical relations that was based on the priority of the private property, as successful completion of a winning "bourgeois revolution".'[93] In addition, a new law (n. 2644 *serie terza*) was promulgated on 10 August 1884 in order to provide a more precise framework for the Italian water concessionary system.[94] This law established the criteria and

temporal frame for water concessions and specified the jurisdictional boundaries of the various public authorities involved in the decision-making process. In short, the law of 10 August 1884 on water concessions established the limit of a concession in 30 years that could be extended at the end of the period, while perpetual water concessions were still admitted but only through the promulgation of a specific law.[95] Moreover, the state could revoke a water concession if it remained unused or in the case of water misuse by the licensers.[96] As regards the criteria of concession, the law was mainly based on a chronological one. This is to say that the first application regarding a specific body of water had priority. On the other hand, minor watercourses – even important ones like the River Aniene – were in the jurisdiction of the local prefecture.[97] In short, this new law represented a progression in the process of the extension of state administrative control over water but left the definition of the concept of public water unsolved. The legal thought disputed whether the distinction between major and minor bodies of water involved different prerogatives of the state. In fact, many minor water bodies were already used and managed by local communities and/or local stakeholders, often on the basis of ancient feudal privileges or particular regulations of the pre-Unification Italian states. In these cases, could the local prefecture assign that water to different users and for different uses? Or, in the case of minor watercourses, was the local prefecture simply an administrative referee able to resolve disputes between the established users of a body of water and to prevent any change to the water body that could damage (i.e., flooding, drought) users or third parties?

These were not minor questions. From the 1880s, the rapid evolution of hydroelectricity attracted many interests over minor watercourses. In addition to this, the pursuit of water by the Italian professional elites in order to improve public health and to develop irrigation increased human pressure on water. The Italian juridical problem was that any watercourse and spring of a certain importance was already subject to a centuries-long history of regulations and uses. This called into question the legitimacy of the local prefecture by allowing a different framework for the existing water bodies. As an example of this, between the mid-1880s and 1910 the Squarciarelli springs (Figure 2.1), located at the crossing of the administrative boundaries of Frascati, Marino and Grottaferrata, were at the centre of disputes and legal trials over its ownership, uses and allowed users. This was one of the first waters to be conducted to Rome again after the siege by the Goths in 537 that signalled the end of the aqueducts of ancient Rome. In fact, in 1122, Pope Callixtus II ordered the channelling of the Squarciarelli springs, whose water was conducted to Medieval Rome in an open canal.[98] However, this canal, called *Marana* (canal) of Acqua Mariana, was not used to provide drinking water to Rome but to irrigate its suburbs and to power some mills.[99] Many papal edicts during the following centuries formalised and gave a juridical justification to this infrastructure. In

1820, an edict issued by the *Cardinal Camerlengo* (the chief of the administrative authority of the papacy) allotted perpetual ownership, management, and use of that watercourse to a private consortium of users.[100]

However, the end of the Papal States and the introduction of Italian legal measures on water gave the communities living in the proximity of the Squarciarelli springs the chance to challenge this status quo. In 1886, the town council of Marino sought to provide a constant water supply to the population living in the upper zones of its administrative territory. The Italian Water Conduits Company outlined a project for the mechanical lifting of water to the upper areas of Marino. This project involved the use of a waterfall made by the canal in the area between two water mills in the administrative territory of Grottaferrata in order to power the mechanical lifting system.[101] On the legal basis of the *Allegato F* and following the procedures established by the law of 10 August 1884 number 2644 on public water concessions, the town council of Marino submitted this project to the Prefect of Rome, who authorised the works.[102]

The *Consorzio Privato dell' Acqua Mariana* opposed this decision and sued the town council of Marino. The lawyers of the CPAM argued that their clients had benefited from the ancient, exclusive use of the water of the canal. Hence, the CPAM had historical rights sanctioned by the edicts of the papacy to the exclusive use of that water body.[103] Moreover, the prefect could not allow new uses and users on that watercourse because articles 427 of the Civil Code and *Allegato F* revealed two different classifications of watercourses and consequently two different orders of prerogatives of the state. On this basis the state could claim the ownership of navigable rivers and streams. By contrast, the jurisdiction of the state, in this case the prefecture, over other watercourses was limited to risk control and maintenance of the existing physical and social features. As a result, the Prefect of Rome could not allow new users and uses on that water. These arguments found acceptance in the Civil Court of Rome. In fact, this established that the town council of Marino had to present its project, request permission, and pay a licence fee to the CPAM.[104] Thus, the Roman Court affirmed the private property of all the water that flowed into the Acqua Mariana canal. This was not an exceptional decision in Italian legal trials at the turn of the twentieth century.[105] For example, as late as 1910 the Court of Aquila declared that minor watercourses remained private even in presence of public needs that a minor watercourse could supply.[106]

Nonetheless, the development of hydroelectricity and the Italian Public Health Act of 1888 led many Italian courts to reframe water legislation. Another legal trial over ownership and uses of the Squarciarelli springs can help clarify these developments. On 2 December 1889, the engineer of the civil service Cesare Tuccimei bought a plot of land that included some water springs of the Acqua Mariana canal on behalf of the town council of Frascati, with the intention of diverting those springs in order

to provide drinkable water to its population.[107] As in the previous case, the CPAM tried to reaffirm the principles of private ownership of those springs and the fact that water was bound with the secular uses made by the consortium.

As a result, the dispute went to the Court. The arguments of the lawyers of the town council of Frascati were two. First and foremost, the lack of appropriate supply of drinking water was

> Source of lethal diseases, which carry within sorrow and desolation in various regions. It is a shame…that while the Government, province and urban authorities try to remedy these pains, private interests and private greedy speculations hinder this reforming and humanitarian activity.[108]

Here, the lawyers were talking about the Italian reform of Public Health Act of 1888. In brief, the Act affirmed the relevance and the necessity of providing any urban settlement with pure drinking water.[109] Their second argument was about the ownership of the springs subject to the dispute. In fact, they argued that the Acqua Mariana was a public watercourse due to its social relevance that in the Roman area was 'only superseded by the River Aniene.'[110] As a result, private agents could not contest the diversion of water from that watercourse and from its springs.[111]

Nevertheless, the Court did not entirely accept these arguments and between January and February 1892 issued a mixed sentence. In fact, according to the Court of Appeal of Rome, the Acqua Mariana canal was a public watercourse, due to 'the amount of its flow, its length, the variety of territories it goes through and for its irrigation and energetic uses.'[112] However, the uses of water made by the CPAM, irrigation and milling, were already of public relevance; therefore it could contest projects and acts that could diminish the water flow of that watercourse. Consequently, the Court established that the city council of Frascati could not divert the water from the Marana. Nonetheless, the state could concede water from the Acqua Mariana canal and its springs without damaging the using rights of the CPAM.

To sum up, the Court of Appeal of Rome distinguished between the ownership of water and the rights to its use. According to the Court the ownership of a watercourse could not be based on edicts of the pre-Unitarian Italian states because these had been repealed by the Italian laws.[113] Hence, in the above-stated case, the CPAM could claim only the rights to use that water, while the state was the proprietor of the water. This latter point was based on the physical features of the watercourse and on its possible practical applications. In this way, the classification of public watercourses stated by the engineers of the Hydraulic Department of the Ministry of Agriculture in the *Carta Idrografica d'Italia* received the juridical recognition of the Court of Rome.

This signalled the beginning of a reframing of Italian water legislation which reached its climax in the first decades of the twentieth century. For example, in 1907, the Court of Appeal of Naples stated that the definition of rivers and streams given in the Italian Civil Code had to be interpreted in a very broad sense.[114] In fact, the Civil Code was indeed referring to 'all the perennial waters, and to the seasonal waters of certain relevance…that were relevant for a pretty large district, their use had an impact on a relevant amount of people for their practical applications…'[115] Another example of this was given in 1908 by the Court of Appeal of Brescia. Here, a private metallurgical company claimed the complete ownership of some minor watercourses that flowed into the River Serio. The argument of the metallurgical company was that the water in question belonged to the plot of land they had bought, calling as juridical title the ancient edicts of the Bishop of Bergamo in 1179 and successive feudal concessions.[116] Nonetheless, the Court of Appeal of Brescia stated that a river and all the water that flowed in it were an organic unity; therefore the state owned those waters as part of something 'that can be used for the benefit of the community.'[117] This was one of the first practical juridical applications of the concept of river basin. As a result, the 'new public law cannot accept feudal prerogatives over something that it is not in the private sphere.'[118] Finally, in 1910 the Supreme Court of Rome stated that all the water bodies from which a certain amount of water could be derived for industrial, agricultural and/or public health purposes had to be considered public; therefore, subject to the state authority.[119]

The reframing of Italian water legislation made by the courts finally found acceptance in the Parliament as well. In 1916, Ivanoe Bonomi, the Minister of Public works of that time, submitted to the Italian Parliament a decree that recognised the definition of 'public' in relation to watercourses that had been forged amid the legal and administrative battles.[120] He stated that 'since the public use is extending, the concept of public waters is widening', showing that the criteria to define watercourses as 'public' was elastic.[121] Eventually, after half a century of disputes, state control on water access and use was established.

Conclusion

In this chapter, I have tried to explore how heterogeneous elements like mapping, engineering projects and legal definitions of water relate to the definition and expansion of the public domain over water. Understanding watercourses as natural organisms, with operating rules that were known only to engineers, was the first step in forging a new water policy. In fact, in order to make expanded irrigation, energy production and sanitation viable targets on a national scale, the Italian reforming elites had to create a space for its action. This space had to be free from any previous local

power, its aims had to be superior to those of a single community and its organisation had to be rationalised according with the principle of maximisation of 'natural resources'. In brief, the conceptualisation of river basins and the definition of public interests of water provided in the *Carta Idrografica d'Italia* from 1891–1892 created this space. Nonetheless, the legitimacy of this space was contested by the previous users of water who opposed their own understanding of water and their system of water access, distribution, and use, accumulated over the centuries. The engineering projects that aimed at reshaping socio-natural relations in view of the maximisation of water potential found a hindrance to its full development in this system of local private concessions and long-established uses. This was particularly true of projects that involved the uses of water that were not in the sphere of the national authorities and that were hardly considered in the public domain. As a result, the resistance of local powers, in some cases, influenced the realisation of waterworks.

Nonetheless, the rapid development of hydroelectricity and the pursuit of the medical establishment to ensure fresh, constant drinking water to the Italian population led to the growth of legal disputes on ownership and management of 'minor' watercourses. As a result, Italian courts had to find an ordering principle between old and new uses and users of water. This principle was found in the legal recognition of the river basin as the space of public authority; therefore, all Italian surface water had to be considered free from private feudal rights and its use had to be subjected to a centralised concessionary system.

The Roman area was at the forefront of this process. The first hydrographic maps in Italy that embodied this new understanding of water were drafted with regard to this area, the first hydroelectric power transmission in Italy was realised there and some of the first judgements about the public ownership of all surface water were affirmed by Roman courts. All of these combined testify to a certain modernising activism in the area of the Italian capital. Nonetheless, the practical results were uneven. In the end, it took various private agencies to make the dream of Italian water modernity real, as we see have seen with regard to the cases of the River Aniene and the Villoresi canal. In terms of the uses of water in the Roman area at the turn of the twentieth century, this resulted in the predominance of industrial uses over the agricultural ones. This would affect the project of intensive land cultivation of the Roman countryside and, more generally, would produce a socio-natural configuration of the space surrounding Rome unforeseen by the Italian elites.

Notes

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4 Text of the proposal of Deputy Agostino Bertani for a committee on the conditions of the rural classes, quoted in Caracciolo, *L'Inchiesta Agraria*, 29.
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7 Ibid., 820.
8 Alice Ingold, 'Cartografare le acque come risorse "naturali" nell'Ottocento: La "Carta Idrografica d'Italia" e gli ingegneri delle miniere', *Contemporanea*, no. 1 (2010), 3–26 (6).
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11 Ibid.
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13 Ibid., 19.
14 Ibid., 22.
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16 Ibid., 34–35.
17 Ibid., 36–37.
18 Ibid., 43.
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21 Ibid., 5.
22 The authors were Giuseppe Zoppi and Eugenio Perrone; the first was the chief of the Hydraulic Department of the Ministry of Agriculture from 1888 to 1897, while the second became in 1907 chief inspector of the same department.
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24 MAIC, DGA, *Carta Idrografica d'Italia. Nera e Velino* (Rome: 1892).
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28 Ibid., 8.
29 Ibid., 13.
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33 MAIC, Direzione Generale della Statistica, Annali di statistica, statistica Industriale, fascicolo LXV: *Notizie sulle condizioni industriali della Provincia di Roma* (Rome: 1903).
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43 Ibid.
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51 Società Italiana per Condotte d'Acqua, *Relazione tecnica compilata dal Corpo Reale del Genio Civile sulla domanda presentata dalla Società Italiana per Condotte d'Acqua* (Rome: 1886).
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70 Ibid.
71 Ibid.
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75 Ibid.
76 Consorzio Idroelettrico dell'Aniene, Governatorato di Roma, Elettricità e gas di Roma, *Gli Impianti di Tivoli* (Rome: 1929).
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79 MAIC, *Il Lazio*, 62–63. The minimum flow of water measured by the engineers of the Hydraulic Department of the Ministry of Agriculture, Industry and commerce was of 12 cubic metres per second.
80 ACS, *MAIC/DAG/versamento v/b.392/fascicolo 55*. 'Angelo Vescovali letter to Ministry of Agriculture, Industry and Commerce', Rome 11 February 1890. In particular, the National Health Council opposed the creation of such an infrastructure.
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84 Ibid., 70.
85 Ibid., 69.
86 Ibid., 79.
87 Ibid., 97.
88 Ibid., 57.
89 Fulvio Cammarano, 'La costruzione dello Stato e la classe dirigente', in Giovanni Sabbatucci and Vittorio Vidotto (eds), *Storia d'Italia*, volume 2: Il nuovo Stato e la società civile (Rome and Bari: 1995), 3–112.
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115 Ibid. See also Court of Appeal of Naples, Judgment 18 March 1907, *Giurisprudenza Italiana*, no. 1 (1907), 818.
116 Court of Appeal of Brescia, Judgment 21 April 1908, *Il Foro Italiano, raccolta generale di giurisprudenza civile, commerciale, penale, amministrativa*, no. 1 (1908), 1264–1270 (1265).
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3 Water, health, and disease

Since Classical antiquity, the impact of water on health was an object of medical enquiry. The Greek physician Hippocrates, in his treatise on 'Airs, Waters and Places', dedicated a chapter to water(s) 'of such as are wholesome and such as unwholesome and what bad and what good effects may be derived from water; for water contributes much towards health.'[1] Water also had a relevant place in many medical dietary regimens and guides to good health published from the Renaissance up to the mid-eighteenth century, though the perception of the influence of water(s) on health was disputed and changed according to the medical gaze.[2] The affirmation of a mechanical conceptualisation of the human body in the eighteenth century brought with it a peculiar attention to 'good' drinking water, which became the best of all remedies in the medical literature.[3] From 1750, physicians and chemists, particularly in France, tried to accurately comprehend the water cycle and its chemical composition. This was a prerequisite of what Goubert called 'the conquest of water', an articulated social task aimed at assessing water quality and at ensuring a rising amount of pure drinking water to any citizen, which involved Western societies from the end of the eighteenth century to the early twentieth century.[4]

In late nineteenth-century Italy, physicians became the social interpreters, mediators of new social needs, and the co-producers of concrete public health policies.[5] As evidenced in Chapter 1, water was a key element in the political discourse of Italian physicians, who pointed out the central role of a constant and abundant provision of pure drinking water for improving physical, mental, and moral faculties of the Italian population. Moreover, in the medical debate of the period, the relations between water, health, and disease were not limited to drinking water but also explored forms of stagnant water like water meadows that were assumed to negatively affect human health. In this discourse, the place of Rome appeared twofold. On one hand, Rome was the city of the ancient aqueducts and had enviable water provision. On the other hand, its countryside was a place where the 'disorder of water' negatively affected human

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health. With this in mind, the central questions of this chapter are as follows: How did the Italian sanitary movement find a place in the Italian administration in the late nineteenth century? How did the medical conceptualisation of water and practices of water assessment change over the period? How did this impact on concrete public health policies in Italy and particularly in the Roman area? What was the water system of Rome up to the 1870? How did it change according to the new perception of water and disease?

The discussion is articulated in six sections. First, I describe the impact of cholera pandemics in nineteenth-century Europe and Italy, the reaction to this disease of institutions and physicians, and the institutionalisation of medical practice in late nineteenth-century Italy. Second, I scrutinise the medical perception of drinking waters in Rome in relation to the 1867 cholera epidemic. Third, I analyse the water system of Rome before 1870. In the fourth section, I explore the different perception and practices in regard to the quality of water in Rome at the turn of the twentieth century. In the fifth section, I investigate how the medical establishment influenced political choices about water infrastructures. Finally, I inspect the shift in the understanding of malaria in the late nineteenth century and the impact of this on antimalarial policies. All of these aspects will clarify how medicine and water became central political matters during the nineteenth century and how this changed the way water was perceived and accessed.

Doctors in the state

The sanitary movement in nineteenth-century Europe was one of the agents that contributed to a reframing of space, nature, and society. The development of medical thinking on water and the political ability of physicians to represent themselves to the political establishment as reliable guides in political economy were two interlaced aspects of such a process. Some of the most significant changes in the thinking, practices, and political role of medicine in the nineteenth century could be viewed through the lens of Asiatic cholera. From the 1830s, the outbreak of recurring epidemics of this disease showed the fragility of the process of modernisation of Western societies, which actually were affected by terrible living conditions of the poor, overcrowded and filthy urban spaces, and the lack of sanitation.[6] The symptomatology of cholera was shocking: stomach ache, violent diarrhoea, dehydration, rough skin, cramps, voracious thirst, low body temperature, deep eye sockets, livid nails, and finally heart or kidney collapse.[7] The social reactions to the outbreaks of cholera were shocking as well. Frequently, those affected by the visible signs of this disease were kept away from relatives and neighbours; waves of collective hysteria were accompanied by extreme forms of religiosity

which filled the streets; populations rapidly abandoned cities, so that shops and manufactures were forced to stop their activities, causing economic crisis.[8]

Hence, the combination of high mortality rates and the social and economic shock that accompanied cholera epidemics required a political response.[9] Many European states tried to prevent its diffusion by using a quarantine system and cordons sanitaire, which not only were ineffective but also were perceived as illiberal measures and as an unacceptable limitation to personal rights.[10] As a result, from 1851, a set of international conferences were organised to arrange a response to a disease that did not respect national boundaries.[11] These conferences gathered together diplomats and physicians, though the agenda was more political than scientific. Italian pre-Unification States were not indifferent to these developments. Nonetheless, only from the mid-1880s did Italian physicians assume a more decisive role in the administration of public health.[12] Until 1888, this was in the hands of the Ministry of Interior and – in hierarchical order – in the hands of the provincial prefects and the mayors. Public health boards at a national, provincial, and municipal level were established, but only as mere counsellors of the bureaucratic authority.[13] These boards not only had no independent political initiative but also could not undertake sanitarian surveys without the authorisation of the Ministry of Interior in charge.[14]

This organisation of public health was reformed after the cholera epidemic of 1884–1887, which was less deadly than the previous one. Specifically, in Italy, the epidemic of Asiatic cholera of 1865–1867 caused 160,147 deaths, whereas the death toll of 1884–1887 was 33,875.[15] What differed from the previous epidemics was the social perception of the phenomenon. In short, in 1865–1867, the Italian state was young, affected by internal and external instability due to the social upheavals in the South and the struggle to complete unification. Hence, it could not be blamed for public health inefficiencies. Conversely, according to Frank Snowden, the epidemic of cholera of 1884–1887 was 'the first in which the claims of the Risorgimento to embody progress and social improvement were brought under scrutiny.'[16] In short, 25 years after Unification, the Italian state had to fulfil the promises of national rebirth, which had propelled the patriotic movement, with tangible social improvements. Consequently, in Naples, the largest Italian city at that time, the state undertook an ambitious programme of rebuilding and renewal (known as the *Risanamento*).[17] As a result, in a few years, Naples was provided with a new source of pure drinking water, the *Serino* aqueduct, and new collectors and sewerage mains were realised to drain the city from storm and sewage water.[18] Nonetheless, the renewal was only partially completed and some of the hygienic problems in the water provision of Naples remained unsolved. As a result, cholera reappeared in Naples in 1911 in spite of the attempts of the Italian government to hide the fact.[19]

At a national level, the Asiatic cholera of 1884–1887 boosted the Italian sanitarian movement that was asking for a more active role of physicians in the administration of public health. In 1887, Italian Prime Minister Francesco Crispi created the General Board of Health (*Direzione Generale della Sanità Pubblica*) within the Ministry of the Interior and appointed the physician Luigi Pagliani as chief of this new board, asking him to develop a project of reform of Italian public health.[20] On 22 December 1888, the new Public Health Act (*Codice Sanitario*) was approved by the Italian Parliament.[21] The new structure of public health was organised as a pyramid with, at the top, the General Board of Health and, at the bottom, the general practitioner, who was appointed as health officer. In an intermediate position, there was the provincial health officer (*Medico Provinciale*), who had to coordinate all the health officers under his jurisdiction, ensuring the contacts between the centre and periphery of the bureaucracy. Moreover, a laboratory of hygiene was established in every provincial capital in order to systematically analyse food, water, and housing quality. Finally, health care was free for the poor.[22] In short, the 1888 Public Health Act assigned to physicians the supervision and practical management of public health.

In conclusion, the interplay between a rising international sanitary movement, its Italian articulation, the outbreaks of cholera epidemic with its social and economic consequences, and the claim of the Italian Risorgimento of embodying progress resulted in the creation of a new institutional framework of public health. However, these were the institutional changes. In the meantime, the medical establishment undertook robust theoretical and practical changes in their understanding of the relations between water and disease and in the methods of assessing water quality.

Medical perception of water and Asiatic cholera in the mid-nineteenth century

From the work of Antoine-Laurent de Lavoisier in the late eighteenth century, physicians understood that water quality could no longer be evaluated only according to sensorial experience (sight, smell, and taste) and water source (rivers, springs, wells, and cisterns) but that conversely water had to be evaluated on the basis of the substances it contained.[23] However, medical analysis of the relations between water and diseases remained rather vague until the 1880s. As in the case of public health policy, Asiatic cholera had an impact on the medical conceptualisation of water. In 1854, Max von Pattenkofer argued that cholera was transmitted through the faeces of infected people.[24] In the same year, British physician John Snow, during a cholera epidemic in London, observed that cholera had a higher incidence where the quality of drinking water (due to contamination with waste and sewer water) was poor.[25] In Rome,

during the epidemic of 1867, Francesco Scalzi came to the same conclusion.[26]

However, the report of this on the 1867 cholera epidemic in Rome revealed that the medical understanding of water at the time was still based on a blend of chemical analysis, empirical observations, and Hippocratic conceptions. For example, meteorology had a central place in the Scalzi report. Barometric pressure, temperature, humidity, wind direction, rainfalls, and atmospheric quality during the period of the epidemic were reported and analysed. Indeed, according to Scalzi, the peak of the epidemic, in August 1867, was related to

> Storms in north Europe. (Moreover) the 17 (August) a storm with continuous lightning, a fall of thunders, 56 millimetres of rain happened. After a period of unstable weather, a similar storm happened again the 24 (August). To these events, the most remarkable during the period of the epidemic, corresponded important changes in the cholera (epidemic), since between the 12 and 22 (August) (I) registered an escalation of (deaths). However, from that moment the daily death toll decreased… As a result, the aforementioned meteorological events momentarily increased the number of casualties, but they also caused the decline of the disease.[27]

Social structure also had a place in Scalzi's analysis. The poor were the most affected by the disease, but proportionally the mortality rate was higher in the wealthier levels of Roman society. According to Scalzi, perhaps this could be connected to the fact that 'the wealthier were likely more terror-stricken than the poorer.'[28]

However, Scalzi noticed that almost half of the cases of death were concentrated in the central Roman districts (*Rioni*) of Trastevere, Borgo, and Monti; consequently, he analysed some of the local peculiarities that could explain this fact. He focused on poverty and water quality. In regard to water, his analysis focused on the quality of the three aqueducts operating in Rome but omitted the numerous wells and cisterns. This was a serious fault for the analysis of the causes of cholera and gives us the idea that one the most prominent members of the Roman medical establishment did not have a clear idea of the relations between this disease and water. In fact, he reported that the mortality of the areas around the River Tiber was one-third higher than the other parts of the city, but he was unable to link this data with the fact that this area of the river collected all the waste and sewer water of the city and therefore with the fact that drinking water in wells and cisterns there could be easily contaminated.

Instead, Scalzi chemically analysed the quality of the aqueduct that supplied Trastevere, Borgo, and Monti. However, cholera was not a matter of the minerals that water contained, though Scalzi did not miss

stressing that the existing aqueducts of Rome were subject to contamination by organic materials. In particular, the water in the Paolo aqueduct that supplied Trastevere was full of organic materials and of the garbage it collected in the factories of the Gianicolo.[29] This was the product of the early modern water system of Rome, where the same water served different purposes. However, this vague understanding of the relations between Asiatic cholera and water limited the suggestions that Scalzi made in terms of practical water management. In fact, he only mentioned the use of return water from some monumental fountains to provide water to many houses, which did not have a good water provision. Rather, the impact of cholera required a deeper rethinking of Rome's water system.

The waters of Rome

Before we examine Rome's early modern water system, it is worth giving some details on the 1867 epidemic of Asiatic cholera in the capital. This lasted from May to October, and the death toll was 2,040.[30] Likely this data, based on the official reports, was an underestimation. Indeed, the increase in the overall deaths in Rome during the period compared with the average for the previous four years suggested that 3,883 people died of Asiatic cholera during the 1867 epidemic in Rome. To remain in Italy, in Naples, which had a population double that of Rome during the epidemic of 1865–1867, 7341 died of this disease.[31] Hence, Rome seemed at least as vulnerable to cholera as the former capital of the Kingdom of the Two Sicilies.

Nonetheless, the perception of intellectuals at the time was different and the water system of Rome was still a source of pride for them. For example, at the 1878 international exhibition in Paris, the Italian Ministry of Interior presented a monograph on the city of Rome and its countryside.[32] The sanitary conditions of the city were among the various features analysed.[33] The authors argued that the mortality rate due to typhoid fever in the 1870s was lower in Rome than other Italian cities because of 'the abundance and of the enviable quality of its drinking waters, which had been carried in Rome by the ancient (Romans) and that the modern (Romans) … have preserved.'[34] However, this was an optimistic picture of late nineteenth-century Roman water provision. Indeed, in Rome, gastrointestinal disease was the second major cause of death (after tuberculosis and pulmonary diseases).[35] This leads us to wonder, what were the real sanitarian conditions of waters and water infrastructures of modern Rome?

Before 1870, the water supply of Rome, as of many early modern cities, was a mixed one.[36] Roman citizens accessed the underground aquifers by means of wells and cisterns.[37] However, before 1870, Rome's main water supply was based on three aqueducts: the Vergine aqueduct, the Paolo aqueduct, and the Felice aqueduct. These infrastructures were the product

of the restoration and reuse of some ancient Roman aqueducts achieved under the papal regime during the sixteenth and early seventeenth century.[38] As a result, the distribution of this water was different from our modern conception of domestic water supply. Water distribution was planned to maximise the reuse of water. In brief, water was distributed by an underground network of lead, travertine, and earthenware conduits. First, these supplied public and semi-public fountains; thereafter, the overflow and return water went to washbasins for laundry and watering places for animals; other branches served for the irrigation of private gardens, villas, and vegetable gardens and for industrial purposes.[39] Private users were usually limited to religious institutions (churches, monasteries, convents, and hospitals) and to the palaces of the Roman aristocracy.[40]

More specifically, the Vergine aqueduct, built in 19 BCE, collected several pools and underground veins of water in the proximity of the River Aniene near the ancient Via Collatina.[41] Because it was almost completely underground, the aqueduct Vergine was the only one that continued to supply Rome, though intermittently, from Classical Antiquity and the fifteenth century.[42] The restoration of the original ancient Roman aqueduct was completed by Pope Pius V in 1570.[43] In 1870, the Vergine aqueduct supplied Rome with 900 litres of water per second.[44] However, the springs were at a very low level, about 24 metres above sea level.[45] This meant that following a natural slope, this water could be distributed only in the lower zones of the city.[46] Moreover, according to the chief engineer of the Hydraulic Service of the Roman municipality, in 1872 the main pipe, an underground tunnel carved into the rock, and the distribution network had to be profoundly renewed, or better, rebuilt in order not to waste most of the water available and to prevent the contamination of drinking water with storm water.[47]

Nonetheless, in terms of water quality and quantity, the Vergine aqueduct was the best in the hands of the municipal authority. In fact, the Paolo aqueduct collected water from the basin of the Lake of Bracciano. This water was impure, and only 20 of 750 litres per second that it carried in Rome were for domestic use.[48] Indeed, since its restoration in the early 1600s, this aqueduct served the western part of Rome (Vatican and Trastevere) but mainly for productive (agriculture and industry) and ornamental uses.[49] Finally, the Felice aqueduct, completed in 1587 reusing parts of the ancient aqueducts that ran through the eastern countryside of Rome, collected water in the lower basin of the Alban Hills and carried only 250 litres per second and its water was impure.[50] More generally, the three municipal aqueducts were old infrastructures in need of a continual maintenance, the amount of water they could carry was limited, and in spatial terms their distribution network could be hardly expanded outside the existing city.[51]

As a result, the early modern water system of Rome might have been enviable during the Renaissance, but in 1870 it required significant

renewal. The public authorities in Rome were aware of this and had already authorised a private company, the *Società Acqua Pia Antica Marcia* (SAPAM), to exploit springs in the River Aniene valley in order to reconnect Rome with the most abundant water of its region.[52] This enterprise is fully examined in Chapter 4. Here, it is worth mentioning the discussion on the quality of the Marcia water, considered by the Ancient Romans to be the best in quality of all the waters.[53] At the time, cholera had already had an impact on European cities but its relationships with water were not demonstrated. However, the attempt to provide cities with more abundant water had already started.[54] Since the late 1840s, infrastructure projects to provide new fresh water in Rome focused on the Marcia water, located 50 kilometres from Rome, a distance that required a significant logistical and economic effort for the period but that was justified by the quality of water and sanctioned by tradition.

Indeed, until the 1880s, assessing water quality remained mainly an empirical exercise, which sometimes could work together with chemical analysis. For example, in 1869, the SAPAM director, Bernardo Blumenstihl, accompanied by a British chemist, went to the site of the springs of the River Aniene valley and discovered that the water from the springs called Seconde Serene was 'admirably crystalline'; moreover, 'local peasants considered that water as the best one…their feelings were equal to a good (chemical) analysis.'[55] However, it seemed that Roman consumers did not agree with this judgement, considering it as not safe for health. In 1874, the Roman Prefect appointed a committee to assess whether the Marcia water was harmful to health or not. The committee concluded that, under the chemical aspect, the Marcia was a good water but very rich in calcium carbonate, and 'when one sees the conduits obstructed after 2 or 3 years, he thinks this obstruction can happen also inside his body, and he do not want to drink Marcia water anymore…Unfortunately, anyone can spot this defect, which informs the judgement of common people.'[56] As a result, the Marcio aqueduct remained undersized since many Romans preferred other sources of water. This forced political and medical authorities to undertake subsequent analysis of the main Roman aqueduct to reassure consumers but also to obtain from SAPAM a better service.

Monitoring, improving, and spreading water supply

Following much empirical evidence that related cholera and water, in 1884 German physician and bacteriologist Robert Koch identified the bacterium of cholera.[57] As a result, by means of the bacteriological analysis of water, a secure linkage between contaminated water and cholera was established. Indeed, from the 1880s, bacteriological analysis became the lynchpin of a renewed medicine, which appeared self-confident at preventing and curing many diseases.

The Italian Public Health Act of 1888 created the municipal laboratories of hygiene. At the end of the nineteenth century in Rome, these labs systematically monitored the biological composition of drinking water.[58] Indeed, from time to time, the quantity of bacteria in the waters of Rome steeply increased. Moreover, sometimes water pouring out from the taps was murky. These and the concomitance of gastrointestinal epidemics, like an epidemic of typhus that involved the military garrison of Rome in 1891, triggered close investigations of the quality of water and of the aqueducts.[59] From 1899 to 1902, the Institute of Hygiene of the University of Rome undertook a detailed survey and bacteriological analysis of the Marcio aqueduct (Figure 3.1) from its springs, catchment works, water mains, reservoirs, and distribution network to assess whether the main aqueduct of the city was subject to the leaking of waste/storm water. The survey aimed not only at assessing the quality of water at any point along the aqueduct, from the springs to the tap, but also at assessing the hygienic quality of the water infrastructures.

Their analysis confirmed that water from the springs of the River Aniene valley was extremely pure. This was the product of the geology of the water basin of the River Aniene, which was made of porous rocks at an altitude between 1,800 and 700 metres, whereas the springs were at a lower level, somewhere between 1,500 and 400 metres; this meant that rainwater 'was (naturally) filtered for several months before pouring out' from underground.[60] The catchment works insulated water from contamination with the external environment even during periods of uninterrupted rainfall and during the floods of the river (usually during April). The water main of the aqueduct realised in 1870 was made of masonry and water was not pressurised; consequently, at the internal top of the pipe, the doctors found bacterial colonies.[61] Thereafter, the aqueduct reached Tivoli and – after 26 kilometres in three different pressurised conduits – Rome.

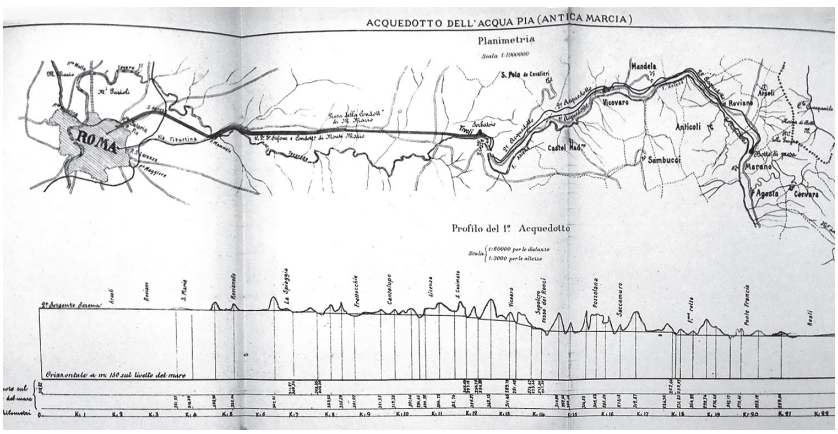

Figure 3.1 Marcio aqueduct, planimetry, 1892.

There, the physicians who conducted the survey discovered the real cause of the sporadic though huge increase of bacteria in the water. From the water main departed a set of secondary and tertiary branches that had to provide a maximum of 200 litres per capita.[62] However, the distribution network was equipped with sliders that sometimes blocked water to regulate water pressure in certain areas of the city or to allow maintenance works. The physicians verified that after some maintenance works the number of bacteria in the water that poured out from the tap increased from 39 per cm^3 to 2,765 per cm^3.[63] Also, the domestic distribution system significantly affected water quality. In fact, in some of the new areas of the city, from the conduit in the street water came directly to the kitchen (ascendant system), the flow of water was uninterrupted, and thus its quality unaltered; the overflow passed in the bathroom and then into the laundries and finally reached and washed the sewers. However, in the 'poorest neighbourhoods of the city and in the houses for rent, the (house) owners distribute water in the cheapest way', namely using water tanks to collect water at the top of the building and from there to the kitchen of any singular flat (descending system).[64] In this way, water stagnated in the tanks before being used or drunk. Often these tanks were ill made and water was in contact with dust and the external environment.[65] Water meters were also a place where bacteria proliferated.

Hence, the technical efficiency of the infrastructures and the methods of water distribution influenced water quality as much as 'natural' features. Such close attention to the infrastructure, construction materials, methods of distribution, and the necessity of water of being pressurised to retain its purity was a result of the bacteriological shift in medicine. The bacterial investigation could establish a more precise cause–effect chain for certain diseases, but solving public health issues was not only a matter of technical efficiency. To a certain extent, finding harmful contaminants in water was not the real purpose of this investigation. Cristopher Hamlin noted that the role of British chemists in the late nineteenth century was to secure better water and come up with a politically practical concept of water purity.[66] This was the case of the report on the Marcio aqueduct. In short, at the turn of the twentieth century, the medical establishment could claim an unprecedented technical proficiency and a more precise understanding of the relations between water and disease. However, this did not lead *per se* to higher-quality water. Manufacturing good and safe drinking water was a complex social process. Physicians highlighted the best practices to preserve and drink pure water, but this was only part of such a process.

Social medicine and water provision

In order to grasp the process of making and distributing good and safe drinking water and the role of medicine in this at the turn of the twentieth century, we see some local cases of expansion of water provision in

the Roman area. A case in point was given by the water provision to Grottaferrata, one of the rural towns in a range of 25 kilometres from Rome. In September 1894, owing to an enteric fever epidemic in this town, the provincial health officer of Rome appointed Bartolomeo Gosio, at that time a young medical researcher working in the Roman municipal laboratory of hygiene, to find out the reasons for such an epidemic.[67]

First of all, Gosio observed for some days the old aqueduct of Grottaferrata. This conducted water from the Squarciarelli springs (see Chapter 2) to Grottaferrata's central square, supplying some public fountains that were the source of drinkable water for most of the local population. In his words, this water main was a simple masonry tunnel with neither concrete nor metal and so superficial that after rainfall water poured out from the fountains, murky and debris-filled.[68] In addition, drains from water closets, sheds, and any kind of waste were discharged alongside this water main.[69] After this inspection, Gosio analysed the chemical and bacterial composition of water at the springs and the central fountains. He concluded that water at the springs was 'excellent and recommended under every aspect.'[70] Conversely, water at the central fountains was full of bacteria.[71] Hence, Dr Gosio had few doubts about the origin of the gastrointestinal disease in Grottaferrata: the poorly made water main. Hence, the town council of Grottaferrata had to realise the necessary works to avoid the contamination of drinking water.[72] After all, according to Gosio, the length of the water main was relatively short; thus, placing a simple cast iron pipe was not so expensive and would be sufficient to protect the population from deadly gastroenteric diseases.[73]

Unfortunately, even if the Italian public health system after 1888 assigned a set of growing legal duties to Italian municipalities, like the realisation or restoration of aqueducts and municipal sewers, financial resources remained scarce.[74] Thus, as Frank Snowden noticed in his study of malaria, several Italian municipalities fell into a 'poverty trap'.[75] That was the case at Grottaferrata. Almost a decade later, Gosio's report was still a dead letter. Many times, the Prefect of Rome urged the General Board of Public Health and the Ministry of Finance to solve the problem of the Grottaferrata water supply. The Prefect was supported by the Roman provincial health officer, who said, 'no example of typhus transmitted through drinking water has ever been as clear as that occurred in Grottaferrata.' Eventually, in 1902, a new cast iron pipe was placed at the expense of the state to prevent drinking water from being contaminated.[76] The statement of Rome's provincial health officer was probably exaggerated, but it gives us an idea of how the administration of public health worked and the role of physicians in it. Stressing the relations between water and a well-known disease like typhus was a way to move the bureaucratic machine to comply with the sanitarian ideal of fresh, pure drinking water for everyone in order to improve physical and moral qualities of the Italian population.

Another example of this can be seen by looking at the provision of drinking water in the surroundings of Rome, namely its 200,000 hectares of countryside and the urban settlements in a range of 25 kilometres from the capital. In 1910, the provincial health officer of Rome, in a report to the General Board of Health, stated that the peasants who worked in the Roman countryside very often had to take water from ditches to quench their thirst.[77] As we see in Chapter 4, the Roman municipality tried to expand the supply of drinking water to the eastern part of its countryside, looking for the support of the SAPAM.[78] Other institutions undertook similar initiatives in order to expand the provision of spring water in the Agro Romano. One of these was the Zoo-technical Institute of Latium (*Istituto Zootecnico Laziale*), which in the 1910s established an experimental farmhouse in the Roman countryside between the railway stations of Ciampino and Capannelle, 11 kilometres from Porta San Giovanni. 'The Institute paid great attention to pursuing good and abundant springs water from outside the farm' and this was found by means of the Private Consortium of Acqua Mariana that conceded to the Zoo-technical Institute about 3 litres per second from a spring near Ciampino.[79] Thus, an aqueduct 11 kilometres long was realised to provide pure drinking water to 'an area where water was completely lacking from old times.'[80]

At the turn of the twentieth century, among physicians there existed an increased public awareness of the preventive effects on public health of water infrastructures that preserved water purity. However, questions like who had to realise the infrastructures, for whose benefit, and at what costs remained political problems. Hence, this demand for good-quality water and aqueducts had to be mediated by authorities like the prefectures, city councils, or other public or semi-public institutions, which intervened to support financially or politically the realisation of the infrastructures and the allotment of part of the hydraulic resources of the Roman area to civic uses. After all, this was one of the biggest conquests of nineteenth-century medicine: making public health and water central political concerns.

Water, malaria, and the colonisation of the Agro Romano

If the impact of Asiatic cholera was a driving force in the medical rethinking of water and disease, the turn of the twentieth century also saw changes in medical attitudes towards another disease that had been considered water-borne for centuries: malaria. In the mid-1880s, malaria was present in 67 of 69 Italian Provinces; almost 11 million people in a population of roughly 25 million were at risk of contracting the infection; of these, two million were infected yearly and at least 15,000 died from the direct effects of the malarial fevers.[81] Those who did not die were subject to reinfection in a chain of onset fevers that debilitated the

body and drained mental skills. However, what were the relations between water and malaria according to the medical culture of the late nineteenth century? How did this perception change at the turn of the twentieth century, and what were the practical consequences for treatment of malaria?

In the late nineteenth century, the miasma theory informed explanations into the origins of malaria.[82] In particular, until the 1870s, malaria was assumed to be caused by the exhalations of the swamplands (paludal explanation) that contaminated the air (from which derived the term 'malaria', 'bad air' in Italian).[83] However, this explanation did not fit many regions in central and southern Italy, where swamplands and marshes were rare but malaria widespread. In the 1880s, in order to cope with the inconsistency of the paludal explanation of malaria, Corrado Tommasi-Crudeli proposed a different hypothesis. Professor of pathological anatomy at the universities of Palermo, Florence, and (from 1870) Rome, he founded the Institute of Applied Hygiene of Rome in 1883.[84]

In 1885, Tommasi-Crudeli inaugurated the academic year with a set of lectures on the climate of Rome, whose central arguments were the causes of the malaria in the Agro Romano and its possible solutions.[85] According to Tommasi-Crudeli, malaria was something that infected the air, and the 'precondition of the malarial production is the presence of the malarial ferment in the ground.'[86] Hence, the germs of malaria were present in some soils (telluric explanation). For Tommasi-Crudeli, the bad exhalations had three causes: a temperature of 20 degrees or higher, a moderate degree of humidity, and the direct contact between oxygen and the malarial soil.[87] As a result, he sought to find a way of sterilising the ground in order to avoid the reproduction of malarial germs.[88] Under this aspect, water had an important role; in fact, the presence of untamed surface water generated humidity, one of the prerequisites of the *fermento malarico*, according to Tommasi-Crudeli. Marshes and water meadows were not necessary to accomplish this task; conversely, this degree of humidity could be given by underground water.[89] Unfortunately, the Roman soils retained a large quantity of underground water in the proximity of the surface. As a result, Tommasi-Crudeli suggested constructing a huge underground drainage network, which would embrace most of the Roman countryside.[90]

Unfortunately, even the telluric explanation of malaria (germs in the ground), like the paludal version (germs in the water), did not offer a concrete plan for tackling malaria. In fact, according to these theories, only by purifying water, ground, and air would it be possible to reduce malaria. Nonetheless, these theories had an impact on the antimalarial legislation. Indeed, the first laws regarding the Roman Campagna (1878 and 1882) promoted the draining of the swamps in this area at the expense of the Italian state, drainage channels at the expense of the landowners, and a more regular, intensive cultivation.[91] These attempts failed,

as the 1900s approached, and the Roman countryside remained unhealthy, and the reclamation efforts did not produce the expected results. By contrast, the workers involved in these projects became ill and died in high numbers and malaria continued to afflict the Agro Romano.[92]

However, from 1880 to 1900, the research on the pathogenic agent of malaria and on the transmission of the disease made decisive progress. In 1880, in Algeria, French physician Louis Alphonse Laveran identified the pathogenic agent of malaria (a protozoan) in a blood sample.[93] In 1885, Roman malariologists Angelo Celli and Ettore Marchiafava gave the first accurate description of the malarial parasites – which they called *plasmodium malariae* – with a detailed analysis of its morphology and behaviour in the human blood.[94] Moreover, between 1887 and 1893, Italian physician Camillo Golgi discovered the life cycle of the *plasmodium malariae* in human blood, connected the various forms of intermittent fevers (one of the most evident symptoms of malaria) with the process of reproduction of the parasite, and assessed the efficacy of quinine as an antimalarial remedy and the schedule for an efficacious cure.[95]

A further step in the struggle against malaria was the discovery of its transmission. In the mid-1890s, the most accredited theory among malariologists in Italy and in the world was that malaria was transmitted by mosquitos.[96] The idea that mosquitos were the vehicle of malaria was not new, but because mosquitos were almost ubiquitous while malaria was not, this did not have a general acceptance.[97] In India, in the summer of 1898, British physician Donald Ross found the *plasmodium malariae* in the body of mosquitos and inoculated it into birds, producing malarial fever.[98] In the autumn of the same year, Italian anatomist and zoologist Giovan Battista Grassi came to the same conclusion and demonstrated the transmission of malaria to humans by means of mosquitos.[99]

Thus, were water and malaria related? Yes and no. In the words of Angelo Celli, 'the germs of malaria… do not live directly in the GROUND (sic), but in the human body and in the mosquitos; and the ground has a secondary, indirect role as source of infection, in so far if it is favourable or not to the reproduction of the malarial mosquitos.'[100] As a result, water was not the direct source of the disease but was vital for the reproduction of the kind of mosquitos that conveyed the malaria parasite. These kinds of mosquitos did not reproduce in putrid water such as that of the swamplands, but in purer pools of stagnant water (like those formed by rainfall) that lasted a sufficient time to permit mosquitos' reproduction.[101]

Now the question was: what were the policies that the Italian malariologists distilled from this new aetiology of malaria? After all, these did not change much from the previous, imperfect knowledge of the aetiology of malaria. The main approaches were pharmaceutical or environmental or a combination of the two. The former focused on the bodily side of the disease and aimed at curing and preventing malaria by means

of a centralised, standardised, and carefully monitored distribution of quinine to the Italian rural population (human sanitation).[102] However, quinine had been known as an antimalarial remedy for centuries and Tommasi-Crudeli, in spite of his faulty understanding of the malarial aetiology, pointed to it as the only valuable remedy.[103] The latter approach focused on the reduction (and possible elimination) of the vehicles of malaria, mosquitos, and on adjusting the environment in order to prevent the reproduction of malarial mosquitos (environmental sanitation).[104]

In 1900, Angelo Celli tried to explain and make viable the environmental approach in the Roman countryside.[105] First, forms of agriculture that could encourage malaria, like rice growing and pasturage, which involved stagnant water, had to be avoided in favour of more intensive cultivations like vegetable growing. In fact, to be effective, this latter required a regulation of the hydraulic regime, and this could counteract the reproduction of malarial mosquitos.[106] Second, Celli argued that the 'real national prophylaxis' consisted in promoting networks of drainage channels, the connections of all the springs to these networks, and the creation of new buildings to promote the colonisation of the Roman countryside.[107]

However, this was more or less the same policy followed by the Italian state since 1883 which was informed by the miasma theory. Why did Celli insist on the importance of regulating the water regime and promoting intensive cultivation, which had an indirect impact on malaria? Probably, part of the answer was found in the mental habits of the Italian professional bourgeoisie as I have described in Chapter 1. In short, increasing the arable surface, colonising unproductive areas, and introducing irrigated agriculture were some of the main targets contained in the narratives of Italian modernity in the late nineteenth century. As a result, antimalarial policy was perceived by many Italian physicians as an indirect tool to stimulate agricultural improvements, which in turn was a means for Italian progress. Also, the hygienic culture between the nineteenth and early twentieth century focused on purifying the environment as preventive measure for many diseases.

On the basis of this approach, in 1903, the Italian Parliament approved a law that offered state loans at an interest rate of 2.5%, tax advantages, and grants to the landowners (and also consortia of landowners) of the Agro Romano who undertook hydraulic works to regulate the water regime, erected rural buildings to host workers, constructed farm roads, and adopted intensive agriculture in a range of 10 kilometres from Rome city centre.[108] In 1910, a new law extended these measures outside this belt; furthermore, state loans were offered to create rural settlements in order to promote the colonisation of the Roman countryside.[109]

Nonetheless, the pharmaceutical approach to malaria seemed more viable and capable of more rapid implementation than the environmental one.[110] Between 1900 and 1903, a set of laws established the centralised production of pure quinine (the military pharmacy of Turin) by the state

and its free distribution to the poor and workers in malarial regions.[111] Despite some limits, the pharmaceutical antimalarial programme had some success in the Roman countryside and in Italy more generally. In 1910, the Roman provincial health officer reported that the mortality rate of malaria was diminishing compared with the last decade of the nineteenth century.[112] He reported 'only' 1,970 cases of malaria and 42 deaths.[113] According to him, given the lack of progress made by the regulation of the hydraulic regime in the Roman area, this result was the product of the 600 kilogrammes of quinine distributed to the rural population that year.[114] Specifically, the antimalarial prophylaxis with quinine in the Roman countryside involved 1,176 people in 1901; in 1910, this number rose to 40,973.[115] In the same time frame, the number of people affected by malaria treated in the Roman hospitals (mainly the Santo Spirito and San Giovanni) decreased from 6,186 to 1,775.[116] More generally, morbidity and mortality rates from malaria in Italy declined from 1901 to 1914.[117] This tendency was interrupted in 1915, when Italy took part in the First World War and many physicians and peasants were conscripted and quinine had a price increase.[118] This meant that, during the war, mass quinine production and distribution had several disruptions. Indeed, the number of deaths from malaria in the Agro Romano passed from 12 in 1914 to 147 in 1918.[119] In Italy, this number rose from 549 deaths in 1914 to 1,987 deaths in 1918.[120] Only from 1920 onward did the antimalarial campaign resume with vigour and the death toll start to come back to the pre-war levels.[121]

In conclusion, medical practice in the late nineteenth century discovered that the relation between water and malaria was weak after all. Nonetheless, this did not change the approach to antimalarial policies. What was radically different was the social and political perception of the disease. At the turn of the twentieth century, malaria passed from being considered endemic to being perceived as a beatable disease. As a result, the state took strong measures to eradicate malaria from the Italian territory. This was to improve the living conditions of millions of Italian peasants.

Conclusion

In this chapter, I have examined the water system of nineteenth-century Rome and the development of the medical understanding of water and disease. In spite of enthusiastic views of Roman water provision, in the late nineteenth century this system showed signs of infrastructural decay and vulnerability to a disease like Asiatic cholera. This, in turn, pushed the international sanitarian movement in the nineteenth century to frame a new conceptualisation of water quality, which passed from being evaluated through sensorial experience to being carefully analysed in its chemical and – from the 1880s – bacterial composition. Hence, the outbreaks

of Asiatic cholera proved that the early modern system of water provision of Rome, as well as for other Italian and European cities, was unsafe since it exposed water to many sources of contamination. The interplay between these two processes led Italian physicians to interpret and disseminate an ideal of social protection that involved the centrality of the state as health-care provider and water management as a fundamental tool to purify the environment. When in 1888 this ideal found a first concrete framework in the Public Health Act, Italian physicians tried to raise the awareness of the Italian population and institutions on the best practices in regard to drinking water management and distribution. The bacterial revolution in the 1880s further ignited a social and political process that made water and health central political matters, which changed the way of accessing, distributing, and consuming water.

However, the relations between scientific advances, concrete water management, and – more generally – public health policies were not so direct. As the case of Grottaferrata showed, these aspects were political. Indeed, public health institutions acted in a political way that emphasised the dramatic situation of the water provision of a small town and the relative ease for the state to provide a solution. Furthermore, some of the radical changes in the water system of Rome started before the discovery of the precise causes of Asiatic cholera transmission. Indeed, already in the 1860s, the empirical experience of physicians pointed out some kind of relations between bad-quality, polluted water and cholera. This was not based on solid, testable evidence but was sufficient to persuade the decision makers to look for different sources of water. In fact, the renewal of Rome's water provision started in the last years of the papal regime. The realisation of a private modern aqueduct, which collected the purest and most abundant sources of water in the Roman area, was the beginning of a transition from a period of relatively scarce, unsafe, and spatially limited drinking water supply to a period of abundant, constantly monitored, and spatially expanding drinking water supply. This also involved the surroundings of Rome, where aqueducts and water mains were constructed or renewed to sustain the process of settlement of the Roman countryside. Clearly, physicians emphasised their progresses in monitoring and assessing water quality, but this, I argue, was more to consolidate their scientific credibility, to propel the action of the state as health-care provider, to instil in the social body confidence in the battle against diseases, and to discipline the population on the safest way to drink water.

This could also be seen with regard to malaria. In fact, the medical perception of malaria and water changed at the turn of the twentieth century. In this case, as opposed to cholera, the relations between water and this disease were finer than it was assumed for centuries. However, the discovery of mosquitos as the vehicle of the disease did not change the approach to cure and prevention of malaria much. Indeed, purifying the

environment and using a well-known antimalarial remedy, quinine, remained the dominant ways to address this disease. What physicians were able to change was the social and political perception of the disease. Hence, what really changed in the struggle against malaria was the scale of the efforts of the sanitarian institutions and a more intense contact between doctor and patient. As a result, the state took responsibility for extending the possible remedies over all the national territory and its population. The outputs of this change in scale, if not in the approach, at least in our case, were tangible. From 1903, the pharmaceutical antimalarial campaign decreased the mortality rate of malaria, making the Agro Romano a more attractive place for many peasants who had escaped from the rural areas of central and southern Italy. This, as we see in Chapter 5, had an unpredictable impact on the Roman waterscape.

Notes

1 Hippocrates, *On airs, waters and places*, English translation (London: 1881), 23. For the Italian version, see Hippocrates, *Sulle arie, sulle acque e sui luoghi*, Giovanni Capsoni (transl.) (Milan: 1839). For an early French translation, see Hippocrates, *Des airs, des eaux, des lieux*, J.N. Chailly (transl.) (Paris: 1817). For a German version, see Des Hippocrates *Schriften uber die winde, wasser und ortslagen*, Joseph Ruder (transl.) (Sulzbach: 1848). The translation of the treaty of Hippocrates in many languages could be interpreted as an index of the long-lasting fortune of his theories and of the central place of the environment in the discussions of the European sanitarian movement in the nineteenth century.
2 David Gentilcore, 'From 'vilest beverage' to 'universal medicine': Drinking water in printed regimens and health guides, 1450–1750', *Social History of Medicine*, 33, no. 3 (2020), 683–703. During the Renaissance and until the work of Antoine-Laurent de Lavoisier in the 1780s, the treaty of Hippocrates, book eight of Vitruvius's *Ten book on architecture*, and Pliny the Elder's *Natural history* informed the conceptualisation of water of European physicians, who stressed the variety of the manifestations and sources of water (rivers, wells, springs, rain, etc.) and their different effects on health.
3 Ibid.
4 Jean-Pierre Goubert, *La conquête de l'eau. L'avènement de la santé à l'âge industriel* (Paris: 1986).
5 Giovanna Vicarelli, *Alle radici della politica sanitaria in Italia. Società e salute da Crispi al Fascismo* (Bologna: 1997), 75–78.
6 Valeska Huber, 'The unification of the globe by disease? The international sanitary conferences on cholera 1854–1894', *The Historical Journal*, 49, no. 2 (2006), 453–476.
7 Anna Lucia Forti-Messina, 'L'Italia dell'Ottocento di fronte al colera', in Franco della Paruta (ed.), *Storia d'Italia, Annali*, vol. 7: Malattia e medicina (Turin: 1984), 431–494 (434). See also J.N. Hays, *The burdens of disease: epidemics and human response in Western history* (New Brunswick, NJ and London: 2003), 136.
8 Eugenia Tognotti, *Il mostro Asiatico: storia del colera in Italia* (Rome: 2000), 112–145.
9 Frank M. Snowden, *Naples in the time of cholera, 1884–1911* (Cambridge, UK: 1995), 181.

10 Huber, 'The unification of the globe by disease', 456.
11 Ibid., 456.
12 Giovanna Ognibeni, 'Legislazione ed organizzazione sanitaria nella seconda metà dell'Ottocento', in Maria Luisa Betri and Ada Gigli Marchetti (eds.), *Salute e classi lavoratrici in Italia dall'Unità al Fascismo* (Milan: 1982), 583–603.
13 Ibid., 594.
14 Ibid., 597.
15 Tognotti, *Il mostro Asiatico*, 223.
16 Snowden, *Naples*, 360.
17 Ibid., 181–230.
18 Ibid., 189–190.
19 Ibid., 297–359.
20 Vicarelli, *Alle radici della politica*, 89–97.
21 Ibid., 59.
22 Ibid., 95–97.
23 Goubert, *La conquête de l'eau*, 43.
24 Tognotti, *Il mostro Asiatico*, 239.
25 Ibid., 241.
26 Forti-Messina, 'L'Italia dell'Ottocento', 457.
27 Francesco Scalzi, *Il colera di Roma nel 1867* (Rome: 1868), 25. Francesco Scalzi was the primary of the Roman hospitals.
28 Ibid., 34.
29 Ibid., 57.
30 Ibid., 11.
31 Direzione Generale della Statistica, *Il cholera morbus nel 1866 e 1867* (Florence: 1870).
32 Ministero dell'Interno, Direzione Generale della Statistica, *Monografia della città di Roma e della Campagna Romana presentata all'Esposizione Universale di Parigi del 1878* (Rome: 1878).
33 Eugenio Rey and Giuseppe Sormani, 'Statistica delle cause di morte', in Ministero dell'Interno (ed.), *Monografia della città di Roma*, 121–148.
34 Ibid., 126.
35 Ibid., 135.
36 For example, in the Low Countries. See Ric Janseens and Tim Soens, 'Urbanising water. Looking beyond the transition to water modernity in the cities of the southern Low Countries, thirteenth to nineteenth century, in Tim Soens, Dieter Schott, Micheal Toyka-Seid and Bert De Munck (eds.), *Urbanising nature: Actors and agency (dis)connecting cities and nature since 1500* (New York and London: 2019), 89–111.
37 Angelo Vescovali, *Fognatura della città di Roma: relazione tecnica alla commissione per la bonifica del sottosuolo di Roma* (Florence: 1889), 61.
38 Katherine Wentworth Rinne, *The waters of Rome: Aqueducts, fountains, and the birth of the baroque city* (New Haven and London: 2010).
39 Carlo Fea, *Storia: I. delle acque antiche sorgenti in Roma perdute, e modo di ristabilirle, II. dei condotti antico-moderni delle acque, Vergine, Felice, e Paola, e loro autori: con suggerimenti per aumentare le loro acque, e migliorarne la qualità* (Rome: 1832), 128–130 and 208–210. Semi-public fountains were built and maintained from private actors in exchange for a discount on the price of water and for the use of its return flow.
40 Ibid., 130.
41 Thomas Ashby, *The aqueducts of Ancient Rome* (Oxford: 1935), 170–171.
42 Fea, *Storia: I. delle acque antiche sorgenti in Roma*, 14–15.

43 Ibid. Until the restoration of the aqueducts Vergine, Felice, and Paolo, the main source of drinking water for Romans was the River Tiber. This had an impact on the urban fabric; in fact, medieval Rome was developed only along the banks of its river, while higher areas in the Aurelian Walls were progressively abandoned. See Giuseppe Bonaccorso, 'Roma e le sue acque potabili nel Cinquecento. La competizione con il Tevere', *Roma Moderna e Contemporanea* 17, no. 1 (2009), 73–90 (81–82).
44 Stefano Battilossi, *Acea di Roma 1909–1996. Energia e acqua per la capitale* (Milan: 1997), 168.
45 Ashby, *The aqueducts*, 171.
46 Fea, *Storia: I. delle acque antiche sorgenti in Roma*, 94–96. Entering from Porta del Popolo, this aqueduct supplied the areas of Piazza del Popolo, Piazza di Spagna, Piazza Navona, Pantheon until the left bank of the River Tiber.
47 ASC, *Biblioteca Romana/Stragr. 811(2)*. Hydraulic committee, 'report on three city council projects on the waters of Rome by the Hydraulic committee appointed by Rome city council the 28th October 1872'.
48 Battilossi, *Acea di Roma*, 168.
49 Fea, *Storia: I. delle acque antiche sorgenti in Roma*, 208–210.
50 *Maria* Rosa Protasi, 'Igiene e Sanità Pubblica a Roma in un'inchiesta ministeriale di fine Ottocento', Roma Moderna e Contemporanea, 13, no. 1 (2005), 157–185 (162). This aqueduct served the areas of San Giovanni in Laterano, Porta San Lorenzo, Termini, Quirinale, and the Capitoline Hill. See Carlo Fea, Storia: I. delle acque antiche sorgenti in Roma, 198–200.
51 SPQR, *Cinque anni di amministrazione popolare a Roma* (Rome: 1912), 122–123. This book represented a manifesto of the achievements of the 'popular' administration, which united Socialists, Radicals, and Republicans in a reformist project of Rome under the guidance of Ernesto Nathan.
52 Francesco Amendolagine, *La rinascita di un mito. Acque sorgenti, acquedotti e imprese finanziarie. Documenti e storia della Società Acqua Pia Antica Marcia* (Venice: 1997), 15–17.
53 Fea, *Storia: I. delle acque antiche sorgenti*, 176–181.
54 Goubert, *La conquête de l'eau*, 177.
55 Società Anonima dell'Acqua Pia, *Relazione all'assemblea generale del 3 Aprile 1869 sullo stato dei lavori* (Rome: 1869), 4.
56 Commissione Sanitaria Provinciale di Roma, *Acqua Marcia: relazione chimico-igienica approvata dal consiglio provinciale di sanità nell'adunanza del 18 Marzo 1876 ed esposta dal Dott. Clito Carlucci, Dott. Pietro Balestra e da Fausto Sestini componenti la Commissione Sanitaria Provinciale, nominata dall'illustre prefetto di Roma il di 27 Dicembre 1874* (Rocca S. Casciano: 1876).
57 Tognotti, *Il mostro Asiatico*, 24.
58 Saverio Santori, *Laboratorio Municipale di Chimica e Batteriologia, sezione Batteriologica: perizie e ricerche eseguite durante l'anno 1896* (Rome: 1897).
59 Celli, 'Studio batteriologico sull'acqua Marcia'.
60 Ibid., 735.
61 Ibid., 769–771.
62 Ibid., 774.
63 Ibid., 844.
64 Ibid., 776.
65 Ibid., 777.
66 Christopher Hamlin, *A science of impurity: Water analysis in nineteenth century Britain* (Los Angeles, Berkeley and Oxford: 1990), 207.

67 Gosio Bartolomeo, in *Dizionario biografico degli Italiani*, vol. 58 (2002). See also Frank M. Snowden, *The conquest of malaria: Italy 1900–1962* (New Haven and London: 2006), 60.
68 ACS, *Ministero Interno/Direzione Generale Sanità/ versamento1867–1900/ b. 39/fascicolo acque potabili*. Bartolomeo Gosio, 'health inspection report of Grottaferrata, to Luigi Pagliani director general of health', Rome 24 September 1894.
69 Ibid.
70 ACS, *Ministero Interno/Direzione Generale Sanità/ versamento1867–1900/ b. 39/fascicolo acque potabili*. Bartolomeo Gosio, 'Chemical and bacteriological analysis of water in Grottaferrata, to Luigi Pagliani director general of health', 5 August 1895. Underlined in the original.
71 Ibid.
72 Ibid.
73 ACS, *Ministero Interno/Direzione Generale Sanità/ versamento1867–1900/ b. 39/fascicolo acque potabili*. 'Bartolomeo Gosio letter to Luigi Pagliani director general of health', Rome 24 September 1894.
74 Carla Giovannini, *Risanare la città: l'utopia igienista di fine Ottocento* (Milan: 1996), 106–120.
75 Snowden, *The conquest of malaria*, 55.
76 ACS, *Ministero Interno/Direzione Generale Sanità/versamento 1882–1915/ b. 331/fascicolo malattie infettive Roma e provincia/sotto fascicolo Grottaferrata Ileo-Tifo*. 'Prefect of Rome letter to Ministry of the Interior, General Direction of Health', Rome 12 December 1903.
77 ACS, *Ministero Interno/Direzione Generale Sanità/versamento 1910-1920/ b. 117bis/fascicolo realzioni sulla lotta contro la malaria/ sotto fascicolo 56 <<Roma>>*. Rome provincial health officer, 'report on the antimalarial campaign year 1910'.
78 SPQR, *Comune di Roma e Società dell'Acqua Pia Antica Marcia: Raccolta di documenti* (Rome: 1904), 5.
79 Istituto Zootecnico Laziale, *L'Istituto Zootecnico Laziale dal 3 Settembre 1911 al 10 Ottobre 1914. Relazione della Commissione Direttiva* (Rome: 1914), 18–20.
80 Ibid., 20.
81 Snowden, *The conquest of malaria*, 15–17.
82 Ibid., 11.
83 Ibid., 11–13.
84 Corrado Tommasi-Crudeli, in Agostino Palmerini, *Enciclopedia Italiana* (1937).
85 Corrado Tommasi-Crudeli, *Il clima di Roma: conferenze fatte nella primavera del 1885 inaugurando l'Istituto d'Igiene Sperimentale della Regia Università di Roma* (Rome: 1886).
86 Tommasi-Crudeli, *Il clima di Roma*, 62.
87 Corrado Tommasi-Crudeli, *Sulla preservazione dell'uomo nei paesi di malaria* (Rome: 1883), 4. He repeated the same ideas in the last chapter of the *Il clima di Roma*.
88 Tommasi-Crudeli, *Il clima di Roma*, 118.
89 Ibid., 63.
90 Ibid., 58.
91 Snowden, *The conquest of malaria*, 34–35.
92 Ibid., 35. For example, the experiment of colonisation near the Tre Fontane Abbey, where prisoners were forced to work on the countryside in order to create a stable colony. The prisoners fell ill and died in large number; see

Maura Piccialuti, 'Il Parlamento Italiano e la Legislazione sulla Malaria dall'Unificazione all'avvento del Fascismo', in Ministero per i Beni e le Attività Culturali, Direzione Generale degli Archivi (ed.), *Fonti per la storia della malaria in Italia* (Rome, 2003), viii–lxxxix (xxix). See also L. Galanti, *La colonia penitenziaria alle Tre Fontane e la malaria. L'Agro Romano e i suoi abitanti* (Rome: 1884).

93 Eugenia Tognotti, *Per una Storia della malaria in Italia. Il caso della Sardegna* (Milan: 2008), 171.
94 Ettore Marchiafava and Angelo Celli, 'Studi ulteriori sull'infezione malarica', *Archivio di Scienze Mediche*, 10, no. 9 (1886), 185–212.
95 Tognotti, *Per una Storia della malaria in Italia*, 172.
96 Ibid., 175.
97 Snowden, *The conquest of malaria*, 41.
98 Tognotti, *Per una storia della Malaria in Italia*, 176.
99 Snowden, *The conquest of malaria*, 43.
100 Ibid., 55.
101 Ibid., 56.
102 Tognotti, *Per una Storia della malaria in Italia*, 180.
103 Tommasi-Crudeli, *Il clima di Roma*, 157.
104 Ibid., 181.
105 Angelo Celli, *La malaria secondo le nuove ricerche*, 2nd edition (Rome: 1900).
106 Ibid., 99–110.
107 Ibid., 177–183. He talked of *bonifica agraria*, which was to say the realisation of houses, warehouses, sheds, farm roads and crops rotation.
108 Mirella Scardozzi, 'La Bonifica dell'Agro Romano nei dibattiti e nelle leggi dell'ultimo trentennio dell'Ottocento', *Rassegna Storica del Risorgimento*, 63, no. 2 (1976), 181–206.
109 'Law 17 July 1910 n. 491', in Antonio Parisella and Susanna Passigli (eds.), *Antologia dell'Agro Romano*, volume V: Dibattiti e relazioni parlamentari 1900–1926, 137–140.
110 Snowden, *The conquest of malaria*, 49–50. In particular, Grassi demonstrated the efficacy of quinine therapy and prophylaxis among the population of malarial River Tiber delta.
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4 The value of water

Water has long been a commodity, something to be bought and sold, whether managed by public institutions or private companies or something in between.[1] It is perhaps the most controversial commodity of all since the 'idea' of water as an essential life-sustaining element militates against the practice of owning and managing water for profit.[2] Nonetheless, the trade in drinking water had been a widespread activity in many European cities at least since the fifteenth century.[3] Indeed, in Rome, the commerce of water had flourished since the late middle ages and the early modern period.[4] The rebuilding and renewal of three of the ancient Roman aqueducts during the Renaissance did not stop the commerce of water but conversely added a new dimension to the commodification of this element. In short, ornamental and civic uses of water went hand in glove with private uses of water that were subject to fees and often to maintenance taxes.[5] Hence, in historical terms, the question is no longer how water became a commodity but 'how that commodity (was) treated and for whose benefit.'[6]

Clearly, the nineteenth century was the age of the creation of the integrated provision of drinking water and sewer systems and – at least for Italy – a century of attempts at expanding irrigated areas; therefore, water entered a period of increasing consumption. Moreover, the realisation of large waterworks required financial resources at an unprecedented level. Consequently, the scale of the process of water as a profit-making element changed compared with the previous centuries, and private water or water conduit companies (or both) were founded in Western Europe in the mid-1800s.[7]

Following this trend, in late nineteenth-century Rome, the main waterworks were realised, managed, and maintained by private sector actors. In this chapter, I seek to explore the commercial enterprises of the *Società Acqua Pia Antica Marcia* (SAPAM), the main provider of drinking water in Rome until the late 1940s, and that of the *Consorzio Privato dell'Acqua Mariana* (CPAM), the only irrigation consortium in the Roman area. In this way, I want to explore the aims and priorities of private water

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management in Rome at the turn of the twentieth century and the attempts by public powers at framing private interests in a broader rubric of 'public interest'. To do this, I have the divided the discussion into three sections. In the first one, I explore the project to renew the ancient Marcio aqueduct and the realisation of a modern aqueduct in 1870 by SAPAM. In the second section, I scrutinise the virtual monopoly of drinking water in Rome obtained by this company and the attempts by the Rome city council to contract the terms and conditions of this water service. In the last section, I investigate the role of CPAM in promoting – on a limited scale – the project for the renewal of the Roman countryside, how this process led the consortium to accumulate capital, and how this was invested.

Reconnecting Rome to its ancient water veins: archaeological or commercial enterprise?

During the Renaissance, the popes successfully reconnected Rome with two out of three of the historical water 'reservoirs' of the ancient city, namely the Lake Bracciano and the water basin of the Alban Hills.[8] Nonetheless, the third one, the most 'noble' in terms of purity and quantity of water, the River Aniene valley, remained out of the reach of the early modern city. However, in the early nineteenth century, the users of the Paolo and Felice aqueducts experienced disruption in the supply of water and frequently had to pay special taxes to maintain the infrastructures.[9] Nonetheless, the conditions of these two aqueducts were deteriorating; during the nineteenth century, the overall water they carried diminished, and the efficiency of the water distribution system was undermined by frequent abuses.[10]

As a result, in 1847, architect Pietro Lanciani proposed to the recently established Rome municipal authority to undertake a survey of the ruins of the ancient Marcio aqueduct.[11] He assumed that the aqueduct, mainly underground, was well preserved and this survey had only to assess the costs of the purging and partial rebuilding of the conduits.[12] Built in 144 BCE, the Marcio aqueduct, like the ancient Anio Vetus, Anio Novus, and Claudio aqueducts, had its origins in the River Aniene Valley and was praised by Pliny the Elder as 'the most famous of all waters in the whole world for coldness and wholesomeness, the glory of the city of Rome, is the (water) Marcia.'[13] However, from the tenth century, there was no information about the working of the ancient Marcio aqueduct, and its route, springs, and state of conservation were unknown in the mid-nineteenth century.[14] Hence, the Marcio aqueduct had to be rediscovered before it could be restored.

Indeed, in the 1850s, another Roman architect, Luigi Canina, and his apprentice, Nicola Moraldi, following the suggestions of Lanciani, undertook surveys in the Roman countryside in order to discover vestiges and

springs of the ancient Marcio aqueduct.[15] In 1863, Moraldi obtained the financial support of the Ministry of Commerce and Public Works of the Papal States to complete these studies.[16] From 1863 to 1865, Moraldi was also seeking funders for the archaeological-financial enterprise of restoration and renewal of the most famous of the ancient Roman aqueducts.[17] In 1865, two British businessmen, Henry Fawcett and James Sheperd, joined with the Italian architect, taking responsibility for funding this enterprise.[18]

On 8 November 1865, this group obtained from the Ministry of Commerce and Public Works of the Papal States a public concession of water for 99 years from some of the River Aniene valley springs and the ruins of the ancient Roman aqueduct.[19] The business was at the 'risk and charge' of the concessionary-holders themselves.[20] In November 1865, they founded the Anglo-Romana Water Company, which had offices in London and Rome, for the subscription of 10,000 shares.[21] The manifesto of this company stated that

> Re-conducting in Rome the water…identified as the water Marcia, the queen of the waters of the ancient Romans is the scope of this enterprise…It is proved that water is highly pure, and it has the immense advantage of (reaching) the highest Roman houses. The present, imperfect water conduits (in Rome) cannot reach that level. Rome is embellished with numerous fountains, but in terms of purity of drinking water is likely inferior to any other European city of the same size. Half of the Roman houses do not have water at all; moreover, the waters Felice and Paola are not good, therefore it is likely to have solicitous buyers for water Marcia.[22]

Moreover – and perhaps the most interesting point for potential investors – the owners of the company calculated that the trade of Marcia water in Rome would have produced more than 10% of annual dividends per share.[23] Hence, the affairs of a modern aqueduct in Rome were born from a peculiar blend of archaeological fascination for ancient Roman aqueducts, the example of the restoration of some of these in the Renaissance, and entrepreneurial capitalism.

Nonetheless, the fund-raising process was not as successful as the promoters expected. In fact, by 1867, more than half of the shares of the Anglo-Roman Water Company remained unsold. As a result, the members of the Roman aristocracy who had invested in this enterprise called in the Belgian *Compagnie générale des conduites d'eau de Liege*, which took over the majority of the shares.[24] In this way, the company changed its name to the *Società Anonima Romana dell'Acqua Marcia* and later *Società Acqua Pia Antica Marcia* (SAPAM).[25] The Belgian company brought to SAPAM its technical know-how about modern waterworks and ensured the provision of cast iron conduits and related devices.

Moreover, the Belgian engineers discovered that, in fact, the ancient Marcio aqueduct was almost completely wrecked and unserviceable; indeed, even the few well-preserved parts required a substantial restoration, whose costs were superior to those of building a new conduit.[26] Furthermore, the ancient aqueduct almost by-passed Tivoli, which was 'an important area, whose geographical position assured a great industrial and commercial future, but Tivoli had a shortage of drinking waters' and the new aqueduct had to cope with these needs.[27] As a result, a completely new aqueduct, 52 kilometres in length, was planned.[28] Basically, this was articulated in three parts: a masonry aqueduct 26 kilometres long from the springs to a reservoir in Tivoli; a cast iron water main 26 kilometres long, where water would have to be pressurised, from Tivoli to a water tower in Rome; finally, a set of secondary and tertiary branches which would provide the capillary distribution in Rome.[29]

When, on 10 September 1870, the water *Pia* was displayed (*mostra*) in a temporary monumental fountain in Termini square, a journalist stated that the water gushed at a high level and 'appeared very limpid, and from its sound, it seemed fresh like ice.'[30] This was a further example of the place of sensorial experience in assessing water quality before the bacteriological revolution. The journalist continued his report describing the scene. The pope received and drank the first glass of this water. At the end of the ceremony,

> The Holy Father showed his satisfaction about what he had seen, he praised the work, congratulated, and wished the best results to the company (SAPAM), stepped down from his throne, climbed into his carriage, and blessing everybody took his way towards the Apostolic Residence.[31]

He would never leave his residence again. Ten days later, Italian troops conquered the city and Pope Pius IX considered himself a prisoner of a usurper kingdom, passing the rest of his life in the Vatican.[32] However, the aqueduct and the water company that took his name conditioned the social and political life of Rome over the following decades.

In conclusion, though the Marcio aqueduct was imagined as the last restoration of the ancient Roman aqueducts, it was actually the first modern and market-oriented waterworks in Rome. However, the cultural elements involved could not be judged as mere folklore. First and foremost, this testified once again to a widespread culture of the Italian urban elite that perceived progress in science and technology as a renewal of the glorious Italian past. This also had an impact on the decision-making process. Indeed, Nicola Moraldi and his partners obtained a water concession from the most important water sources of the Roman area without a real, detailed project for a modern aqueduct, and his fanciful idea of restoring the ancient Marcio aqueduct was based on little evidence. Rome in the

1860s was in need of a new aqueduct for public health reasons, as we have seen in Chapter 3, so the Roman authorities looked with favour on any enterprise of this kind. Another element to consider was cultural and political. In fact, the restoration of some of the ancient aqueducts during the Renaissance contributed to restoring the prestige of the papal government.[33] In the mid-1860s, the Papal State was experiencing its sunset and one could see a similar scope in the enterprise of the modern Marcio aqueduct. Similarly, we cannot exclude that these ideas had a role in bringing some of the most prominent Roman nobles to participate in the Marcio aqueduct 'adventure'. Indeed, with the Papal States reduced and endangered by the Kingdom of Italy, what better occasion to reinvigorate the status of the Roman aristocracy than offering to the city the best-quality water of the ancient Romans? Furthermore, the Roman aristocracy found in the new aqueduct a chance to acquire an economic, social, and political role in the life of the city that could resist a regime change.

Public needs, private profits: a difficult coexistence

The new aqueduct was named after Pius IX not only for cultural and symbolic reasons but also as a debt of gratitude. In fact, in 1867, the water company had successfully completed the allocation of 10,000 shares for an overall amount of 5,000,000 lire; the management board of the company consisted of prominent members of the Roman aristocracy who obtained the sum for the realisation of the infrastructures by means of financial guarantees. Nonetheless, the enterprise risked failing halfway because of a financial shortfall. At least 1,000,000 lire was needed to complete the waterworks of the new aqueduct, and the Pope persuaded the main Roman banks to grant this credit to SAPAM.[34]

Despite the patronage of the pope, SAPAM remained a commercial, private enterprise whose aim was profit-making. In fact, its statute explained that the target of the company was that of 're-conducting water Marcia to Rome and all the other waters involved in the water concession…in order to trade it…in the capital and in the surroundings, everywhere it would be convenient for its interests.'[35] This was a significant shift in purpose compared with the reasons behind the restoration of the ancient aqueducts during the Renaissance. In fact, in that case, the rebuilding of the aqueducts was part and parcel of a wider programme of urban renewal – envisioned and carried out by the papacy over 150 years – aimed at restoring 'the prestige of the Roman Church through the *renovatio Romae*.'[36] Besides making Rome a model for Christianity, the Renaissance aqueducts responded to the needs of public health and to a reorganisation of productive activities to ensure the economic prosperity of the city.[37] As a result, the central state authority – the Cardinals' committee in Charge of Roads, Bridges and Fountains – held responsibility for aqueducts, roads, fountains, and bridges.[38]

By contrast, a profit-making activity had a different impact on the way that water would be distributed and managed. The most direct effect was that the distribution network followed the demand for water rather than an urban plan.[39] This meant that affluent areas were privileged compared with poor ones. For example, in 1885, Rome's mayor, Leopoldo Torlonia, had to solicit SAPAM to expand its distribution network towards the working-class district of Testaccio, which the water company seemed unwilling to supply.[40] Moreover, SAPAM sold water through a flat rate system, irrespective of the actual water consumed.[41] More specifically, the water company sold water at a pre-defined amount; water continuously flowed into the distribution conduits, and the amount was regulated by means of a calibrated faucet.[42] From the faucet, the buyers could direct water as they wished in order to ensure domestic supply. As I have described in Chapter 3, this led many building owners to adopt a descending distribution system – particularly in the poorer areas or in the houses for rent – collecting water into tanks, where water quality deteriorated. Since the water flow from the calibrated faucet was continuous, when a water tank was full, water was discharged into the sewers in order to allow the delivery of the pre-determined amount of water per day. Clearly, this distribution system was water-consuming but for the medical culture of that time this was an advantage since sewers were continuously washed and purified.[43]

Moreover, water users in the higher parts of the city – many of the new quarters constructed from 1870 onward – paid 14.3% more than the users in the lower parts, namely the old city and the new quarters along the River Tiber.[44] Apparently, there was no technical reason for this. The Marcio arrived in Rome at a high level, and gravity permitted water to reach any part of the old and new districts of the city. Moreover, the distribution network was like 'the distribution of blood in the human body', and secondary and tertiary branches led directly from the water main without either piezometers or water reservoirs to regulate water pressure.[45] As a result, SAPAM did not have to make any particular arrangements to supply the higher parts of the city. Consequently, this rise in price in these areas of the city was the product of SAPAM's almost complete monopoly on water. Indeed, the municipal aqueducts and particularly the Vergine aqueduct – the only one that could compete in quantity and quality with the new Marcio aqueduct – could distribute water only in the lower parts of Rome because of the low level above the sea of its springs. Overall, this commercial strategy was productive for the water company. For example, in 1895, when it was at full capacity, the company earned 1,758,888 lire from the water trade, and the net profit was 685,515 lire.[46] The dividend in respect of the shares was 11.2%.[47]

To sum up, SAPAM's commercial strategy was a variable in matters of urban planning, public health, water access, and consumption. As a result, the Roman municipality tried to negotiate some of the conditions

of water distribution in the city in order to ensure a better-quality, easy, and affordable access to water. Before analysing this, we need to take a step back to 1865 and to the water concession gained from the newly born SAPAM, in order to understand the original frame that regulated the relations between this private enterprise and the public powers. The papal government conceded to the water company the right to exploit the springs in the River Aniene valley in order to supply Rome with almost 700 litres per second, something like 60,000 cubic metres per day.[48] One of the most important articles of the concession was about the distribution of that water. In fact, the water company had to

> Distribute water in Rome according to the water demands of the dwellers for temporary or permanent use, privileging the neighbourhoods that do not have access to *Vergine* water. The residual quantity of water (not sold in Rome) could be sold outside Rome, in the countryside, in the villages or in the surroundings. However, at least half of the total amount of water… must remain available for the city.[49]

Other articles detailed the route of the aqueduct and the construction materials, but there was no mention about distribution network, fares, and urban design. Indeed, in November 1865, a few days after the concession was awarded, Rome's municipal authority wrote to the Ministry of Commerce and Public Works of the Papal States, complaining about the fact that the private company was basically independent from the municipality.[50]

The problem for the municipality was that the water concession allowed SAPAM to control the most abundant water 'reservoir' of the Roman area. Consequently, the private company had a *de facto* monopoly on the water supply of the city, particularly in the areas of urban expansion. Moreover, in Rome, the private company had no formal obligation to distribute more than 700 litres of water per minute. Finally, the distribution network was allowed to follow the demand for water and not directly the building of new areas. This point was tricky. In fact, the new urban areas that were growing in Rome after 1870 were in need of a water supply; therefore, in these areas, the demand for water was high. However, the demand had to match the supply and the price of this. As a result, water supply for working-class districts like Testaccio was not granted. More generally, already by the mid-1880s, the situation of urban water supply 'was getting worse, since the growth in population of the city increased the needs for a larger amount of water. (Also) the construction of houses for workers…and finally the compliance of the reclaiming laws' required the mediation of the urban authority to moderate the price of water and to allocate water in a wider plan of urban and rural development.[51]

The negotiations between SAPAM and Rome's urban authority had some success, and on 2 December 1885 they signalled an agreement. In

order to increase the supply of water and to avoid disruption in its distribution, the water company had to construct a second aqueduct from the springs to Tivoli and an additional water main from there to Rome. Second, SAPAM had to create a water pipe to supply eight reclaiming centres in the Agro Romano. Third, Rome's municipal authority purchased 70 litres per second for municipal services at a favourable price. In addition, water had to be sold with at least a 50% discount on SAPAM's price list to working-class and popular housing districts. The same discount had to be applied to a provision of 11.5 litres per second to the city's hospitals. Finally, the water company had to provide free water to 100 fire hydrants in the city. On the other side, SAPAM gained a *de jure* monopoly on the introduction of drinking water in Rome for 25 years, and Rome's municipal authority could use new sources of water for industrial or municipal services only.[52] The municipal authority was allowed to increase drinking water distribution in Rome by improving the existing municipal aqueducts only.[53] In short, SAPAM accepted some limitations to its autonomy regarding water prices, uses, and infrastructures in exchange for operating in the Roman area without real competitors. However, deep down, the board of the water company understood that

> being compliant in order to maintain good relations with the municipal authority was our utmost interest…(indeed) our trade took place mainly in the city, and our greatest customer is the municipality, thus contributing in some way to its prosperity, we pursued the benefit of our shareholders.[54]

After all, even with these limitations and obligations and after having constructed the second aqueduct in 1894, the trade in drinking water under almost monopoly conditions remained very profitable. However, for the municipality, this model of relations was challenging. In fact, water-related issues like new districts, municipal services, and more generally the quality of the water distribution had to pass through the 'interests…and benevolent attitude of a private company, against which – at worse – there was no other way of suing it.'[55] As a result, the Rome municipality tried to reduce SAPAM's monopoly on drinking water. Nonetheless, the agreement with SAPAM and the practical lack of large and good-quality water resources other than those controlled by the private company forced the municipality to focus on the existing aqueducts.

In 1901, a programme of renewal of the Vergine and Felice aqueducts was started. This involved catchment works, water mains, and a distribution network in order to increase the quantity of water in the aqueducts and to not waste the precious content.[56] By means of this, in 1912, the quantity of water in the Vergine aqueduct was increased and a lifting

plant was installed in order to distribute this water at a higher level than in the past.[57] As a result, in 1912, the distribution network of this aqueduct was of 35 kilometres in the low city, and a new Vergine aqueduct was planned in order to supply the high city.[58] However, the new Vergine aqueduct was completed only in the late 1930s.[59] Finally, from the 1910s – at the end of the 25-year agreement with SAPAM – the municipal offices began drafting a plan to create a brand-new municipal aqueduct, which would collect water from the River Peschiera in the central Apennines, 100 kilometres from Rome.[60] However, the project was only completed between 1937 and 1947; therefore, it was only in the late 1940s that Rome had a new municipal aqueduct that could compete with the private one.[61]

In the meantime, the private company continued to use a system of maximisation of profits, fixed fees for a pre-determined amount of water, and minimisation of expenditures: no water towers or meters and little maintenance and control.[62] Nonetheless, for the expansion of Rome during the Liberal period (1870–1922), the Marcio aqueduct was essential, and quality and quantity of water partially compensated for the speculative practices of this private company. In detail, the population of Rome increased from 244,484 in 1871 to 691,661 to 1921.[63] In a similar period of time (1880–1923), the water supply of the Marcio aqueduct increased from 550 to 2,125 litres per second.[64] Hence, in that period, the Roman population almost tripled while the water supply provided by SAPAM almost quadrupled.

To conclude, in Liberal Rome, a private, profit-making company managed most of the drinking water. This had an impact on the way that water was bought and sold. The relations between the urban authority and SAPAM were twofold. First, urban policies as regards water – public health, new quarters, and irrigation – had to adapt to the pursuit of profits of a private water company. Second, only the water company could provide water, infrastructure, and money to support these policies. On the other hand, SAPAM was aware of the importance of retaining good relations with the local authority, which was also the company's best customer. Hence, the relationships between the local authority and the private company were mixed. They supported each other, but sometimes their strategies conflicted. As a result, the Rome water supply at the turn of the twentieth century was operated in the middle of this ambivalence.

The rent of water in the countryside

As we have seen, the commerce in drinking water in the Roman area was a good business and the logic of profits could be only partially tempered by public powers. Now, was water in the Roman countryside also managed in view of private profits? The project to reclaim and intensify cultivation of the Agro Romano was a key element of the politics of

renewal of the Roman area. Indeed, the first point of the agreement between Rome's city council and SAPAM was about the provision of water to eight settlement centres at 6/8 kilometres from Rome. Nonetheless, passage from extensive to intensive agriculture required water for irrigation. In Chapter 2, we have seen that in the 1890s attempts at creating a large canal for the irrigation of the Agro Romano failed. As a result, only natural streams remained available to promote the renewal of agriculture there. From the 1890s, civil engineers and members of the Department of Agriculture turned their attention to CPAM, a unique case in the Roman area of a private institution, irrigation consortia, already widespread in Northern Italy.

The Acqua Mariana canal was an infrastructure that had its roots in medieval Rome. Indeed, in the eleventh and twelfth centuries, few of the ancient waters had remained available in Rome and the River Tiber represented the main water source of the city.[65] The lack of water conditioned agriculture and also the economic prosperity of some powerful clerical institutions located in the highest part of Rome, such as the Chapter of the Basilica of St John Lateran (San Giovanni in Laterano Basilica), which owned large estates. As a result, in 1122, Pope Calixtus II ordered the diversion of one of the main streams that naturally flowed from the Alban Hills towards the River Aniene.[66] This stream had its origins in the Squarciarelli springs identified by Thomas Ashby as the ancient water Iulia; therefore, this hydraulic work was the forerunner of the successive restoration of the ancient Roman waters.[67] In 1122, this water was canalised by means of a barrage in an underground conduit (probably of the ancient Claudio aqueduct) and after 900 metres appeared in the Roman countryside close to the ruins of most of the ancient aqueducts.[68] Thereafter, it passed for several kilometres through the countryside flanking the Felice aqueduct (Figure 5.2) and finally reached Porta San Giovanni (close to the Lateran Basilica), turned southward, flowing around the Aurelian walls, and finally entered Rome through the Porta Metronia. Finally, it passed the area of the Baths of Caracalla, then the Circus Maximus and finally flowed into the River Tiber. In this way, from the Middle Ages, this canal irrigated vineyards and vegetable gardens and provided waterpower to various manufactures.[69] The Lateran Chapter had managed this canal for centuries and even after 1820 – when this role passed to the consortium of private users – remained the juridical protector of the consortium.

During the early modern period, other rivulets and springs were diverted into the Acqua Mariana canal, like the Preziosa springs, which were those of the ancient water *Tepula*.[70] Overall, in terms of water amount, the canal was subject to seasonal oscillations, passing from a minimum of 200 to a maximum of 270 litres per second and averaging 250 litres per second.[71] Thus, quantitatively, this canal was comparable to the Felice aqueduct, of which it followed the route for some kilometres.

Still, in the final decades of the nineteenth century, the Acqua Mariana canal was used for both agriculture and milling, passing through the territories of Grottaferrata, Marino, and Rome.[72] The members of the consortium were 24, including Rome's municipal authority, for the irrigation of the municipal seedbed and the Anglo-Romana Gaslight Company, which used that water in the first gaslight factory in Rome, located in the Circus Maximus from 1853.[73] The other manufacturers participating in the consortium were three marble sawmills, two paint factories, a wood sawmill, and seven grain mills, one of which was also a pasta factory.[74]

Nonetheless, the use of the canal was not limited to the members of the consortium. Indeed, the consortium could extend irrigation to other riverine landowners or tenants.[75] However, until the turn of the twentieth century, requests for irrigation were numerous but the quantity of water requested was limited. Indeed, in many cases, the irrigation tools were simple pails and barrels.[76] On the other hand, permanent and abundant water demands for irrigation were limited because the economic system in the Agro Romano did not require a large use of water and the consortium members feared that this could negatively affect the industrial uses.[77]

Nevertheless, the trade in water for irrigation was a source of income for the consortium. The 1883 law on the renewal of the Agro Romano produced few practical results but moved some landowners to pass from extensive agriculture to irrigated cropping.[78] One of these was Cesare Bertone, the owner of an estate crossed by the Acqua Mariana canal (before the underground conduit). In 1884, Bertone bought water for irrigation from CPAM in order to begin cultivating artificial lawns, cereals, and leguminous and textile plants on his estate.[79] In 1888, the Ministry of Agriculture, reporting to parliament on the limited advances made by the project of renewal of the Roman countryside, singled out Bertone as an example to follow for the other Roman landowners.[80] This is to say that, at the turn of the twentieth century, the demand for water in the Roman countryside was slowly increasing and this represented an opportunity to increase the consortium's revenues. Moreover, during the same period, the consortium had to face the pressure of the towns in the surroundings of the springs of the canal that sought to use that water for drinking, therefore changing uses and ownership of the canal (see Chapter 2).

As a result, the consortium found a possible source of income and a way to retain its jurisdiction on the canal in the policy of renewal of the Agro Romano by stressing its 'public' role as developer of irrigated agriculture. However, the synergy between agricultural and industrial uses of the canal was based on a delicate equilibrium. This system allowed only slight variations in the quantity of water allotted to cultivation. How could the consortium break this balance without compromising industrial activities? In a sense, this was possible by 'importing' water from a distant place, not in the form of H_2O but as hydroelectricity, in order to

power the manufacturing plants while leaving the water of the canal to rural uses. Indeed, in 1892, Rome was one of the first Italian (and world) cities to have a supply of hydroelectricity (see Chapter 2). As stated above, the Anglo-Romana Gaslight Company – from 1892 the Anglo-Romana Gaslight and Electricity Company – that had realised the hydroelectric power station in Tivoli was a member of CPAM. From the 1900s, this company was looking to expand its distribution network in the Roman suburbs and countryside.[81] Thus, the interests of CPAM and of the Gaslight and Electricity Company converged.

The former had made concrete projects to substitute electrical for water power at least from 1902.[82] The installation of distribution lines (primary and secondary) and voltage transformers required no small investment from the consortium budget. In fact, CPAM had planned to apply for a bank loan of 35,000 lire, but in 1909 the financial situation of the consortium had improved, and the investment was made without resorting to bank loans.[83] An agreement with the electric company for the realisation of the works was signed the same year.[84] How did CPAM raise the money for such an investment? The balance sheets of the CPAM provide an answer.

Table 4.1 shows the main items of expenditure and income of the consortium in the period of 1894–1900. In addition, it provides information about the liquid deposits of the consortium that is a valuable indicator of the level of capital accumulation. A first aspect to underline is that two-thirds of consortium expenditures were administration, maintenance, and control items, which involved salaries (mainly a guardian), canal maintenance, and legal costs. The legal costs were for the payment of fines, injunctions, legal consultations, and trials, part of the process of controlling and organising a range of uses over the Acqua Mariana canal.[87]

On the other hand, in the same period, annual subscription fees and water sold to other users constituted 85% of the consortium's overall income.[88] The latter alone was 44% of the entire income; thus, it was a vital source for the consortium's workings. However, this source of income could be increased only with difficulty and only partially covered the expenditures, which in case of accident – such as in 1895 – could sharply increase, causing a heavy deficit. In this situation, accumulating capital was hard. In fact, the deposit in the consortium's bank accounts was insignificant. An increased commercialisation of water was a condition that could permit a capital accumulation. Table 4.1 indicates that the consortium sought to develop this aspect. As a result, the income from this item had a slight but steady increase.

As Table 4.2 shows, in the period of 1901–1907, this upward trend was confirmed. In fact, in the two-year period of 1902–1903, the income from the trade in water rose significantly. By contrast, annual membership fees declined. Nevertheless, the consortium's income was not affected

Table 4.1 CPAM balance sheets, 1894–1900

Year	*Salaries*	*Legal costs*	*Canal maintenance*	*Bank accounts*	*Member's fees*	*Water trade*	*Expenditure*	*Income*	*Total*
1894	3,413	2,402	1,004	x	4,435	3,520	10,180	9,980	–200
1895	3,278	822	1,133	26	3,525	4,455	21,65[85]	1,3616	–8037
1896	3,278	387	1,548	26	4,700	4,795	7,995[86]	11,996	4,001
1897	3,278	194	1,441	26	4,700	5,177	7,332	9,968	2,636
1898	3,278	2,677	1,430	28	4,700	4,804	9,731	9,797	66
1899	3,278	3,396	1,925	129	4,700	5,616	10,794	10,833	39
1900	3,278	1,171	2,978	130	4,700	5,655	9,604	10,694	1,090

Sources: ASR, *CPAM/b. 12/fascicolo bilanci e realzioni dei sindaci dall'anno 1888 all'anno 1900*. CPAM, balance sheets.

Table 4.2 CPAM balance sheets, 1901–1907

Year	*Salaries*	*Legal costs*	*Canal maintenance*	*Bank accounts*	*Member's fees*	*Water trade*	*Expenditure*	*Income*	*Total*
1901	3,278	1,353	1,425	2,466	4,700	5,310	7,391	10,381	2,990
1902	3,328	301	1,222	8,559	4,700	7,709	6,614	12,878	6,264
1903	3,328	1,166	1,203	18,350	4,700	8,975	7,629	14,900	7,271
1904	3,138	1,112	1,783	22,323	4,415	7,402	7,877	12,827	4,950
1905	4,148	1,172	1,265	17,647	3,802	7,356	7,506	12,491	4,985
1906	4,148	105	988	22,137	2,627	7,544	5,875	11,729	5,854
1907	4,148	263	2,531	26,727	2,557	7,761	7,988	12,285	4,297

Sources: ASR, *CPAM/b. 12/fascicolo bilanci e realzioni dei sindaci dall'anno 1901*. CPAM, balance sheets.

by this reduction; on the contrary, profits sustained by the commercialisation of water saw a marked increase. In addition to this, the consortium had a more cautious attitude towards expenditures. The combined effect of these processes was the creation of an embryo of capital accumulation as the almost linear progression between profits and bank account deposits testifies.[89]

Table 4.3 shows the sharp and rapid increase of the consortium's earnings after the completion of the hydroelectric distribution network in 1909. This economic 'spurt' was sustained by the commercialisation of water for irrigation use, whose income tripled between 1908 and 1912, while annual membership fees decreased and became a marginal item of income. This was an explicit target of the consortium that aimed at reducing and possibly excising the membership tax.[90] Expenditure also rose in the period of 1908–1914. For example, maintenance costs tripled. This was probably the result of the increased canalisation of water for irrigation that eroded the canal infrastructure. However, all the costs linked with administration and control of the canal contributed to this increase.[91]

Overall, by means of hydroelectricity, CPAM was able to allocate 150–175 litres per second to rural uses, which was sufficient to irrigate 150–175 hectares of land.[92] As a result, the consortium not only increased its revenues but also obtained the approval of the Ministry of Agriculture. Indeed, the inspector of the committee that had to monitor the evolution of the project of reclaiming, colonising, and cultivating the Roman countryside stated that 'the Consortium Mariano (of the Acqua Mariana) deserved the highest encomium from the Ministry of Agriculture, since this work (increasing water for irrigation) was of much importance for the renewal of the Agro Romano.'[93] Indeed, from 1910, CPAM signed many agreements for trading water in the Roman countryside and was generous in selling drinking water in order to promote the settlement of that area.[94] Hence, CPAM had been able to insert its commercial strategy into one of the modernising strands of the Italian elite, as a result of which its 'public' perception switched from that of greedy speculators of ancient and illiberal privileges (see legal trials and the *Carta Idrografica d'Italia* in Chapter 2) to that of agents of modernity. Consequently, in 1910, the Ministry of Finance recognised CPAM as the legal user of the Squarciarelli springs, though a moderate quantity of water from those springs was allotted for drinking and civic uses to Grottaferrata.[95]

Nonetheless, CPAM traded every drop of water to increase its profits. This had a negative impact on the living conditions of the suburban areas crossed by the canal. In fact, during the summer of 1914, the Mayor of Rome complained that owing to the intensive commercialisation of water for irrigation, the urban section of the canal between the vie Appia Nuova, Tuscolana, and the popular housing areas of Ferratella and Porta Metronia was almost dry. In this way, black puddles and organic waste stagnated in the riverbed, causing bad smells and public health issues.[96]

Table 4.3 CPAM balance sheets, 1908–1914

Year	*Salaries*	*Legal costs*	*Canal Maintenance*	*Bank accounts*	*Member's fees*	*Water trade*	*Expenditure*	*Income*	*Total*
1908	4,148	2,047	5,658	26,195	2,627	8,332	12,928	12,865	–63
1909	4,148	2,311	1,794	1,127	2,627	9,778	16,881	13,740	–3141
1910	3,848	628	3,229	1,155	2,627	15,342	16,825	19,780	2,955
1911	5,168	2,065	4,693	7,757	2,677	23,023	23,009	27,268	4,259
1912	5,573	3,260	4,911	174	2,612	27,785	24,557	31,767	7,210
1913	5,748	65	4,571	5,202	2,025	26,720	21,201	31,694	10,493
1914	5,028	1,700	4,069	226	1,778	26,365	23,009	28,803	5,794

Sources: ASR, *CPAM/b. 12/fascicolo bilanci e realzioni dei sindaci dall'anno 1901*. CPAM, balance sheets.

However, the consortium had no intention to reduce its profits from the trade in water.[97] Finally, the problem was solved at the expense of the municipal authority, which between 1915 and 1924 covered and connected the suburban section of the canal with the sewers.[98]

In the end, CPAM was a long-lasting agent in the Roman countryside. This durability was the product of its ability to adapt and develop a commercial water strategy that interlaced capital, technological upgrade, public territorial policies, and cultural perceptions. Specifically, in the period between 1890 and 1910, the role of water for the consortium shifted from a source of energy to a source of money. In this way, CPAM gained multiple benefits: it increased consortium income, generated a capital accumulation that was invested in a technological upgrade, and also matched the interests of the Ministry of Agriculture and the rural strands of the Italian elite's discourses on modernity. Nonetheless, since the main aim of the consortium was in maximising profits, the ecology of the system of the canal was shaken and the public authority had to intervene to reduce the side effects of the private pursuit for value.

Conclusion

In this chapter, I have shown the economic value of water in the Roman area at the turn of the twentieth century. The two examples discussed exemplify how the main water infrastructures in Rome and its countryside were managed by private companies. This meant that water in the city and in the countryside was treated in order to maximise profits. However, this private pursuit for money took place in a context shaped by a cultural perception of water and of water infrastructures and public projects of urban/rural renewal. This is to say that the pursuit of profit had to be moulded accordingly and could be influenced by public powers. For example, in the case of SAPAM, the claims of the private company to reconnect Rome to its ancient water veins required that abundant and high-quality water be provided to the city. Moreover, Rome's urban authority was able to temper the water company's tendency to minimise expenditures and focus on affluent users and uses by leveraging its role as SAPAM's best customer and as promoter of new districts of the city. In this way, the private company had to introduce some elements of 'public service' – like affordable prices for popular districts and for urban services – in its pursuit for profits. On the other hand, owing to the lack of competition in the drinking-water market, Rome's municipality could not exercise a more decisive influence on the water policy of the private water company.

The case of CPAM showed the same trend. Indeed, the private Acqua Mariana consortium had to reinvent its social role by changing its use of water, focusing more on the trade in water for rural activities than directly using it for energy. This had multiple benefits for the consortium. In fact,

the commerce of water allowed a process of capital accumulation that led the consortium to a technological upgrade. In this way, more water was made available for rural uses, contributing to the renewal of a part of the Roman countryside. This pushed forward one of the modernising designs of the Italian elite: increasing irrigated areas. As a result, CPAM was recognised by the Italian state as an ally in the pursuit of modernity, therefore retaining its control of one of the main water resources of the Roman area. However, the fact that the only irrigation consortium of the Agro Romano used irrigation as a profit-making activity but reinvested the money in industry was a good example of the place of agricultural uses of water in the Roman area during the period. Because the water quantity available was limited and contested by other uses, mainly drinking water, CPAM did not invest in developing the infrastructures. On the contrary, it invested the revenues in the realisation of a hydroelectric distribution network. As a result, capital was transferred from agriculture to industry.

Overall, at the turn of the twentieth century, the commerce of water for drinking and productive uses in the Roman area was expanding. This meant that a larger quantity of water was allotted among a larger number of people in a wider area. The question was how this water was used by these people and how the socio-natural landscape was manufactured by these private uses of water. In order to answer these questions, the next chapter will examine the private uses of water in a part of the Roman area.

Notes

1 Martin Melosi, *Precious commodity: providing water for America's cities* (Pittsburgh: 2011), 12–13.
2 Richard Coopey and Terje Tvedt, 'Introduction: water as a unique commodity', in Richard Coopey and Terje Tvedt (eds.), *A history of water*, series 1 volume 2: The political economy of water (London: 2006), 9–18.
3 For an Italian example, see David Gentilcore, 'Cool and tasty waters: managing Naples water supply, c. 1500–c. 1750', *Water History*, 11, no. 3–4 (2019), 125–151.
4 Giuseppe Bonaccorso, 'Roma e le sue acque potabili nel Cinquecento: La competizione con il Tevere', *Roma Moderna e Contemporanea*, no. 1–2 (2009), 73–90.
5 Carlo Fea, *Storia: I. delle acque antiche sorgenti in Roma perdute, e modo di ristabilirle, II. dei condotti antico-moderni delle acque, Vergine, Felice, e Paola, e loro autori: con suggerimenti per aumentare le loro acque, e migliorarne la qualità* (Rome:1832).
6 Melosi, *Precious commodity*, 13.
7 Jean-Pierre Goubert, *La conquête de l'eau. L'avènement de la santé à l'âge industriel* (Paris: 1986), 177–182. See, for example, the case of the French *Compagnie General des eaux*.
8 Katherine W. Rinne, *The waters of Rome: aqueducts, fountains, and the birth of the baroque city* (New Haven and London: 2010).

9 Fea, *Storia: I. delle acque antiche sorgenti in* Roma, 176–181.
10 Proposal of the architect Pietro Lanciani to the Rome city council for the renewal of the Marcio aqueduct', in SAPAM, *Atti della Società dell'Acqua Pia (Antica Marcia), compilati per ordine del consiglio d'amministrazione* (Rome: 1881), 3–6.
11 Ibid., 4.
12 Ibid., 5. Also Alessandro Salone, 'Una riforma "moderata": il provvedimento di Pio IX sulla nuova organizzazione del municipio Romano', *Roma Moderna e Contemporanea*, no. 2 (1996), 403–441.
13 Quoted in Thomas Ashby, *The aqueducts of Ancient Rome* (Oxford: 1935), 90.
14 Ibid., 93.
15 'Exchange of letters between Nicola Moraldi and Ministry of Commerce and Public Works, in SAPAM, *Atti della Società dell'Acqua Pia*, 7–19.
16 Ibid., 7–19.
17 'Bill of sale of the concession on water Marcia from Nicola Moraldi to Mr Henry Fawcett and Mr H.N. Woolbert', in SAPAM, *Atti della Società dell'Acqua Pia*, 19–24.
18 'Bill of sale of the concession on water Marcia from Nicola Moraldi to Mr Henry Fawcett and Mr James Sheperd, in SAPAM, *Atti della Società dell'Acqua Pia*, 24–32. In the 1860s, James Sheperd was a well-known businessman in Rome, in fact, in 1853 he had promoted the creation of the Anglo-Romana Gaslight Company, that illuminated the main streets of Papal Rome. See Stefano Battilossi, *Acea di Roma 1909–1996. Energia e acqua per la Capitale* (Milan: 1997), 29. This was the same company that carried hydroelectricity from Tivoli to Rome in 1892 (see Chapter 2).
19 'Decree awarding water concession for the networking and provision in Rome of the water Marcia', in SAPAM, *Atti della Società dell'Acqua Pia*, 32–46. The springs called Lago di Santa Lucia and Serene.
20 Ibid., 33.
21 'Manifesto for the issue of 10,000 shares of the Anglo-Roman water company ltd. in London and Rome', in SAPAM, *Atti della Società dell'Acqua Pia*, 77–79.
22 Ibid., 77.
23 Ibid., 79.
24 'Shareholder general meeting in Rome, 1 May 1867, in SAPAM, *Atti della Società dell'Acqua Pia*, 92–94.
25 'Contract between SAPAM and Compagnie générale des conduites d'eau de Liege for the provision of cast iron pipes', in SAPAM, *Atti della società dell'Acqua Pia*, 94–99.
26 'Engineers Piercy and Berger report to the shareholder general meeting on the conditions of the ancient Marcio aqueduct and project for a new aqueduct', in SAPAM, *Atti della società dell'Acqua Pia*, 168–175.
27 Ibid., 169.
28 Ibid., 169–175.
29 Domenico Berno, *Sull'Acqua Pia (Antica Marcia) sua conduttura e distribuzione in Roma* (Rome: 1892), 5.
30 'Inauguration, *Giornale di Roma* n. 206, 12 September 1870', in SAPAM, *Atti della società dell'Acqua Pia*, 239.
31 Ibid., 239.
32 Fulvio Cammarano, 'La costruzione dello Stato e la classe dirigente italiana: 1861–1887', in Giovanni Sabbatucci and Vittorio Vidotto (eds.), *Storia d'Italia, volume 2: Il nuovo Stato e la società civile* (Rome and Bari: 1995), 3–112 (50–56).

33 Katherine Wentworth Rinne, 'Hydraulic infrastructure and urbanism in early modern Rome', *Papers of the British School at Rome*, 73 (2005), 191–222.
34 SAPAM, *Atti della Società dell'Acqua Pia*, 18–19. The SAPAM obtained a loan of 300,000 Lire from the Monte dei Pegni of Rome, 600,000 lire from the Banca Romana. Moreover, before the end of the works the Church State refund the deposit (130,625 Lire) the SAPAM had given to as guarantee of the works.
35 SAPAM, *Statuto della Società Anonima dell'Acqua Pia (Antica Marcia) approvato con decreti del 18 marzo 1868 19 Aprile 1874 e 14 Agosto 1880* (Rome: 1880), 3–4.
36 Rinne, *The waters of Rome*, 43.
37 Ibid., 52.
38 Ibid., 52. In particular, here the discussion refers to the Vergine aqueduct.
39 SAPAM, *Atti della Società dell'Acqua Pia*, 241, 'The distribution network is almost completed in Monti, and it is developing…preferring the directions where water demand is higher'.
40 'Mayor of Rome letter to Board of Directors of the Società Acqua Pia' (Antica Marcia), Rome 27 November 1886 in SPQR, *Comune di Roma e Società dell'Acqua Pia Antica Marcia, raccolta di documenti* (Rome: 1904), 11.
41 'SAPAM contract sample for water provision' in SPQR, *Comune di Roma e Società dell'Acqua Pia, documenti*, 17.
42 Ibid. From a maximum of 20 cubic metres to a minimum of 2.5 cubic metres per day.
43 Angelo Celli, A. Bajardi and Oddo Casagrandi, 'Studio batteriologico sull'acqua Marcia dalle sorgenti alla sua distribuzione: contributo alla batteriologia delle acque condotte e sorgive', *Annali d'Igiene Sperimentale*, no. 3 (1903), 729–853.
44 'SAPAM price list', in SPQR, *Comune di Roma e Società dell'Acqua Pia, documenti*, 17.
45 Berno, *Sull'Acqua Pia*, 18.
46 SAPAM, *Assemblea Generale ordinaria del 23 Marzo 1895, Rapporto del Consiglio d'Amministrazione, relazione dei sindaci, bilancio al 31 dicembre 1894, deliberazioni* (Rome: 1895), 20–21.
47 Ibid., 14. At that time 20,000 shares of 500 Lire each.
48 'Decree awarding water concession for water Marcia', in SAPAM, *Atti della Società dell'Acqua Pia*, 32–46 (33).
49 Ibid., 40.
50 'Rome city council letter to Ministry of Commerce and Public Works', in SAPAM, *Atti della Società dell'Acqua Pia*, Ibid., 47.
51 'Memorandum signalled by Rome city council and SAPAM on 2 December 1885', in SPQR, *Comune di Roma e Società dell'Acqua Pia, documenti*, 3–9 (3–4).
52 Ibid., 7.
53 Ibid., 7.
54 SAPAM, *Assemblea Generale ordinaria 1895*, 6–7.
55 Council member Nobili Vitelleschi member of the municipal committee for the water service quoted in Battilossi, *Acea di Roma*, 164.
56 Ibid., 167.
57 SPQR, *Cinque anni di Amministrazione* Popolare (Rome: 1912), 122–123.
58 Ibid., 122–123.
59 Battilossi, *Acea di Roma*, 177.
60 Ibid., 169.
61 Ibid., 271–273.
62 Ibid., 177.

63 Eugenio Sonnino, Maria Rosa Protasi, Rossana Rosati, 'Aspetti Demografici, Sanitari e Territoriali di Roma dal 1870 al 1940', *Roma Moderna e Contemporanea*, no. 1–2 (1999), 17–56 (52).
64 Battilossi, *Acea di Roma*, 168.
65 Bonaccorso,'Roma e le sue acque potabili'.
66 ASR, *CPAM/ b.11/fascicolo relazione al Prefetto di Roma*. 'CPAM president letter to the Prefect of Rome', Rome 25 June 1895.
67 Ashby, *The aqueducts*, 162–163.
68 ASR, *CPAM/b.11/fascicolo Bando Pacca*. Cardinal Bartolomeo Pacca, 'Proclamation on the Acqua Mariana, its watercourse, mills, Gualchiere and other buildings', Rome 1820, 2.
69 Paolo Buonora and Manuel Vaquero Piñeiro, 'Il sistema idraulico di Roma in età Moderna, assetti di potere e dinamiche produttive', in Carlo Maria Travaglini (ed.), *La Città e il Fiume, secoli XIII–XIX* (Rome: 2008), 147–168. From the early modern age until late 19th century these buildings were mainly grindstone and wool clothes manufactories.
70 Ashby, *The aqueducts*, 159.
71 MAIC, DAG, *Carta Idrografica d'Italia. Il Lazio* (Rome: 1892), 107.
72 Actually in Grottaferrata the canal provided water to the Saint Nile Abbey aqueduct and to a public washing place.
73 ASR, *CPAM/b.11/fascicolo Bando Pacca*. CPAM, 'Rules of procedures', January 1896. This factory was realised on the ground of the former vegetable gardens labelled De'Cerchi, also Stefano Battilossi, *Acea di Roma*, 29.
74 ASR, *CPAM/ b.11/fascicolo cenno storico utenze di irrigazione*. CPAM, 'historical report on the irrigation users', without data but probably part of an 1895 handwritten report to the Prefect of Rome, 71–80. Still in 1877 almost a third of the entire amount of hydraulic energy in Italy was used by grindstones. See MAIC, Direzione Generale della Statistica, *Industria della macinazione dei cereali* (Rome: 1889), 22–23.
75 ASR, *CPAM/ b. 16/ fascicolo domande d'acqua fino al 1900*.
76 Ibid.
77 ASR, *CPAM/ b. 16/ fascicolo domande d'acqua fino al 1900*, 'Sabatini letter to the consortium president', 28 October 1890. It contains 'response letter' from 10 November 1890. The applicant wanted a 9-year water concession to irrigate his estate; the consortium president replied that the request would have been evaluated by the engineer of the consortium in order to esteem the compatibility of the request with the regular working of the mills.
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79 ASR, *CPAM/b. 10/fascicolo Cesare Bertone*. 'Cesare Bertone letter to Giovanni Lais, president of the CPAM', Rome 25 March 1884. The agreement was renewed in 1894; see ASR, *CPAM/b. 10/fascicolo Cesare Bertone*. 'Copy of the contract between the CPAM in the person of Count de Cesaris and Mister Cav. Cesare Bertone', Rome 3 July 1894.
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81 Battilossi, *Acea di Roma*, 32.
82 ASR, *CPAM/b. 16/fascicolo trasformazione elettrica negli opifici*. Società Italiana Oerlikon, 'estimate of costs n. 5329', 22 November 1902, Also, Ditte Gadda e c. & Brioschi Finzi e c., 'estimate of costs', 11 December 1903.

83 ASR, *CPAM/b. 16/fascicolo relazioni diverse dal 1871*. 'CPAM president annual report to the consortium assembly', 15 February 1909, 2.
84 Ibid.
85 This value was an outcome of the legal trial against the town council of Marino. The CPAM lost the trial and had to pay 2482 lire to the counterpart and 5828 lire to the lawyers. These costs were apart from the normal legal expenditure.
86 In the balance sheets, this value is higher (14504) because it included the balance deficit of the previous year.
87 ASR, *CPAM/b.11/fascicolo contravvenzioni e citazioni*.
88 The balance sheets of the consortium counted an income item from other uses of the canal. This voice was about few hundred lire per year.
89 Apart for the year 1905.
90 ASR, *CPAM/b. 12/fascicolo bilanci e realzioni dei sindaci dall'anno 1901*. Balance sheets auditors, 'balance sheets audit report', Rome October 1911.
91 Also, electricity became a relevant cost for the consortium; in fact, in the period of 1909–1914, it cost 7625 lire on average.
92 ASR, *CPAM/b.16/fascicolo realzioni diverse citation*. 'Spinetti inspector for the Ministry of Agriculture report to the Committee for the Reclamation of the Roman Countryside', Rome 28 May 1909.
93 Ibid.
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96 ASR, *CPAM/b.19/Comune di Roma II/fascicolo reclami*. Rome city council, 'office V letter to CPAM', Rome 3 August 1914.
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5 Water uses and the making of a new socio-natural landscape

The growth of Southeast Rome

In the period from 1870 to 1920, the urban form of Rome changed considerably. In 1870, the Roman population was crowded into little more than 400 hectares in the proximity of the River Tiber (Figure 5.1). Fifty years later, urban growth had overcome the barrier of the ancient Aurelian Walls and the boundaries between city and countryside had started to vanish in places in the eastern and southeastern quarters.[1] The traditional Marxist approach to the study of modern Rome explained this process as the result of land speculation and the absence of urban planning.[2] Another line of thought focused on the overlapping of contradictory policies aimed at developing rural, industrial, and housing activities over the same territory.[3] However, the creation of a new landscape in a relatively short period should not be seen as merely manufactured by a single mechanism or top-down political dynamics. Rather, this process involved many actors and the interactions between these actors and nature, not only land, of the area. As a result, consistent with the aims of this thesis, explanations of the rapid spread of Rome and its surrounding territory have to consider the role of water in this process. To be more precise, given the ways that water access, distribution, and use were being configured in the Roman area between 1870 and 1922, how did these influence the development of the urban fabric? How was water used by the local population and for what purposes?

Some of the possible answers have already been discussed in Chapters 2–4: the diffusion of new veins of drinking water that contributed to the expansion of the urban fabric in the upper zones of the Roman territory; the methods of distribution and costs of drinking water not affordable for the lower levels of the Roman population; and the limited quantity of water available for rural activities. However, in this chapter, I want to delve deeper into the way that water was used and incorporated in Rome's development. Given the extent of the process, I shall focus on a delimited area. In keeping with the discussion in the previous chapters, the selected area is more or less the hydrographic watershed between the River Aniene and River Tiber basins, an area where the Acqua Mariana

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Figure 5.1 Topographic map of Rome and suburbs, 1839–1870.

canal, the Felice aqueduct, and *Società Acqua Pia Antica Marcia*'s (SAPAM's) water main for the Agro Romano all intersected (Figure 5.2). Indeed, in that area, the interplay between the rural, industrial, and civic uses of water will shed light on how the three strands of water modernity interlaced with each other and contributed to shaping the space.

The discussion is organised into four sections. First, I summarise the situation of the waterscape in Rome and its surroundings and how this was planned so as to attract permanent migrants to the Roman area. Second, I analyse the role of water access, distribution, and uses in the creation of an industrial suburb in the area outside Porta San Giovanni. Third, I explore how increasing levels of water pollution had an impact

Figure 5.2 Detail of Rome's southeast suburbs, 1839–1870.

on the uses of water and land, also conditioning the social configuration of this industrial suburb. Lastly, I scrutinise the same process in a rural area located in the Agro Romano, Tor Pignattara, and how this became an urban 'island'.

Water and migration

As we have seen in all the previous chapters, the Roman waterscape at the turn of the twentieth century was manufactured by various authorities: the Ministry of Agriculture, Ministry of Public Works and Civil Service, physicians and the Public Health Department, local municipal

authorities like those of Rome, Tivoli, Grottaferrata, Marino and Frascati, and private sector actors like SAPAM, *Consorzio Privato dell'Acqua Mariana* (CPAM), and the Anglo-Roman Gaslight and Electricity Company. Furthermore, the Roman Prefecture and courts participated in this process of waterscape-making by settling the controversies regarding water access, distribution, and uses that arose between these actors. These conflicts, in turn, were the product of the difficult coexistence of the three strands of modernity delineated in Chapter 1: purifying urban and rural spaces in order to protect human life from nature's 'whims'; water as an element to boost the industrial productivity; and water to increase arable land and the productivity of agriculture. However, in the Roman area at the turn of the twentieth century, the first two targets were embodied in two large infrastructures, the new Marcio aqueduct and the hydroelectric power stations in Tivoli. These infrastructures fixed a specific use for water, delimited the possibility of its distribution, and allowed (private) providers of water and energy to regulate water access by means of contracts and tariffs. By contrast, Roman agriculture did not have anything similar.

Given the place that agriculture had in the political discourses of the Italian elites, the absence of large infrastructure targeting irrigation in the Roman countryside is surprising. In fact, the settlement of uncultivated, unpopulated areas was perceived by both liberal landowners and urban professionals as a means of making the Italian economy more solid. In this way, not only would cultivated areas expand, entering into the market, but peasants would also move and settle over a larger portion of the Italian territory, thus diminishing their social pressure on the existing overcrowded cultivated areas.[4] The Agro Romano seemed the perfect laboratory for this policy. In fact, in 1894, permanent residents on the 200,000 hectares of the Roman countryside numbered only 4,098.[5] Nonetheless, the Roman area was the lynchpin of one of the most important systems of migrant labour in nineteenth-century Europe. In fact, almost 100,000 people moved seasonally each year from central Italy, Umbria, Marche, Abruzzo, and south Lazio to the Roman area to work in the building industry and in agricultural activities.[6] Indeed, a 1905 survey of the Ministry of Agriculture calculated that the Agro Romano was the destination of 48,000 seasonal workers during the autumn and of 38,000 during the winter, employed in the ploughing and sowing of the fields, and of 62,000 workers during the summer, employed in the mowing and harvesting of grain.[7] Nonetheless, few of these migrant labourers remained in Rome and its surroundings. Hence, the idea that lay beneath the renewal of the Roman countryside was that of turning these seasonal migrants into permanent small farmers.[8]

In order to reach this target, the policy regarding the Roman countryside was that of dividing up large estates into smaller ones, giving the possession and enjoyment of these plots to peasants, gathered into rural

settlements, who had to keep the land in cultivation, improve the estates, and establish intensive cropping.[9] Hence, the reclaiming of the Agro Romano, the creation of waterworks in this area, and the antimalarial struggle had to remove the main obstacles to the settlement of the area surrounding Rome. Indeed, the Roman population increased from 244,484 in 1871 to 691,661 in 1921, migration from central Italy to Rome representing between 70% and 80% of this increase.[10] However, this tells us little about the real occupation of these migrants in Rome and the way they used and transformed the Roman space.

We now have to take a step back in order to understand how water could have favoured the establishment of a permanent population in Rome and its surroundings. First, malaria, the disease that had gripped Rome for centuries, had to be tamed. In Chapter 3, we have seen how, from 1900 onwards, the efforts of the state, Rome's municipal authority, and physicians caused mortality and morbidity rates of this disease to decline. More generally, Rome's municipal authority established health-care centres in the suburbs and the countryside. In 1912, these numbered 32.[11] As regards water, in 1908, the Hydraulics Office of the Roman urban authority stated that water, 'the necessary element (was) present almost everywhere with few exceptions.'[12] However, this statement was more ideological than a precise description of the availability of water. In fact, since the 1880s, landowners and land tenants in the Agro Romano had pointed to the lack of water for both drinking and irrigation as one of the main reasons for not proceeding with the improvements detailed in the law for the reclamation and renewal of the Agro Romano.[13] Actually water in the Roman countryside was quite widespread, but not in the quantity, form (canals) or with the facilities necessary for intensive, irrigated agriculture.

However, the area I have selected for this analysis (the Southeast suburbs of Rome) was actually provided with both drinking and 'rural' water. In fact, the Felice aqueduct crossed this area in a radial direction from the Alban Hills to the city centre. In 1908, this aqueduct supplied some public fountains and 56 private users alongside the territory it covered outside the ancient Aurelian Walls.[14] However, owing to the precarious conditions of the subterranean water main and the presence of some human settlements of shepherds in the proximity of its springs, this water was neither abundant nor completely safe.[15] Other estates in this region had drinking water by means of wells and fountains that collected water directly from small underground springs and pools.[16] Moreover, from the late 1880s, the water main of the new Marcio aqueduct, built to supply the Roman countryside, crossed this area, making a 20-kilometre semicircle from east to south at a distance of 6 to 8 kilometres from the Aurelian Walls, encompassing some of the main roads that connected Rome with its surroundings (Figure 5.3). This water main was planned to supply 23 litres a second to 12 population centres.[17] Given the

Figure 5.3 Development Plan of Rome, official edition, 1908–1909.

rural 'nature' of these centres and the fact that the rural population could not cope with the expenses of private water provision, the Roman municipality built eight public fountains, some watering places, and four washbasins.[18]

In terms of water for rural uses, the situation was less clearly delineated. As we have seen in Chapter 2, the 'battle' for the River Aniene in Tivoli resulted in no large irrigation canal; as a result, only natural streams were available for the irrigation of the countryside. Indeed, the area in question was crossed by the Acqua Mariana canal in the direction from the Alban Hills to Rome and the River Tiber and from another natural stream called the Marranella (Figure 5.2) that ran from the right bank of the Acqua Mariana canal towards the River Aniene. Hence, the antimalarial struggle and the spreading of drinking water facilities attracted permanent population in Rome's southeast suburbs. How did this population use water for productive activities?

Water in the birth of an industrial district

In order to examine in detail the interplay between migrants, productive activities, and water, I shall scrutinise an area delimitated by the Aurelian Walls, enveloped by the Rome-Civitavecchia railway, and crossed by the Acqua Mariana canal (Appio-Latino and Tuscolano). The uses of this canal were mixed, rural, and industrial. These latter were predominantly concentrated after the canal split its course from that of the Felice aqueduct (Figure 5.2). I have not chosen this area by chance. In fact, here, from the turn of the twentieth century, a spontaneous suburb grew up.[19] In addition, the presence of CPAM provides significant evidence of the otherwise 'silent' private uses of water in this area.

More specifically, this area was excluded from the development plans of Rome until 1909 – and even later was not considered an industrial district. Nonetheless, in 1922, the most complete commercial and industrial guide of the Italian capital, the *Guida Monaci*, reported more than 30 industrial plants of various dimensions and economic relevance that were active in this area.[20] There were wheat mills and two pasta factories, four chemical factories, a shoe factory, a strongbox factory, some distilleries, two foundries, various laboratories for the production of films and other devices for the cinematographic industry, an electric engine factory, a boiler factory, two large printing works, a citrate factory, and other mechanical workshops.[21] In addition, in 1906, the cinematographic studios of the Cines Company were built in this area.[22] In brief, this was a precocious 'productive' suburb that spanned rural tradition and industrial innovation.[23] According to Pietro Bertelli, the reasons for such a phenomenon were to be found in the presence of a source of energy (the Acqua Mariana canal) and of other infrastructure, like railways and main streets.[24] A closer analysis will refine this judgement.

As evidenced in the map (Figure 5.2), in 1870 the area in question was deeply rural. One of the first relevant changes to this picture came in 1889, when the Mediterranean Railways Company (*Società Strade Ferrate del Mediterraneo*) built a freight yard at the junction of the Acqua Mariana canal and the Rome-Civitavecchia railway.[25] It is unknown whether the presence of the canal was a relevant element in the location of the freight yard. Certainly, the stream was important in the practical realisation of the buildings and of other works related with the railway. In fact, most of the building materials, like concrete and various types of mortars and limes, had to be processed and assembled directly at the building site.[26] The contemporary building manuals and the indications of the Public Works Department prescribed good practices in processing building materials. Water had to be used to wash building materials like sand in order to purify it and to prepare the building mixtures, which had to be assembled just before its use.[27]

As a result, the construction companies that had to realise the works involved in the building of the Tuscolana railway station undertook an agreement with CPAM to use 300 cubic meters of water daily for the whole duration of the works. These lasted from June 1889 to the early months of 1890.[28] This event was not a one-off. In fact, from 1889 to 1891, the Mediterranean Railways Company completed a new set of local railways, various train stations, and roadmen's houses in the Roman area. In many cases, the water of the Acqua Mariana canal was essential to carry out the works, such as in the cases of the stations of Frattocchie, Capannelle, and Ciampino.[29] In this last case, CPAM provided drinking water from the springs of the canal near Ciampino in order to ensure basic public services, such as drinking, washing, and the filling of the locomotive boilers.[30]

The nexus between the canal and the building industry in this area was exemplified not only by the constructions linked with railways. Another example of this relation was given in 1899, when a chemical fertiliser factory (*Società Solfato di Rame*) was constructed in front of the Tuscolana railway station. Indeed, the watercourse was crucial for the material construction of the buildings.[31] Around 1910, new factories and workshops were built in this area and the use of water from the canal by the building industry increased, also outside CPAM's control.[32] Hence, the Acqua Mariana consortium was an actor that could not fully control the uses of water and, as we see below, this had an impact on the canal system. Furthermore, from the 1900s, the Acqua Mariana canal was intensively used in many industrial processes. In fact, together with power, this watercourse was used to fill boilers and cooler condensers of different factories, to process cereals and sugar in the distilleries, and to process sodium sulphate, sodium hydroxide, lye, and bleach in chemical factories and for many other processes.[33]

Another element that had a certain importance in the creation of a self-built industrial district, also related with one of the strands of water modernity in the discourses and projects of the Italian elites, was the conduction of hydroelectricity into this area. In Chapter 4, we saw how CPAM exploited the canal for commercial purposes in order to fund the electrification of the consortium plants. This involved an agreement with the Anglo-Roman Gaslight Company, which transported energy in this area from the hydroelectric power station in Tivoli. Moreover, the company installed a grid of primary and secondary distribution lines and voltage transformers alongside the watercourse at CPAM's expense.[34] Consequently, the self-employed and small entrepreneurs who established workshops and factories in this area could easily obtain a supply of hydroelectricity. Thus, the contribution of the Acqua Mariana canal and of the private consortium that managed it to the development of an industrial suburb was multifarious and went beyond the traditional uses of that watercourse.

The waste side of water: poor environmental quality and popular housing

Other than providing water for processing a range of goods and the electrification of the area realised by CPAM's commercial strategy, the Acqua Mariana canal provided an easy answer to other 'industrial' needs, which could attract entrepreneurs and small employers: a tool for removing the waste of industrial productions and human faeces. This also affected the water and land uses in the area outside Porta San Giovanni. Indeed, before the late 1910s, the Acqua Mariana canal represented the main infrastructure for the disposal of waste in this area. Already in 1900, 25 – mainly illegal – private sewers discharged their waste in the canal.[35] As a result, the Mayor of Rome had to forbid irrigation with the water of the canal in the area in question, though, after complaints from CPAM, this measure was mitigated to a more general limitation of the direct watering of vegetables.[36] However, the industrial development of the area made the situation even worse since the pollutants deposited in the canal included chemicals. For example, in 1903, CPAM had to sue a chemical fertiliser factory situated near the railway station because it discharged 'acidic liquids' into the canal.[37] The Consortium had to intervene to remove these evident abuses since this damaged the boilers of the Anglo-Romana gaslight factory in the Circus Maximus.[38] In short, the establishment of new factories and housing from the 1900s increased human pressure on the canal.

The private nature of the consortium, whose aim was profit and not public health, and the lack of interest from Rome's municipal authority for an area that was not included in Rome development plan until 1909 led to a systemic pollution of the watercourse. Indeed, in 1914, the Director-General of the Bank of Italy, which had some buildings on the banks of the canal near Porta San Giovanni, wrote to the Mayor of Rome with a request to 'cover the Acqua Mariana canal (outside Porta San Giovanni) in order to prevent such an unhygienic filth…and to provide all the necessary measures that could alleviate the conditions of the working classes (in this area).'[39] Indeed, at the turn of the twentieth century, many of the new quarters of Rome built in the close surroundings of the Aurelian Walls, including authorised ones like the Nomentano, Salario, and Tiburtino, discharged human excrement into the local watercourses.[40] To be fair, in 1912, the municipal authority had planned the creation of appropriate mains sewers for these neighbourhoods, including the area in question, but the executive project for this work was not ready and no funds were allotted from the municipal budget.[41] In the following years, during the First World War, investment in sewers in peripheral areas of the city was not a top priority of the municipal authority. In the meantime, nobody would take responsibility for the worsening quality of the canal's water. For example, in 1914, the urban section of the canal was

subject to a shunting back and forth of responsibility between the municipality and CPAM. The former complained about CPAM's greedy attitude that had traded too much water for irrigation, thus making the canal run almost dry in its urban section, therefore making it unable to remove all the waste that was discharged in it.[42] CPAM replied that the illegal discharge of waste and sewerage in the canal was out of control because of the intense housing development in the area outside Porta San Giovanni, which was under the jurisdiction of the city authorities.[43]

The canal was caught in the middle of this tug-of-war. As a result, as late as 1919, a user of the canal stated that

> The Acqua Mariana (canal) is not a real sewer, this is true. Nonetheless all the rainwater, the discharges of all the factories …and the effluents of all the water closets and cesspools of various houses, villas and farms established along its course are released into such a canal.[44]

It was only in the 1920s that the project of a new main sewer and the covering of the suburban section of the canal were undertaken.[45] However, the question for our research is how the pollution of the Acqua Mariana canal influenced the development of water and land use in this area. In 1909, the city authorities bought 44.6 hectares of land outside Porta San Giovanni, Porta Metronia, and Porta Latina (Appio-Latino) in order to establish a public area where a set of mass housing projects were planned.[46] This was the largest municipal land purchase of Rome's centre-left administration between 1907 and 1913 and also the cheapest one, as shown by Table 5.1.[47]

In conclusion, over 30 years, from the construction of the Tuscolana railway station to the realisation of a new sewer network in the interwar period, this area (Appio-Latino and Tuscolano) was turned from a rural area into a mixed popular housing and industrial suburb (Figure 5.4). In the end, the creative, multifarious private appropriation of water was a determinant factor in shifting the frontier of urban expansion. In short, water access and uses shaped the social configuration of this

Table 5.1 Land purchases of Rome urban authority, 1907–1912

Location	*Hectares*	*Prices per square metre in lire*
Testaccio	5.1	10.80
Outside Porta Pinciana	11.1	11
Appio-Latino	44.6	2.85
Valle Giulia	13.8	3.50
Via delle Tre Madonne	0.5	10
Via Po	1.7	65
Portuense	7.45	13.42

Sources: SPQR, *Cinque anni di amministrazione popolare*, 66–71. Personal elaboration.

Figure 5.4 Topographic map of Rome and suburbs, Appio Latino and Tuscolano, 1924.

neighbourhood. Its industrial trait was the product of the predominance of industrial uses over the rural uses of the main watercourse that crossed the area. Also, the fact that the canal was managed by a private institution which sought to profit from the trade in water without concern for the quality of the watercourse, and thus of the surrounding environment, compromised the rural uses of the watercourse in its suburban section. Environmental degradation, in turn, was a cause of the low land values in this area, thus indirectly coaxing the lower levels of Roman society to settle there and, indeed, in some cases being forced to settle there.

'Unruly' water and self-built neighbourhoods

Another example of the impact of water access, uses, and distribution in moulding space and society could be seen by looking at the Roman countryside. There, in a range of 10 kilometres from Rome's city centre, some isolated rural centres were established. Tor Pignattara was one of the most precocious and relevant (Figure 5.5). This rural settlement, product of the settlement policies for the Agro Romano, was located alongside the Via Casilina (one of the Roman consular streets), a few kilometres from the suburb that we have discussed above. As early as 1883, this settlement comprised a parish, a rural school, a rural health centre (*Stazione*

Figure 5.5 Topographic map of Rome and suburb, detail the area between Tuscolana Railway Station and Tor Pignattara, 1924.

Sanitaria Rurale), a police (*Carabinieri*) station, a few shops for basic needs, and a few shelters that offered accommodation for steady and seasonal workers.[48] The overall population of this area spanned between 300 and 500 people.[49] Both services and population were unusual at that time in the Agro Romano.[50] Normally, the closest general practitioner was many kilometres away, schools were almost absent, while peasants usually relied on their employer's provisions for food and other necessities.[51] Hence, Tor Pignattara represented a comfort zone compared with the average of the Agro Romano.

This favourable position was made possible in part by the accessibility of water for both drinking and agriculture. In fact, since 1797, a public fountain existed there. This was supplied with 4.5 litres of water per second from the water of the Acqua Mariana canal by re-using a section of the ancient Aqua Alexandriana aqueduct.[52] Underground water was also available; in 1883, both the local school and the general practitioner's house had a well in their backyards.[53] Moreover, since 1889, SAPAM's underground water main for the Agro Romano supplied the local water tower, a public fountain, a public washbasin, and a watering place.[54] In terms of water for agriculture, this territory was crossed by a stream, the Marranella.

In the early 1900s, these favourable conditions received a boost from the distribution of quinine to prevent and cure malarial fevers. In fact – as

in the case of the suburb outside Porta San Giovanni – cases of malaria dropped from 81 in 1900 to 69 in 1904 with a minimum of 21 in 1903.[55] With regard to this disease, in 1915, the Italian Ministry of Agriculture, reporting to the Chamber of Deputies on the improvements in cultivation and settlement in the Agro Romano since the early 1900s, noticed that 'the route undertaken to protect the health of peasants have been very productive.'[56] As a result, Tor Pignattara was attractive not only for the rural workers of the Roman countryside but also for peasants who escaped the overcrowded countryside of Southern Italy looking for a better future. In fact, according to Stefania Ficacci, who has studied this particular Roman neighbourhood, the typical dweller of such a place was a migrant, who had sold his small plot of land in southern Lazio or in Abruzzo in order to raise money to start a family-run commercial activity.[57] In addition, Tor Pignattara offered low-cost and tax-free lands, a growing population with increasing needs, and a relative proximity to the capital and to its job opportunities and – of course – water. As a result, from 1910 onward and particularly after the Great War,

> Together with workshops of farriers, blacksmiths, inns, and a coaching house (existing since) the nineteenth century, coffee toasting, bakeries, glassmakers, lamp factories, and raw material deposits grew up. All these activities discharged the residues of their industrial processing into the *Marranella*.[58]

The Marranella and the Acqua Mariana canal thus both provided a direct answer to these needs, which were essential for the growing of human settlements. In addition, as we stated above, water was relevant in the practical realisation of buildings and in many other processes. In fact, the connections of this settlement with the city centre remained rare. The railway that encircled Rome created a barrier, and transports were infrequent and not cheap; therefore, only male workers employed in the city had contacts with Rome.[59] As a result, many basic goods like shoes, clothes, glasses, and lamps had to be made or repaired directly in this urban island. Consequently, the Marranella was an integral part of the development of this new suburb, particularly because the quantity of water required for many activities was not massive; therefore, simple tools like buckets or a hand pump were sufficient to satisfy the 'thirst' for manufacturing water in this quarter. In addition, since many of the inhabitants of Tor Pignattara had strong linkages with rural culture and had limited means, the type of houses they built were one- or two-room single-floor buildings with a small vegetable garden annexed in the backyard in order to supplement the family's revenue.[60] Hence, the stream was a resource for this complementary activity.

As regards the provision of drinking water, some of the wealthier dwellers of this quarter had a home supply provided by SAPAM.[61]

However, a direct water supply in this area was not widespread. Indeed, in 1913, Socialist deputy Leonida Bissolati wrote to the Roman councillor of Public Works, stating that

> The village of Tor Pignattara-Marranella has become a city with increasing public needs, as you know…, once a desert, now a numerous population is agglomerated in the locality of Marranella with only a 'mouth' of water, without a washtub. This – even very modest – is absolutely necessary…In addition the inhabitants of that locality have no water inside their houses and have to walk a lot to find it…

Consequently, he asked for the construction of another public fountain.[62] The councillor replied that according to the new building code implemented by the city authorities, any new building had to be provided with a direct, private supply of water. As a result, he did not see any reason to spend 500 lire, an insignificant sum, for the creation of a new public fountain in Tor Pignattara-Marranella.[63] This exchange of letters exemplifies two different approaches towards drinking water. The first, supported by the Socialist deputy, saw water as a vital support for life and thus a necessity, something close to what we would call a human right. By contrast, the second point of view saw water as a commodity, thus something that should be bought on the market instead of being freely provided by public offices. Also, this showed a certain reluctance of the urban authorities to include this growing quarter in the proper urban administration.[64] However, Bissolati's requests followed a petition for water supply from the inhabitants of Tor Pignattara; therefore, a private water supply was probably far from the thoughts and indeed far beyond the financial reach of a large portion of this suburb's population.

One could ask whether public fountains were sufficient to meet the needs of this area's growing population. An answer can be found by looking at the living conditions of the Roman sub-proletariat as late as the 1950s (and, in many cases, even later). In fact, the inhabitants of the shanty towns that dotted the interstitial spaces of the city heavily relied on wells and public fountains for their needs.[65] Nonetheless, according to the local priest, in 1921 the population of Tor Pignattara rose to 9,523 people even without a second fountain.[66] Around 1920, other urban settlements grew alongside the Marranella in close connection with Tor Pignattara, which represented the commercial zone of the urban archipelago that was encroaching on the Roman countryside just outside the railways that encircled the Roman suburbs.[67]

Specifically, peasants, construction workers, shopkeepers, small entrepreneurs, nobles looking for a good income, and even chemical companies like the Cisa-Viscosa, the largest Roman chemical factory (which produced rayon), exploited land and water in this rural/suburban area in order to satisfy a myriad of private needs, which involved agriculture

only as a secondary activity to support the income of the population. As a result, as early as 1922, a series of urban islands were spreading over the Marranella in a territory which, according to the state project of renewal for the Roman countryside, was destined for intensive agriculture.

Hence, did the renewal of the Roman countryside end up preparing the ground for uncontrolled urban expansion? Yes and no. Indeed, to remain within Rome southeast side analysed in this chapter, irrigated agriculture was developing alongside the rural section of the Acqua Mariana canal, basically from the Alban Hills to the beginnings of the industrial plants near the Tuscolana railway station. As we have seen in Chapter 4, from 1910 onward, CPAM worked in close connection with the Ministry of Agriculture in order to provide water for irrigation to many estates. One of these was the *Podere Saccardo*.[68] This was a 10-hectare estate that at the turn of the twentieth century was still 'an overgrown corner of the Agro Romano, while… (In 1913) was a first class horticultural estate' visited by the Italian royal couple.[69] Another example of this was the so-called estate of Roma Vecchia (owned by the Torlonia family), which nowadays remains one of the largest green areas of Rome.[70] In general, the riverine estates of the canal in the area between the Alban Hills and the intersection of the Acqua Mariana canal with the Felice aqueduct saw a rapid increase in irrigation and cultivation from the 1910s.[71] In short, where rural water uses were fixed in an infrastructure exclusively dedicated to agriculture and where this supply matched the demand of medium and large estate owners, the chance of increasing irrigated surface and rural productivity stepped up. Conversely, where the uses of water were not clearly delineated, and a myriad of 'hands' competed to access water, rural uses were likely to give way to other, industrial – in a broad sense – uses.

Conclusion

In this chapter, we have seen the trajectory of a portion of the Roman countryside, which in the time span from 1890 to 1922 passed from being an almost deserted rural area to a set of populous suburbs interspersed with agricultural areas. This transformation was brought about by a set of overlapping agencies and contingencies which were connected – sometimes indirectly – by water, its flows, and its gushes. At a general level, this was the result of the interplay between the three strands of water modernity: public health, industry/hydroelectricity, and agriculture. In terms of water infrastructures, the first two strands had gained both spaces and resources, while agricultural infrastructures remained limited. Moreover, from a material point of view, water could be considered a flexible object that enables humans and other objects to accomplish various tasks.[72] Hence, an element to consider in assessing the role

of water in shaping the features of a territory should be given to the individual uses and practices. In short, the ways that water access, distribution, and uses were organised opened a spectrum of tasks that water could support. However, at the end of the day, individual choices mattered in the way that water would be used, particularly where control over water was not clear and its use poorly delineated, as in the case of Tor Pignattara. It was a matter of scale that conditioned social dynamics. That is to say, a few people using water for small industrial activities did not turn a rural area into an industrial district, but if the number of these people increased, carrying within it the development of industrial facilities, like hydroelectric distribution, transports, and the almost inevitable environmental and watercourse deterioration, an industrial or commercial district occupied by popular classes was the likely output.

In the end, what happened to agriculture? In spite of the central place this had in the discourses of the Italian elites and of the measures for the renewal of the Agro Romano, the absence of a large infrastructure dedicated to this aim made the practical realisation of that design patchy. At the turn of the twentieth century, there was still a place for rural uses of water in the Roman area, but these were the most 'fragile' in the competition between water uses. For example, the area crossed by the rural section of the Acqua Mariana canal became an irrigated, productive area because the rural use of that water was clear, protected by a consortium that was interested in earning money from the trade of rural water and matched the demand of landowners who found in rural improvements a good investment. Where this blend was not reproduced or where a growing number of people used water other than in agriculture, industrial or self-built neighbourhoods (or both) were likely to take the place of cultivation and pastureland. In the end, in Rome at the turn of the twentieth century, governing land uses by decree or by law was difficult and could be ineffective. By contrast, governing water was a less direct but more effective way of promoting a specific design of renewal of the space. Unfortunately for the supporters of the agricultural strands of modernity, water was organised mainly as an 'urban' resource.

Notes

1 Antonio Parisella and Susanna Passigli (eds.), *Antologia dell'Agro Romano*, volume V: Dibattiti e realzioni parlamentari 1900–1926 (Villa d'Agri: 2008), 262–263.
2 See, for example, Italo Insolera, *Roma moderna. Un secolo di storia urbanistica* (Turin: 1962); Giovanni Berlinguer and Piero Della Seta, *Borgate di Roma* (Rome: 1976); Lando Bortolotti, *Roma fuori le mura: L'Agro Romano da palude a metropoli* (Rome and Bari: 1988); Piero and Roberto Della Seta, *I suoli di Roma: uso e abuso del territorio nei cento anni della Capitale* (Rome: 1988).
3 In particular, about the Ostiense, see Anna Laura Palazzo and Biancamaria Rizzo, 'La destinazione industriale del quadrante Ostiense: difficoltà e contraddizioni di una politica urbana', *Roma moderna e contemporanea*, no.

1–2 (2004), 127–144. Giuseppe Stemperini, *La Politica annonaria del Comune di Roma tra Ottocento e anni Trenta del Novecento: La questione dei mercati all'ingrosso* (Rome: 2009).

4 Lando Bortolotti, 'Il mito della colonizzazione in Italia, 1850–1950', *Storia Urbana*, no. 57 (1991), 87–168 (94).
5 Bortolotti, *Roma fuori le mura*, 15–31.
6 Jan Lucassen, *Migrant labour in Europe, 1600–1900: the drift to the North Sea* (London: 1987). Also, the Agro Romano until the 1930s was the destination of a transhumance from the central Appenines, particularly from Abruzzo; see Fernand Braudel, *Civiltà e imperi del Mediterraneo nell'età di Filippo II*, Volume 1, Carlo Pischedda (transl.) (Turin: 2010), 88–89.
7 Maria Rosa Protasi, *Emigrazione e immigrazione nella storia del Lazio dall'Ottocento ai nostri giorni* (Viterbo: 2010), 91.
8 Bortolotti, 'Il mito della colonizzazione', 94.
9 Ibid., 125–126. For contemporary examples of this theory, see Giuseppe Pinto, *Roma, l'Agro Romano e i centri abitabili* (Turin: 1882); Ghino Valenti, *La Campagna Romana e il suo avvenire economico e sociale* (Bologna: 1893).
10 Eugenio Sonnino, Maria Rosa Protasi, Rossana Rosati, 'Aspetti demografici, sanitari e territoriali di Roma dal 1870 al 1940', *Roma Moderna e Contemporanea*, no. 1–2 (1999), 17–56 (26).
11 Ibid., 36.
12 ASC, *ripartizione V/ lavori pubblici/servizio idraulico/carteggio/b. 50/fascicolo 9*. 'Report on drinking waters and aqueducts in Suburbio e Agro', Rome 1 April 1908. However this judgement seems built on the report of Raffaele Canevari, *Cenni sulle condizioni altimetriche ed idrauliche dell'Agro Romano* (Rome: 1874).
13 Giuseppe Pinto, *Le acque potabili dell'Agro Romano* (Rome: 1883), 93.
14 ASC, *ripartizione V/ lavori pubblici/servizio idraulico/carteggio/b. 50/fascicolo 9*. 'Report on drinking waters and aqueducts in Suburbio e Agro', Rome 1 April 1908.
15 ASC, *ripartizione V/ lavori pubblici/servizio idraulico/carteggio/b. 50/fascicolo 9*. Engineer Bentivegna and Engineer Vescovali, 'Report on springs and catchment works and distribution networks of Rome's aqueducts', Rome 15 September 1893.
16 Canevari, *Cenni sulle condizioni altimetriche*, 25.
17 ASC, *ripartizione V/lavori pubblici/servizio idraulico/carteggio/b. 13/fascicolo 2*. 'Overview on the water Marcia distribution centres in the Agro Romano at the 31 July 1891'.
18 Ibid.
19 Insolera, *Roma moderna*, 74–75.
20 Tito Monaci, *Guida commerciale, scientifica, artistica e industriale della città di Roma*, year 1922 (Rome: 1922).
21 Ibid., 1083–1087, 1125–1127, 1267–1287, 1336–1379, 1442.
22 Susanna Passigli, 'L'area del IX municipio fra città e campagna. Condizioni e dinamiche dell'insediamento', in Antonio Parisella and Giuseppe Mogavero (eds.), *Memorie di quartiere. Frammenti di storie di guerra e di resistenza nell'Appio Latino e Tuscolano, 1943–1945* (Rome: 2007), 29–64 (39–41).
23 Ibid., 39.
24 Pietro Bertelli, 'Note sull'industria a Roma, dalla fine del regime pontificio alla Seconda guerra mondiale', *Storia Urbana*, 57 (1991), 29–41.
25 ASR, *CPAM/b. 16/fascicolo domande d'acqua fino al 1900*. 'Fratelli Vitali e Travella Building Company letter to the CPAM', Rome 21 June 1889.
26 Giorgio Muratore (ed.), *Cantieri Romani del Novecento. Maestranze, materiali, imprese, architetti nei primi anni del cemento armato* (Rome: 1995).

27 Ibid., 295–296. Building norms and procedures by the Public Work Department. For an example of contemporary building manuals, see Carlo Formenti, *La pratica del fabbricare* (Milan: 1893).
28 ASR, *CPAM/b. 16/fascicolo domande d'acqua fino al 1900*. 'Fratelli Vitali and Travella Building Company letter to the CPAM president', Rome 17 June 1889; 21 June 1889 and 21 August 1889; 'reply' Rome February 1890.
29 ASR, *CPAM/b. 16/fascicolo domande d'acqua fino al 1900*. 'Cecchetti Building Company letter to CPAM', Rome 9 October 1889 and 15 February 1890; 'reply', Rome 14 January 1890.
30 ASR, *CPAM/b. 9/ fascicolo Strade ferrate del Mediterraneo/acquisti d'acqua*. Notary Tommaso Monti 'Certified copy of the contract between the CPAM and the Società Italiana per le Strade Ferrate del Mediterraneo for the sale of three once of water Mariana', Rome 19 April 1890.
31 ASR, *CPAM, b. 16/fascicolo domande d'acqua fino al 1900*. 'Solfato di rame Chemical Company letter to CPAM', Rome 14 April 1899.
32 ASR, *CPAM/b. 11/fascicolo contravvenzioni e citazioni*. 'Reports of the gurdian to the CPAM president', Rome 18 March 1909, 15 February 1910, 2 April 1912. See also ASR, *CPAM/b. 11/fascicolo contravvenzioni e citazioni*, CPAM 'note on the guardian's fees from 16 December 1912 to 12 Dicembre 1913'.
33 See, for example, ASR, *CPAM/b. 9/fascicolo Società Molini e Pastificio Pantanella*. 'Copy of contract bewteen the CPAM and Società Molini and Pastificio Pantanella for the rent of six once of water', Rome 21 December 1898. See also ASR, *CPAM, b. 9/fascicolo Società la Varecchina*; ASR, *CPAM/b. 9/Società Aerolievito Dr. De Vecchis and Co*; ASR, *CPAM/b. 14/ fascicolo Società Cervisia Fabbrica Romana Lievito e Distillerie Italiane*.
34 ASR, *CPAM/b.16/fascicolo relazioni diverse dal 1871*. 'CPAM president annual report to the consortium assmebly', 15 February 1909.
35 ASR, *CPAM/b. 19/ Comune di Roma 1/fascicolo inibizione di irrigazione*. CPAM, 'report on the survey of the sewers on the Acqua Mariana canal', Rome 11 May 1900.
36 ASR, *CPAM/b. 19/ Comune di Roma 1/fascicolo inibizione di irrigazione*. 'Mayor of Rome letter to CPAM president', Rome 12 May 1900.
37 ASR, *CPAM, busta 9/fascicolo Società Solfato di Rame e altri*. CPAM, 'legal warning against Roman Sulphates Chemical Company', Rome 23 December 1903.
38 See, for example, ASR, *CPAM/b. 9/fascicolo Società Solfati e altri*. Lawyer Giulio Pouchain for Società Anglo-Romana Gas, 'writ of summons to the Royal Civil Court of Rome against Roman Sulphates Chemical Company, Province Administration and CPAM', Rome 31 December 1903.
39 ASC, *Post-unitario/ripartizione V/direzione/b. 57/fascicolo 21*. 'Director-General of the Bank of Italy letter to Prospero Colonna, Mayor of Rome', Rome 19 September 1914. The Bank of Italy owned some buildings along Via Appia Nuova, just outside Porta San Giovanni.
40 SPQR, *Cinque anni di amministrazione popolare* (Rome: 1913), 143. The first two in the *Marana di Sant'Agnese*.
41 Ibid., 158.
42 ASR, *CPAM/b.19/fascicolo Comune di Roma II/reclami*. 'Mayor of Rome letter to CPAM President', Rome 3 August 1914.
43 ASR, *CPAM/b.19/fascicolo Comune di Roma II/fascicolo reclami*. 'CPAM president letter to Mayor of Rome', Rome 7 August 1914.
44 ASR, *CPAM/b.14/fascicolo Società Anonima Derivalcol*. 'Società Anonima Derivalcol letter to CPAM president', 27 December 1919.
45 ASC, *post-unitario/ripartizione V,/servizio idraulico/b.85/fascicolo 10*. Engineer Antonini, 'project of sewer and divertion of the Marrana Mariana

between Porta San Giovanni and Porta Metronia', 1919. ASC, *post-unitario/ripartizione V,/servizio idraulico/b.85/fascicolo 10*. 'Development plan office chief engineer letter to hydraulic office chief engineer', 7 November 1921.
46 SPQR, *Cinque anni di amministrazione popolare*, 68–74.
47 Ibid., 66–68. Only the land purchase made alongside the coastal side were cheaper, but these lands were far from the city.
48 Pinto, *Le acque potabili dell'Agro Romano*, 52–53.
49 Ibid., 52–53.
50 Bortolotti, *Roma fuori le mura*, 15–31.
51 Ibid., 15–31.
52 Thomas Ashby, *The aqueducts of Ancient Rome* (Oxford: 1935), 315. See also ASR, *CPAM/b.18/fascicolo Torpignattara*. 'Prefect of Rome letter to CPAM president', 19 October 1891. In details, the Prefect asked to the Consortium to finance (at least partially) the refurbishment of the Aqua Alexandriana aqueduct.
53 Pinto, *Le acque potabili dell'Agro Romano*, 52–53.
54 ASC, *post-unitario/ripartizione V/lavori pubblici/servizio idraulico/carteggio/b. 13/fascicolo 2/sottofascicolo 11 Tor Pignattara*. 'Water Marcia distribution in the Agro Romano'.
55 SPQR, *Relazione della commissione per l'accertamento dei servizi comunali in Agro Romano e Suburbio* (Rome: 1909), 54.
56 'Ministry of Agriculture report on the reclamation of the Agro Romano at the 30 June 1914, Rome 12 April 1915', in Parisella and Passigli (eds.), *Antologia dell'Agro Romano*, volume V, 168–176.
57 Stefania Ficacci, *Tor Pignattara, Fascismo e Resistenza di un quartiere Romano* (Milan: 2007).
58 Ibid., 17.
59 Ibid., 18–19 and 34–35.
60 Mario Sanfilippo, *La costruzione di una capitale*, volume 2: Roma 1911–1945 (Cinisello Balsamo: 1993), 106; Ficacci, *Tor Pignattara*, 14.
61 ASC, *post-unitario/ripartizione V/lavori pubblici/servizio idraulico/carteggio/b.50/fascicolo 9*. 'Report on drinking waters and aqueducts in Suburbio and Agro', Rome 1 April 1908.
62 ASC, *post-unitario/ripartizione V/lavori pubblici/direzione/titolario 1871–1914/titolo 6 Suburbio e Agro Romano/b.30/fascicolo 54*. 'Leonida Bissolati letter to councilman of Public Works', Rome 29 March 1913.
63 ASC, *post-unitario/ripartizione V/lavori pubblici/direzione/titolario 1871-1914/titolo 6 Suburbio e Agro Romano/b.30/fascicolo 54*. 'Councilman of Public Works letter to Leonida Bissolati', Rome 19 May 1913.
64 Indeed, for the municipality, this quarter and the other that were growing in the Agro Romano had to remain rural areas, thus outside the ordinary urban administration; see Denis Bocquet, *Rome ville technique (1870–1925), une modernisation conflictuelle de l'espace urbaine* (Rome: 2007), 335.
65 Franco Ferrarotti, *Roma da capitale a periferia* (Bari: 1970).
66 Mario Benigni, 'La Pastorale nelle Borgate Romane: Torpignattara tra il 1904 e il 1932', *Ricerche per la Storia religiosa di Roma*, 3 (1979), 181–218 (183).
67 Ficacci, *Tor Pignattara*, 15.
68 ASR, *CPAM,/b.15/fascicolo Saccardo Domenico*. 'Contract between CPAM and Saccardo Domenico for the provision of water for irrigation summer 1916', Rome 1 June 1916.
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6 Euro-Mediterranean socio-natural trajectories

Beginning with the Introduction, I have stressed the fact that scrutinising the history of the Eternal City involves the risk of overemphasising its exceptionality. Indeed, the sense of uniqueness of Rome could also appear by looking at its history through the lens of water. After all, what other city could boast a similar experience of aqueducts and relative water abundance spanning several thousand years? However, in Chapter 3, we have seen that by the mid-1800s Rome's water system was showing signs of infrastructural decay. Moreover, the impact of Asiatic cholera made evident the fragility of the model elaborated in the early modern period. Furthermore, the rise of the modern state, professions, and market economy all had a hand in transforming water management. During the nineteenth and early twentieth century, this transition was apparent in many Italian and European cities. Hence, it is useful to analyse the Roman case within the broader context of European capitals. This will allow a deeper grasp of local specificities, on one hand, and the definition of a common trajectory for these cities, on the other.

Unfortunately, the approach of this book – that is, the close scrutiny of the cultural, technical, legal, medical, economic, and usage aspects of water and its management – has not been widely adopted. For this reason, a point-by-point comparison has the additional challenge of finding a variety of secondary readings that could make it possible. A first criterion that oriented my choice of which cities to compare was given by the publication of recent research exploring the various dimensions of water. For these reasons, it is apparent that the European cities that can most fruitfully be compared with Rome are Athens and Madrid. This choice also makes sense for other reasons. First, these cities were more or less part of the same geographical and climatic area – the Mediterranean – with its irregular water regime. Heavy rains and dry seasons alternated, generating a turnover between overabundance of water and drought, which conditioned the uses of water, particularly the practice of agriculture.[1] Second, this irregular water regime had a practical impact on the conditions of the lowlands, which in many Mediterranean countries were

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marshlands. Indeed, the struggle to reclaim marshlands and increase the arable surface was a long-lasting feature of Mediterranean civilisations.[2] Third, Rome and Italy shared many points with Madrid (and Spain) and Athens (and Greece) in terms of political, legal, technical, cultural, and economic aspects. For example, these countries experienced substantial political turmoil during the nineteenth and early twentieth century: regime changes, revolutions, and struggles for political independence. A product of this political turbulence was the creation of ideologies of national rebirth, which saw in water management a tool for moral and material regeneration. It was not by chance that Rome and Athens became the capital cities without a suitable economic, political, and also infrastructural organisation. Indeed, the cultural fascination of these two cities was a vital element in the construction of these ideologies of regeneration. Thus, Athens and Rome were subject to a process of modernisation that aimed at reconnecting these cities with their glorious ancient past. Hydraulics was a relevant part of this process. As we shall see, the renewal of nineteenth-century Madrid likewise had a hydraulic side and similar associated cultural values.

These are only some of the points of contact between these three cases. As a result, the research questions of this chapter are as follows: What were the similarities and differences between the legal, political, cultural, economic, medical, and usage aspects of water in the cases of Rome, Athens, and Madrid? Did these three cities and their societies experience mutual problems and discover similar solutions with regard to water management at the turn of the twentieth century? What Roman specificities emerge from this comparative analysis?

National rebirth and social question

One of the first points of contact between nineteenth-century Italy, Spain, and Greece was the creation of political discourses aimed at spreading in the respective national communities the awareness of the poor living conditions of the population and the ways to pursue economic, social, and moral redemption. In Chapter 1, I scrutinised the reasons behind the fragility of the Italian nation-state, which had to face the challenges of modernisation, state formation, and consensus-making at the same time. The rebellion in the Southern regions of Italy against the new order in 1861–1866 and the various movements of peasant occupation of uncultivated lands, particularly in Central and Southern Italy, testified that the social basis of the nation-building was unstable. In many ways, water policy was a means of consolidating the Italian state. Specifically, hydraulics was relevant to the settlement of unproductive and uncultivated lands, which, it was assumed, could be reborn through the patient work of engineers and small peasants. Indeed, the creation of a substantial class of small

farmers was perceived by landowners as a means of supporting the Italian Liberal regime. Water policy was also a way of protecting human life from the diseases that afflicted the Italian population and, in particular, the poorest fringes of Italian society. Finally, for a country poor in fossil fuels, water was the most valuable source of energy to power industrial production. Pursuing these three targets meant increasing and expanding a minimum standard of economic and social prosperity across the various levels of Italian society, which would support the stability of the new state. Engineers and physicians clearly had a relevant role in pursuing these three targets. Indeed, in the last decades of the nineteenth century, these professional categories were included in the ranks of state administration, supplying a foundation to the stability of state building. The language used to promote this water policy which had as its object the reform of Italian society was socially neutral in order to gain cross-party support. In fact, in these discourses, Italian decay was the product of a moral and natural degradation, while the social structure went unquestioned. As a result, the images of fall and regeneration that accompanied political discourses on the management of water had to unify all the progressivist fringes in Italian society in the pursuit of a mutual goal, thereby neutralising social differences, economic interests, and conflicts. In short, this political language had to work as the glue of a composite political alliance consisting of 'enlightened' landed aristocracy, liberal landowners, and the urban bourgeoisie, particularly physicians and engineers, who actually pursued different and sometimes conflicting targets vis-à-vis water management.

This cultural framework of these Italian reformist fringes appears very similar to the case of late nineteenth- and early twentieth-century Spanish *Regeneracionismo*.[3] This was a drive to modernise and revive the Spanish national spirit, referring to a 'political-economic desire for modernisation and development… (And) to a scientific, cultural, and aesthetic movement.'[4] The promoters of such a movement in Spain were intellectuals, professionals (particularly engineers), progressivist politicians, journalists, and the rising middle class of farmers and industrialists.[5] This composite social group responded to the national shock generated by the loss of the last Spanish colonies, the Philippine Islands and Cuba, in 1898 – which disoriented the Spanish elite and generated a sense of backwardness of Spain compared with the other Western countries – by creating a socio-natural project of hydraulic improvements with the aim of regenerating 'the fatherland by means of the transformation of soil and race.'[6] In fact, Spanish reformers saw in the low yields of Spanish agriculture the main reason for the low competitiveness of the Spanish economy in the world context as well as being a source of social tensions.[7] According to the members of this composite movement, the irregular distribution of pluvial and fluvial water turned many Spanish lands, particularly Castile and Andalucìa, into arid and unproductive wastelands.[8] As a result, the

regenerationist movement sought a hydro-policy that would restore Spanish ecological harmony, which, in turn, would bring with it social harmony.[9]

For Erik Swyngedouw, this emphasis on water projects allowed the Spanish progressivist elite to raise questions about economic decline and mass unemployment, but not in class terms.[10] To be more precise, the remaking of Spanish space involved the defence of the small peasant producer-as-landowner, the state control of water, and technical water management. In fact, one of the aims of Spanish regenerationism was that of expanding land ownership by means of the settlement of uncultivated lands, which were perceived as land to be redeemed (*tierra irredenta*).[11] As a result, a heterogeneous social alliance made up of small holders, intellectuals, professionals, and more generally a rising bourgeoisie coalesced around the project of the socio-geographical reconfiguration of Spain. In the meantime, the extreme wings of Spanish society, left-wing revolutionists, and ultra-conservatives, were excluded from such an alliance.[12]

Nineteenth-century Greece also experienced a bundle of socio-hydraulic problems such as untamed water regimes, soil erosion, widespread marshlands, and a feudal agrarian system that affected the productivity of the country's agriculture.[13] Nonetheless, hydraulic politics and political discourses in Greece did not achieve the same centrality that they did in the Italian and Spanish cases.[14] The reasons for this could be found in the international status of the Greek state in the nineteenth and early twentieth centuries. In fact, according to Maria Kaika, many aspects of nineteenth-century Greece made of this country a semi-colonial regime.[15] For example, the Greek state relied heavily on foreign capital and engineers to implement infrastructural projects; these were privileged projects that had an immediate profitability and opened up new markets to the products of the industrialised West.[16] Foreign capital and engineers 'exported' communications and transport infrastructures, like railways and steamships, to Greece. By contrast, hydraulic infrastructures that might promote the local economy were discussed mainly in the closed network of the Greek engineering community, which struggled to affirm its scientific credibility before the Greek government.[17] Nonetheless, water provision to Greek cities, particularly to its capital, reveals that some of the aspects of the discourse around physical and moral regeneration through water were also present in Greece. For example, from the 1840s, the Athens city council attempted to sanitise the landscape of the city of garbage, dust, and dirt, which in turn were perceived as sources of moral degeneracy, by allocating a consistent part of the scarce water resources available to frequently wash Athens's streets.[18] Furthermore, in the same years, Queen Amalia of Greece promoted the realisation of a royal garden, which placed a further burden on the city's scarce water resources, in order to bolster the image of Athens as a western city.[19]

Moreover, as is fully examined in the third section of this chapter, the only infrastructure project on water that was realised in nineteenth-century Athens was the restoration of the city's ancient Hadrian aqueduct.[20] This symbolised the rebirth of the city and the reconnection between modern Athens and its past.

In brief, in all three countries, the taming and reordering of water were perceived by a composite social and intellectual elite, consisting primarily of urban professionals (engineers, physicians, lawyers, and more generally intellectuals), as a way of modernising their societies, improving the living conditions of their populations, and boosting the economy. This, in turn, was understood as a prerequisite necessary to reacquire, in modern times, the roles that Italy, Spain, and Greece had had, in different historical periods, as beacons of Western civilisation. For this reason, the cultural value of water and waterworks in these three countries was very similar. In particular, in Italy and Spain, the images of fall and regeneration that informed the political discourses on water contributed to creating a common cultural ground between the composite social groups that formed the modernising elites of these countries. As a result, these discourses emphasised the point of contacts between these groups, hiding social and political differences. For example, both economies in the late nineteenth century were still mainly based on a labour-intensive, undermechanised agriculture. In addition, many lands in both Italy and Spain were underused or abandoned for socio-environmental reasons (being large latifundia or because of drought). Thus, the countryside had to be reformed in order to promote a capital-intensive, mechanised agriculture. However, landowners represented a dominant part of the ruling classes in both countries; as a result, a modernisation of this economic sector could only marginally involve agrarian reform. By contrast, water management was a means for indirectly promoting the capitalist modernisation of these countries and solving problems like that of an overabundant and impoverished peasantry and overcrowded and unhealthy urban spaces without social upheaval.

Liberalising and reconceptualising water

In the previous section, we have seen how the modernising elites in nineteenth-century Italy, Spain, and, to a lesser extent, Greece discussed matters of economic development, public health, and social tensions through grand narratives of national rebirth, which found political expression in claims for a technical and efficient water management. At the same time, these narratives had to be accompanied by other measures in order to produce tangible signs of economic, moral, and social change. Clearly, legislation was one of the first fields in which the modernising elites intervened in order to encourage the most productive use of water and to allow state control over this element.

As I showed in Chapter 2, in spite of the narratives of decline and decay that accompanied the political analysis of Italy's lamentable 'disorder of water', late nineteenth-century Italian water sources did not lie abandoned or unused. On the contrary, these had been managed for centuries by local populations accustomed to different legal traditions, established water uses, and different cultures and social structures. In brief, multiple private concessional systems based on layered seigniorial and municipal rights and concessions regulated water access, distribution, and uses in nineteenth-century Italy. In order to ensure the optimal use of water for agriculture, industry, and civic purposes, the Italian modernising elites had to undermine the historical-juridical foundations of the private concessional system and replace this with a homogeneous centralised concessional system. This was a twofold task. On one hand, water had to be conceptually separated from its local socio-cultural peculiarities. The reciprocal influence between a specific watercourse and local communities had to be downplayed in favour of a conceptualisation of water as a natural element with its own natural operating rules. Italian engineers involved in the making of the *Carta Idrografica d'Italia*, dating from 1891, pursued this target. On the other hand, the juridical framework had to include this new conceptualisation of water as a natural organic unity (river basin) and assign decision-making power over its access, distribution, and uses to an authority that was able to manage such a complex natural system. The state was such an authority. At the turn of the twentieth century, Italian courts frequently intervened to solve controversies on water access and uses that pitted public authorities like municipal councils and state agencies against private owners and companies who claimed ancient seignorial rights over water. In the 1910s, the predominant interpretation of the Italian courts recognised river basins as the space of state authority; therefore, all Italian surface water was to be considered free from private feudal rights and its use subject to a centralised concessionary system.

In Spain, a similar process of liberalisation of water was realised during the Spanish Liberal revolution (approximately 1811–1871). As early as 1811, the Spanish *Cortes* abolished patrimonial, seigniorial rights over water.[21] The aim of this measure was to substitute the 'imperfect' feudal property of water (understood as collective, compartmentalised, and bounded to seignorial rights) with a 'perfect' private property of water (understood as individual, complete, free, and unalienable).[22] Subsequent laws removed fiscal and legal obstacles to the circulation/commodification of water, while a centralised concessionary system was established in 1866 to allocate water for its optimised use.[23] Finally, in 1879, the country's first water law declared all surface water to be the property of the state, which had the rights to assign and supervise its use.[24] However, these measures required further conceptual and political developments to be effective. In fact, at the turn of the twentieth century,

> the (Spanish) engineering community argued for the foundation of engineering and managerial intervention on the basis of the 'natural' integrated water flow of a water basin, rather than on the basis of the historically and socially formed administrative regions.[25]

This was an attempt by the Spanish engineering community to replace the socio-political configuration of water by stressing its natural features. The cultural process that led to the conceptualisation of river basins as circumscribed spaces that had to be managed according to scientific principle was another striking similarity between the Spanish and Italian cases.

By contrast, the process of water liberalisation in Greece took longer compared with Spain and Italy. The Greek legal framework over water was conditioned by measures and uses established under Ottoman rule, where water rights and land property were tightly linked.[26] Ottoman land tenure was based on the sharing of its use and benefits by the sultan and one or more parties on a temporary basis and for specific purposes, the *timar* system, similar in some ways to western feudalism.[27] In theory, watercourses were considered to be part of perishable property, namely national property that could be sold or leased in order to maintain and defend it from encroachment.[28] From the 1840s to the late 1860s, the Greek state leased swamps and marshlands for 10 to 15 years on the condition that the lessee drain and cultivate them. However, the Greek public domain was 'poorly managed, suffered constant encroachment… The state became involved in endless litigation by which it resisted but could not stem the tide of private appropriation.'[29] Furthermore, the legal linkages between water rights and land property forced the Greek state to pay expensive compensation to landowners to own a water source.[30] As a result, until the interwar period, the Greek state was unable to forge a water law and policy that could allow the optimal use of this element.[31] Moreover, the Greek engineering community had to affirm its scientific credibility in in the face of foreign engineers before it could become a leading social group in the Greek state. In practice, the socio-geographical reconfiguration of Greece through hydraulic politics only gained momentum from the second decade of the twentieth century under the auspices of the liberal policy of Prime Minister Elefterios Venizelos.[32] As an example of this, the new modern aqueduct of Athens was realised only in the 1920s.[33]

In short, following the creation of a political narrative able to unify heterogeneous social groups towards the pursuit for modernity in these three countries, the next step was the affirmation of a conceptualisation of water as a natural space that could be managed effectively only by understanding its natural rules. The forging of a legal framework able to ensure state control over water resources grew out of this conceptualisation. This meant the liquidation of feudal rights over water and the

affirmation of engineers as the most suitable technical figures for ensuring optimal water use. Of course, this is to simplify a complicated process which took place at different times in the three countries under discussion, one that was moulded by the interactions with local dynamics of power, as I have shown in Chapter 2 with regard to the case of Tivoli.

Under this aspect, the new Italian water law was not only or mainly the product of the development of liberal principles in legal thinking. On the contrary, it was the result of attempts by the courts to find an ordering principle in the midst of conflicts for water control that arose at the turn of the twentieth century. This ordering principle – influenced by contemporary Italian engineering thinking – lay in the concept of the river basin and of the 'nature' of water. In the Spanish case, the development of the principles of liberalism in the legal framework appears more linear. However, Spain's engineering community likewise had a relevant role in creating the concept of the river basin as the space of intervention for centralised, rational water management. The Greek case, by contrast, shows that a failure to create a technical and legal conceptualisation of water as an alternative to the seignorial understanding of water was a hindrance in the realisation of large water infrastructures since these involved a centralisation of water access and use in the hands of a public authority or a private company.

The waters of Madrid and Athens

Engineering and law were not the only fields in which water was being reconceptualised in nineteenth-century Europe. Indeed, recurrent outbreaks of Asiatic cholera had a significant impact on the way that water was perceived and managed. As I have discussed in Chapter 3, this disease not only was lethal and culturally shocking but also generated several urban riots and brought into question the social and political organisation of cities. The first epidemics of cholera in Europe (1830–1834, 1848–1849, and 1853–1854) also showed that the medical establishment was unable to understand the causes of the disease and to suggest and coordinate an efficacious public health policy. This led the medical establishment in various European countries to question the traditional ideologies and refound the medical understanding of water based on the new bacteriology and bacteriological analysis. By the end of the nineteenth century, the relation between polluted water and cholera had been clearly understood.[34] This represented a significant factor in pushing for the renewal of water infrastructure in European cities.

Despite its three aqueducts, Rome was struck by Asiatic cholera, as we have seen. This was due to the precarious conditions of these aqueducts and also to the fact that part of the water provision came from wells in the proximity of the River Tiber.[35] Nonetheless, owing in part to the new, private Marcio aqueduct, Rome had a daily allowance of water per capita

(Lpcd) of 670 litres in 1870, at least in terms of water quantity.[36] In 1880, Madrid had 108 Lpcd; in 1879, Athens had just 44 Lpcd.[37] For a broader comparison, at the end of the period, in 1923, Rome had 485 Lpcd, Madrid 218 (in 1919), Paris 216, and London 159.[38] Athens was affected by the decline of the Hadrian aqueduct and by a refugee crisis, so the rate was only 10 Lpcd in 1923.[39]

However, as in Chapters 3–5, Rome's water abundance was not equally distributed throughout the various areas of the Italian capital and among different levels of the population. This was also true of Madrid. Like many European cities, Madrid was struck by cholera in 1834, 1855, 1865, and 1885.[40] To limit ourselves to our comparison cities, in Rome in 1867 2,040 people died of cholera, whereas in Madrid in 1865 2,869 people died. The population of the two cities was slightly different. Rome had 215,573 inhabitants in 1867, whereas Madrid had a population of 283,917 in 1865.[41] In the Spanish capital, popular districts like Inclusa and Latina were recurrently more highly affected by this lethal disease, which carried with it not only a demographic impact but also social and economic tensions.[42] More generally, nineteenth-century Madrid had a negative natural growth rate, with a high rate of infant mortality that was compensated by immigration.[43] The poor quality of water had an impact on this situation.[44] In 1850, Madrid's water system was still the one realised in the sixteenth century, based on water carriers (*aguadores*) and 77 public fountains supplied by underground conduits (*Los viajes de la Agua*) that filtered and conducted water from Madrid's aquifers.[45] Moreover, by the turn of the nineteenth century, the conditions of the underground conduits had declined and the quantity of water they provided in 1815–1828 had significantly dropped from the period of 1780–1800.[46] In short, in the first decades of the nineteenth century in the Spanish capital, as in Rome, the early modern water system was showing signs of infrastructural decay and vulnerability to water contamination. As a result, from 1829, projects were drafted to supply the Spanish capital with a new source of water and a new hydraulic infrastructure.[47] Finally, in 1854, a new water system – the Canal do Isabel II – 55 kilometres of lagged pipes and two dams – the Pontòn de Oliva and Navalejos that diverted water from the River Lozoya – was realised.[48] This new infrastructure was inaugurated in 1858, and the water per capita in Madrid reached 90 litres per day, plus 20 litres/per capita available in the public fountains.[49] In the following years, other infrastructure projects were realised to complete this water system: a distribution network, water tanks, the Antiguo channel, a sewerage system, and three irrigation ditches (*canalillos*) 17 kilometres long, which used surplus water to irrigate orchards and vegetable gardens in Madrid's surroundings.[50] Nonetheless, as in late nineteenth-century Rome, in Madrid the benefits of this new water system did not reach all areas of the Spanish capital and its population. In fact, at the turn of the twentieth century, many

complaints concerning muddy and hot water, low pressure, and a complete lack of water were registered, particularly in the northern and eastern periphery of Madrid.[51] In addition, in 1915, around 40,000 Madrileños lived in the *Extrarradio*, an area that had arisen outside of any regulatory policy and that had poor street planning and precarious urban services.[52] Here, a water distribution network was completed only during the early 1930s.[53]

Despite these limitations, the water systems of Rome and Madrid were more developed than that of Athens at the turn of the twentieth century. From 1833, water provision to the Greek capital relied on water vendors and the restored Hadrian's aqueduct, constructed in 140 CE under the command of the Roman emperor of the same name.[54] However, the constant, expensive maintenance that this aqueduct required and the increasing levels of leakage that frequently affected the quality of drinking water rendered the sanitation of nineteenth-century Athens a utopian dream, as the average water per capita dropped from 44 litres per day in 1879 to 16.5 litres per day in 1898.[55] As a result, late nineteenth- and early twentieth-century Athens had a negative demographic rate which was compensated only by immigration.[56] The capital's water problem was a field in which Greek engineers contested the expertise of a delegation of French engineers, who were the most significant actors in the construction of infrastructural projects in nineteenth-century Greece. Greek engineers sought an increased role in the realisation of alternative engineering projects for the country's development of Greek agriculture and the sanitation of urban spaces. More generally, the Greek engineering community planned irrigation and water supply projects that aimed to direct technology and investments towards the development of Greek agriculture and the sanitation of urban spaces.[57] The first proposal to supply Athens with a new source of water was submitted in 1889 to the municipality of the Greek capital by Aggelopoulos, a Greek public works engineer who proposed to canalise water from Lake Stymphalia in the mountains of Corinth to Athens.[58] In reply, the Greek government asked Quellenec, chief engineer of the French Mission of Public Works in Greece, to examine Athens's water supply.[59]

In 1890, Quellenec proposed bringing water to Athens by channelling water from Lake Stymphalia, but instead of referring to Aggelopoulos's project of the previous year, Quellenec claimed inspiration from the water projects of the Ancient Romans. In short, the French engineer calculated that the water available from Lake Stymphalia was about 2,000 litres per second, from which 900 litres would go to the water provision of Athens and Piraeus, while the rest would irrigate 4,600 hectares of land. The Greek government announced a public competition to realise the project drafted by Quellenec, but the Association of Greek Engineers felt that its scientific credibility was in question and consequently criticised the measurements that were at the core of the project. For example, Greek

engineer Stratos demonstrated that the supply of water from Lake Stymphalia was no more than 650 litres per second, forcing Quellenec to admit that he had used measures calculated by others without any further examination of the springs. In the end, Quellonec's project was abandoned, and owing in part to the bankruptcy of the Greek state in 1893, none of the ambitious engineering proposals to bring water to Athens that followed this debate received financial support.[60] As a result, Athens's water supply was not renewed until the 1920s.

In conclusion, when it comes to drinking water, the experiences of nineteenth- and early twentieth-century Rome and Madrid were similar. In fact, in the first decades of the nineteenth century, a water system that had been developed in the sixteenth and early seventeenth centuries was still operating in both cities, although there were signs of infrastructure decay and conceptual limits on the side of water purity. Indeed, these infrastructures were not sufficient to prevent the outbreaks of Asiatic cholera and other water-borne diseases in the two cities. However, new water sources were connected to Madrid in the mid-1800s and to Rome from 1870 by means of new water infrastructures. As a result, in the first decades of the twentieth century, these two cities had the highest average available drinking water in Europe. Nonetheless, this water abundance was not equally distributed throughout the two cities. For the poorer levels of Roman and Madrilenian society during the period, a direct, constant home water supply was an exception, while public fountains remained the most reliable source of drinking water. Conversely, Athens, that to some extent had to be completely rebuilt, had to rely on what was perceived as a cheap solution, namely the restoration of the ancient Hadrian aqueduct. Nonetheless, as *Società dell'Acqua Pia Antica Marcia* (SAPAM) engineers noticed with regard to the ancient Marcio aqueduct, restoring such an old conduit was neither cheap nor efficient. Late nineteenth-century projects to bring water to Athens were prevented by the financial shortfalls of the Greek state. In addition, the quasi-colonial regime of Greece, its reliance on foreign capital, and the rivalry between the Greek engineering community and those of the western powers represented a hindrance to the realisation of a modern water infrastructure for Athens. As a result, in the 1920s, in terms of water quantity Athens was at the opposite extreme of the other two Euro-Mediterranean capitals.

Water between public service and private profits

The case of Athens shows that the raising of funds was a crucial obstacle to water infrastructure at the turn of the twentieth century. Indeed, the financial aspect of water infrastructures conditioned the realisation of projects and who these benefited. In Chapters 2 and 4, I have shown that the main modern water infrastructures in Rome – the hydroelectric power

stations in Tivoli, the new Marcio aqueduct, and the Acqua Mariana canal – were owned and managed by private actors. At least two points can be drawn from this. First, a part of the Roman aristocracy showed an entrepreneurial mentality, business acumen, and ability to raise funds and to recruit the necessary expertise. Moreover, the case of the Acqua Mariana canal – which involved small entrepreneurs – showed that late nineteenth-century Roman society was able to achieve savings, investments, and technological improvements. Second, private ownership and management of the main water infrastructures had an impact on the planning of Rome's municipality, on the conditions of water distribution, on the areas served, and, more generally, on the environmental quality of some urban districts. For example, the area outside Porta San Giovanni, which was planned to be residential, actually became a mixed housing and industrial working-class district. Moreover, in the poorest areas of the city, many households remained not directly connected with the aqueducts well into the twentieth century. The municipality had to intervene to fix a ceiling price for drinking water and use its political and commercial power to temper the pursuit for profits of the private company, inducing this to introduce some elements of 'urban service' in its management.

The role of the public in the water infrastructures of late nineteenth- and early twentieth-century Madrid and Athens was greater than in Rome. In Madrid, projects to link the city with new water sources by means of new infrastructures dated back to at least 1830. This first project planned to take water from the River Guadalix and Manzanares by means of three different aqueducts, whose owner was to be Madrid Municipality.[61] However, the project did not receive effective, specific financial support from the Spanish state, and the Spanish Liberals criticised the public ownership of water, so the project remained a dead letter. A new project to bring water to Madrid was drafted in 1846, the water source was the River Lozoya, and the private company, *La Aurora*, was awarded the contract to realise the project but was unable to start the works. As a result, in 1848–1849, the Spanish Ministry of Commerce, Instruction and Public Works took responsibility for drafting a precise, viable project for a modern aqueduct for Madrid.[62] Finally, in 1851, this new project, which planned to collect water from the River Lozoya, passed the various institutional hurdles and received financial support from the state, Madrid's municipality, and private subscribers (Queen Isabel II among them).[63] However, the enterprise failed to attract other private subscribers and the Spanish Treasury had to buy the remaining shares that remained. Even this effort was not sufficient, and in 1855 the funds that had been raised did not cover the construction costs of the distribution network; therefore, the Spanish Public Works Department issued bonds (50 million *reales*) with an annual interest rate of 8% and the government provided 15 million *reales*.[64] Only with this additional

state financial effort did the Canal do Isabel II conduct water to the houses of Madrileños. As of 1858, the distribution of water was realised by means of calibrated or free faucets, and water fares were not based on water consumed but on a range of subscriptions.[65] A more consumer-orientated practice of subscription, with the introduction of water meters, started in 1873 and in 1903 became the only method of calculation of fares.[66] This and the fact that there were not different fares for different areas of the city were remarkable differences with the distribution system adopted by the Roman private water company.

Nonetheless, even the public water management in Madrid was not able to completely cope with the demands of Madrileños for abundant, good-quality water. In fact, at the turn of the twentieth century, the growth rate of the Spanish capital was higher than the increase in the quantity of water taken from the River Lozoya. Moreover, the water flow of the River Lozoya had significant seasonal variations and its water contained clay particles.[67] In the first decade of the twentieth century, the Canal do Isabel II was subject to an administrative reorganisation of its management board that brought infrastructural improvements: new catchment works, extension and diversification of the distribution network, sanitation of water by means of ozone, and the production of hydroelectricity.[68] Moreover, from 1907, permanent water quality control was established and water-related diseases in Madrid rapidly decreased.[69] These improvements in the management of the Canal do Isabel II were a direct consequence of the entrance of a (private) competitor into Madrid's water market: the *Hidraulica Santillana*, promoted by the Marquis of Santillana.[70] The Marquis of Santillana was 'the prototype captain of industry' in late nineteenth-century Spain – noble but with a professional education (law) and attitude towards large investments in infrastructures.[71] This establishes a further point of contact with the Roman case, where projects of water infrastructures were promoted and financed by members of the aristocracy. In 1902, 10 years after Rome had been provided with hydroelectricity, the *Hidraulica Santillana* had obtained water concessions from the rivers Manzanares, Guadalix, and Guadarrama and started to produce and distribute hydroelectricity in Madrid.[72] Moreover, the projects of the Marquis of Santillana also involved the distribution of drinking water in the peripheral areas of Madrid that were not covered by the Canal do Isabel II.[73] The new board of the public infrastructure, which included engineers, physicians, and members of the local institutions, reacted to this proposal with a new project, the canal transversal, which would also ensure the distribution of drinking water to Madrid's northern and eastern peripheries. This new infrastructure was completed in 1911, starting to solve the thirst for water of those areas of the city.[74] In short, in the case of late nineteenth- and early twentieth-century Madrid, in contrast to the Roman case, the public authorities had a central role in promoting the modernisation of

the water system. In the mid-1800s, only the state had the financial strength to realise an infrastructure that involved two dams, 55 kilometres of water mains, reservoirs, and several kilometres of distribution network. However, the final product, though a remarkable achievement for the 1850s, was not sufficient to ensure constant, good-quality water to all areas of Madrid. It was only in the first decade of the twentieth century, when under the pressure of a private competitor the Canal do Isabel II management board was reorganised, that the water system created in the 1850s was renewed and improved.

In the case of Athens, the public and in particular the state also played an important role in leading the modernisation of the capital's water service. From 1833 onward, the restoration of the ancient Hadrian aqueduct was partially covered by means of state funds, interest-free loans, and loans from the Bank of Greece.[75] In 1889, despite a time-consuming and costly effort, the municipality of Athens decided to suspend all repair works to the Hadrian aqueduct, because of the poor results in terms of both water quantity and quality, and began looking for a different source to bring water to Athens.[76] However, it would take 40 years for Athens to receive water from another abundant and reliable source.

Finally, in 1918, a project to create a dam and a reservoir at Marathon, which was accompanied by an economic feasibility study and supported by US capital and engineering, seemed to break the deadlock in which the matter of water for Athens was stuck.[77] In 1924, the Greek state, the Bank of Greece, and the US construction firm Ulen & Co. signed an agreement for the construction of the Marathon dam project.[78] The total costs of the enterprise exceeded the reserve funds of the Bank of Greece, so the North American company provided the initial funding. However, the Greek state maintained ownership of the infrastructure by issuing a $10 million loan to Ulen & Co. Moreover, the financial management, the supervision of the works, and the distribution of water were assigned to a Greek water company (EEY), as established by parliament.[79] From 1926, Athens started receiving water from the Marathon dam. The works of the entire network were completed in 1932, and a replica of the temple built by the ancient Athenians at Delphi (after the victory in the battle of Marathon in 490 BCE against the ancient Persians) was built at the foot of the dam. At long last, water connected modern Athens with its glorious history, even if this time the victory at Marathon was 'in wresting from nature its life giving water for the citizen of Athens.'[80] In short, owing to the high initial costs, insecure revenues, and the long time in receiving interest on the invested capital, the realisation of a large water infrastructure for Athens required an infusion of cash from foreign countries and the real support of the Greek state, which was also an actor in the technological modernisation of water infrastructures in other Greek cities.[81]

In the end, the relations between private and public in our three cases were very different. In the case of Rome, private actors funded, realised the infrastructures, and managed the water system, while the Papal State had a marginal though not irrelevant role in all of these steps. Moreover, the private infrastructures operated as virtual monopolists of water in Rome until the late 1930s, and the local municipality had to bargain for any element of the service: water for public services like hydrants and hospitals, distribution also in the popular areas, and lower fares for the poor. By contrast, the failures of private actors in funding a large water infrastructure for Madrid forced the Spanish state to take complete responsibility for all the steps in the realisation and operation of the new water system. Nonetheless, the quality of the water service in late nineteenth-century Madrid does not appear very different from that of Rome. Water quality and its distribution in the period were subject to criticisms, though the public management of water in Madrid reacted more rapidly to the demand for better-quality water, for a widespread distribution network, and for a differentiated system of fare calculation than did private management in Rome. Finally, in Athens, foreign capital was necessary to cope with the high costs, but the Greek state increased its national debt in order to ensure the public ownership and management of its water system.

In the end, what lessons can we learn? At the turn of the twentieth century, in the three Euro-Mediterranean countries, problems linked to water infrastructure did not come with a simple ideological solution, public vs. private. Water infrastructures required a complex concentration of capital, technology, power, and expertise. What was realised was not necessarily the optimal engineering, technical option or the most suitable for the 'many' or for the 'public'. Only those able to combine and satisfy these complex demands were able to ensure the feasibility of the project. This was achievable in different ways: almost complete public finance and management in the case of Madrid, almost complete private finance and management in the case of Rome, or cooperation between public and private sector actors, while maintaining public management, in the case of Athens. These different responses, in turn, had an impact on the role of water as a public service and as a means to private profits.

Agency from below: private uses of water and the creation of mixed landscapes

One of the problems with water provision in modern Rome, Athens, and Madrid was that of stretching the distribution network to areas that grew outside existing regulatory policies and urban planning. Indeed, the process of spontaneous urbanisation was shaped by water and could be seen as the product of the material culture of the people who realised these urban settlements around the 'legal' cities. In fact, at the ground level,

water, even in limited amounts, was essential as both inflow and outflow of many small industrial processes. As we have seen in Chapter 5, in the case of Rome, private, individual appropriation of small watercourses for industrial purposes was essential for the development of a local economy, based on the production of necessary goods like shoes, clothes, lamps, and glass. These activities, in turn, offered employment to the migratory inflow that from the surrounding regions was directed towards the urban/rural southern and eastern areas of Rome. In brief, looking at the material culture of these social actors, at the way objects of wide circulation, including buildings, were practically constructed, reveals the multifarious roles that water had for the social process of production. The presence of a technically easily available source of water, its limited or zero cost, and its constant flow were thus key elements in the spontaneous construction of urban islands in the surroundings of Rome at the turn of the twentieth century.

A similar development can be seen in the Athenian neighbourhood of Metaxourgeion, whose area in the 1830s lay outside the historic city of Athens but in the proximity of its west side. Until 1852, this was a rural area covered by orchards and fields, but in that year a silk factory was installed there.[82] This changed the priority among the uses of local underground water. Rapidly, the silk mill's growth and a steam-powered oil press and steam-powered flour mill were built near it, and 'of fundamental importance for running the steam-powered factory was securing adequate water reserves.'[83] Moreover, in 1859–1861, an Athens gaslight factory and – in 1869 – a railway station on the Athens-Piraeus line was built in the area. As we have seen with the Roman case, this could be understood as a sign of the presence of a constant water flow. As a result, this area of Athens was filled with facilities serving transports needs, older pack-saddle makers, fodder traders, and the newer carriage-makers, carpenters, and foundries.[84] These were the first to pioneer the expansion of this industrial zone on the western side of Athens by living near their workshops.[85] After the closure of the silk mill in 1875, the demand for housing in the area was massive. In fact, a related migratory inflow from the countryside and provincial towns was directed towards this area, contributing to the formation of a popular neighbourhood with basic houses for artisans, journeymen, and all manner of small tradesmen and manufacturers.[86] This has led Cristina Agriantoni to state that 'contrary to familiar stereotypes concerning its "parasitic" character, Athens was and remained an industrial city: but even in the industrial period it remained a city of small factories producing a wide range of consumer goods.'[87] This statement also fits the Roman neighbourhoods that we analysed in Chapter 5.

In conclusion, Mediterranean cities experienced a similar phenomenon of 'unfinished community' sprawling, which made the development of these cities sectorial rather than concentric, as Leila Leontidou has also

suggested.[88] This development should be linked with the nature of the real estate market of these cities, which was affected by the prohibitive costs of the plots inside the city plan.[89] However, Chapter 5 and the cases described earlier in this section both show the importance of integrating this robust analysis of urban sprawl, linked to land speculation, with the logic inherent in the social organisation of production processes, in order to have a more nuanced picture of how precisely some areas were subject to urban expansion instead of others.

Conclusion

The comparison of these three cases provides us with elements to enable reflection on both the mutual features and Roman peculiarities. Culturally, water was part of discourses of national decay and regeneration, particularly in the Italian and Spanish cases. More precisely, the optimal use of water was perceived by the modernising elites of these two countries as a fundamental tool in reviving the national economy and society without radical social change. Before doing so, in conceptual terms, both legally and politically, these Euro-Mediterranean countries had to solve the same problems presented by multilayered local private rights, perceptions, and uses of water. In the Spanish and Italian cases, liberalisation and centralisation of the decision-making powers over water went hand in hand with the conceptualisation of watercourses as natural unities, separated by local societies. In Greece too, large water infrastructural projects were implemented when ancient seignorial rights on water started to be withdrawn. Hence, at cultural (in terms of both language and concepts), political, and legal levels, one could say that the three cases I have analysed actually followed a similar trajectory, though with different timescales.

However, in terms of local water provision in the nineteenth century, Rome, Athens, and Madrid had to face shared problems, such as those linked with centuries-old water infrastructures and their physical decay and with conceptual inadequacies in the face of water-borne diseases. Indeed, the outbreak of Asiatic cholera was a significant burden on the pre-existing, essentially early modern water system. The developing medical understanding of water in nineteenth-century Europe found an answer in the concept of water as a natural purifier that had to be broadly spread in order to clean up cities. Furthermore, at the turn of the twentieth century, great attention was paid to ensuring water purity, including materials and methods of water distribution. As a result, the three cities all had to find water outside the urban fabric, in a range of 40/50 kilometres from the city centre, and to undertake new modern infrastructures. However, one of the distinctive features of the Roman case was the relevance of private-sector actors. In early twentieth-century Rome, from drinking water to irrigation and hydroelectricity, all the main water

infrastructures were financed and controlled by private companies. This is not to say that the three strands of water modernity would have been pursued otherwise more coherently or that they were inherently instable and conflicting, but this doubtless complicated public control over the shaping of space. Indeed, even in cities where the management of water was mainly public, as in Madrid or Athens, part of the space was moulded by various private actors.

This leads us to think about the relations between water and migratory flows, for water infrastructures attracted migrants towards these capital cities. Migrants exploited local nature, land, and water in a creative way according to their material culture. As a result, in the cases of Rome and Athens, some industrial (though small industries), commercial urban islands started to grow in the surroundings of the city centres, among rural plots, outside of any regulatory policy. As regards Rome, this was an unexpected outcome for the Italian elite that had supported the agricultural strand of water modernity. In fact, by contrast with Athens and Madrid, the Roman countryside had a national cultural and political relevance. So one might be surprised by the fact that the portion of the Agro Romano where state and city council efforts at creating rural settlements and increasing arable surface were stronger ended up in the creation of areas on the Roman periphery. One of the variables was the creativity of the population. However, at a more general level, in spite of the decisions taken in the parliament and in the city council regarding land use, the struggle for water resources in the Roman area was favourable to industrial and civic uses rather than agricultural ones. Space was thus moulded accordingly. Regulating water access, use, and distribution was a less direct way of ordering space than land use but was probably more effective for shaping space and society in a coherent design.

Notes

1 Fernand Braudel, *Civiltà e Imperi Del Mediterraneo Nell'età di Filippo II*, volume 1, Carlo Pischedda (transl.) (Turin: 2010), 53–70.
2 Ibid., 53–54.
3 See Alfonso Ortì, 'Politica hidraulica y cuestion social: origines, etapas y significados del regeneraciosnismo hidrauilico de Joaquin Costa', *Agricultura y sociedad*, 32 (1984), 11–107; Alan Hoyle, 'Introduction: the intellectual debate', in Joseph Harrison and Alan Hoyle (eds.), *Spain's 1898 crisis: Regeneracionism, modernism, post-Colonialism* (Manchester: 2000), 9–51; Casado de Otaola, *Naturaleza patria: cienca y sentimiento de la naturalesa en la Espana del Regeneracionismo* (Madrid: 2010); Erik Swyngedouw, *Liquid power: Contested hydro-modernities in twentieth-century Spain* (Cambridge, UK and London: 2015).
4 Swyngedouw, *Liquid power*, 42.
5 Ibid., 42.
6 Ortì, 'Politica hidraulica', 16.
7 Ibid., 15.

8 Swyngedouw, *Liquid power*, 43.
9 Ortì, 'Politica hidraulica', 18.
10 Swyngedouw, *Liquid power*, 48.
11 Ortì, 'Politica hidraulica', 16. The linguistic contiguity between Spanish expression *tierra irredenta* and the Italian *terre irredente* demonstrated the similarities between the cultural framework of Spanish and Italian reformers at the turn of the twentieth century.
12 Ibid., 50.
13 John S. Kaliopoulos and Thanos M. Veremis, *Greece the modern sequel: From 1831 to the present* (London: 2002), 183.
14 Maria Kaika, *City of flows: Modernity, nature and the city* (New York and London: 2005), 131.
15 Ibid., 109–112.
16 Ibid. Here Kaika refers to the 'selective modernisation' theory stated by Daniel R. Headrick, *The tentacles of progress: Technology transfer in the Age of Imperialism* (New York and Oxford: 1988).
17 Kaika, *City of flows*, 118.
18 Ibid., 95–97.
19 Ibid., 97–99.
20 Ibid., 100–104.
21 Jordi Maluquer De Motes, 'La despatrimonialisacion del agua: movilizacion de un recurso natural fondamental', *Revista de Historia Económica – Journal of Iberian and Latin American Economic History*, 1, no. 2 (1983), 79–96 (85).
22 Ibid., 87.
23 Swyngedouw, *Liquid power*, 71–72.
24 Ibid., 72.
25 Ibid., 61.
26 William W. McGrew, *Land and revolution in modern Greece, 1800–1881: The transition in the tenure and exploitation of land from Ottoman Rule to Indipendence* (Kent OH: 1985).
27 Ibid., 26–28.
28 Ibid., 196.
29 Ibid., 203.
30 Kaika, *City of flows*, 104.
31 Ibid., 115.
32 Richard Clogg, *Storia della Grecia Moderna. Dalla caduta dell'impero bizantino a oggi*, Andrea Di Gregorio (transl.) (Milan: 1996), 100; Kaika, *City of flows*, 119.
33 Kaika, *City of flows*, 125–129.
34 For a contemporary example, see Ernest Hart, 'How Cholera can be stamped out', *The North American Review*, 157 (August 1893), 186–196.
35 Francesco Scalzi, *Il colera di Roma nel 1867* (Rome: 1868), 50–63.
36 Stefano Battilossi, *Acea di Roma 1909–1996. Energia e acqua per la Capitale* (Milan: 1997), 168.
37 For Madrid, Josè Carlos Rueda Laffond, *El agua en Madrid. Datos para la historia do Canal do Isabel II* (Madrid: 1994) 50. For Athens, Kaika, *City of flows*, 103.
38 Stefano Battilossi, *Acea di Roma*, 168 and Hug March Corbella, 'Urban Water Management and market enviromentalism: a historical perspective for Barcelona and Madrid', Ph.D. thesis (Barcelona: 2010), 465.
39 Kaika, *City of flows*, 103.

40 Antonio Fernandez Garcìa, 'Repercusiones sociales de las epidemias de cólera del siglo XIX', *5th Congreso Nacional de Historia de la Medicina*, Volume 1 (Madrid: 1977), 127–145.
41 Ibid., 139.
42 Ibid., 141–144. Also physical violence against the presumed cholera-spreader, like the massacre in the Madrilenian Puerta do Sol in 1834.
43 Rueda Laffond, *El agua en Madrid*, 29.
44 Ibid., 28.
45 March Corbella, 'Urban water management', 444–446.
46 Rueda Laffond, *El agua en Madrid*, 35. From an average of 473 *Real Fontaneros* in 1780–1800 to an average of 313 *Real Fontaneros*. The author did not provide an equivalence in litres.
47 Ibid., 37–38.
48 March Corbella, 'Urban water management', 450–453.
49 Ibid., 454.
50 Ibid., 456.
51 Rueda Laffond, *El Agua en Madrid*, 53–54.
52 Ibid., 92.
53 Ibid., 105–106.
54 Kaika, *City of flows*, 104.
55 Ibid., 102–103.
56 Eugenia Bournova and Maurice Garden, 'La population d'Athènes et de sa Règion dans la seconde Moitié du XIXme Siècle', *Annales de démographie historique*, 119, no. 1 (2010), 181–203.
57 Kaika, *City of flows*, 115.
58 Ibid., 116.
59 Ibid., 116–118.
60 Ibid., 118. The bankruptcy of the Greek state was partially the result of large state investments in railways.
61 Rueda Laffond, *El agua en Madrid*, 37–38.
62 Ibid., 40.
63 March Corbella, 'Urban water management', 452.
64 Ibid., 454.
65 Rueda Laffond, *El agua en Madrid*, 48.
66 Ibid., 52.
67 Ibid., 55.
68 Ibid., 56 and 68–77.
69 March Corbella, 'Urban water management', 465.
70 Ibid., 461–463.
71 Rueda Laffond, *El agua en Madrid*, 58.
72 Ibid., 62–63.
73 March Corbella, 'Urban water management', 462–463.
74 Ibid., 468.
75 Kaika, *City of flows*, 101–102.
76 Ibid., 104.
77 Ibid., 121.
78 Ibid., 123.
79 Ibid., 124.
80 Ibid., 128, the quote is taken from a sign placed at the entrance of the temple at the foot of the dam.
81 Konstantinos Chatzis, Anna Mahera and Georgia Mavrogronatou, 'Supplying the city of Ioannina with 'modern' waters, 1913–1940: the 'modern

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82 Ariatea Papanicolau-Christensen, 'The Athens silkmill: from shopping centre to factory', in Christina Agriantoni and Maria Cristina Chatziioqnnou (eds.), *Metaxourgeion. The Athens silkmill*, Alexandra Doumas (transl.) (Athens: 1997), 45–82.
83 Ibid., 75–77.
84 Cristina Agriantoni, 'The neighbourhood of Metaxourgeion', in Agriantoni and Chatziioqnnou (eds.), *Metaxourgeion*, 157–171 (164–165).
85 Ibid., 164–165.
86 Ibid., 165.
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Conclusion

In these final notes, I would like to highlight the contribution this book makes in terms of three areas: urban morphology, political ecology, and methodology. As regards the first, in the Introduction I warned the reader not to expect the main themes usually discussed in the historiography on modern Rome: land speculation and urban planning, the struggle for power within the political institutions, the political divide between Catholics and Liberals, the symbolism of monuments, and political aesthetics. According with these points of view, the development of Rome from the early twentieth century could be seen as a matter of land speculation, lack of mass housing, or a product of the struggle between the offices of the municipality, which privileged the old Roman aristocracy, and those of the state, or as the creation of Rome as the 'stage' of Italian politics. Instead, I argue that Rome's urban growth was characterised by the birth and aggregation of multiple, frequently spontaneous, urban settlements. With this in mind, I have sought to analyse the urban development of the Roman area through the lens of water, the essential element for both life and production.

In fact, it is my view that, at a general level, the making of the Roman area was closely linked to the development of water infrastructures. These, in turn, were the products of unstable and sometimes conflictual discourses and perceptions of modernity among the Italian elites and intellectuals who held state and local offices. Indeed, according to Paul Rabinow, instability is a main feature of political discourses on modernity. This is to say, in the context of this book, the discourses on rational water management and the optimal use of water contained different and overlapping aims and targets. This is evident in the struggle for water resources both in the case of the River Aniene and in the case of the Acqua Mariana canal. In the first case, the springs of the river were progressively channelled into the Marcio aqueduct, while the water that remained available in Tivoli was planned to supply agricultural and energy uses. However, this probably would have put unsustainable pressure on the River Aniene, not least because there were pre-existing uses to

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be respected. As a result, the most rewarding investment, and one that could mediate between the different interests of investors and the local community, a hydroelectric power station, was realised while the plan for an irrigation canal was dismissed. The same happened to the canal of the Acqua Mariana, whose water in the early twentieth century was used for irrigation, industrial production in the suburban section, and as a source of drinking water by the local population in the Alban Hills and in some settlements in the Agro Romano. As a result, agricultural uses of water were confined to only a part of the canal. In short, in political-ecological terms, the social struggle for water access, distribution, and uses that manufactured the water infrastructures of the Roman area at the turn of the twentieth century configured water as a mainly 'urban' resource.

More specifically, by social struggle, I do not mean purely the economic competition between various private and public agents over water resources. Indeed, as evidenced in Chapter 6, most of the historiography on water infrastructures has focused on this aspect. On the contrary, the social struggle that emerges from the previous pages is more complex and articulated. It involved competition between different uses: irrigation, drinking, industry, and who was to benefit from them. This was something that fully engaged the life of local communities, which for centuries had shaped their social organisation around water. Under this aspect, the battle for water involved a resistance to the centripetal reorganisation of water resources of the Roman area. In short, examining the history of water needs to be a very 'democratic' exercise since it has to consider a set of agents that encompass aristocratic entrepreneurs and councilmen of small towns, state departments and members of the parliament, professionals, and local users. Clearly, the power of these agents was different, as was their agency. However, the influence of the local population on the shaping of territory, for instance, was in no way minor.

There are other possible explanations for the settlement of the Roman countryside, like those that gave a relevant role to transport, particularly to railways. However, even in this case, the role of water has emerged in this book. Indeed, some of the railway stations in the Roman area were constructed in proximity to a watercourse for the reason that water was vital for constructing the buildings and the filling of locomotive boilers. Moreover, the development of electric railways, tramways, and omnibuses that from the late nineteenth century connected Rome with the surrounding towns was influenced by the early development of hydroelectricity in this area. Without the hydroelectric power station at Tivoli, operating from 1892, the development of transport in the Roman area would have been different. Once again, the way that water and society interacted contributed to shaping the space and making the presence of human beings in a given area feasible.

This work has shown how the making of water and of its socio-natural space in the Roman area at the turn of the twentieth century was the product of a set of elements, which together produced an unpredictable socio-spatial configuration. This is quite different from what has been studied hitherto. For example, Denis Bocquet has focused on public projects like the embankment of the River Tiber, the construction of the sewers, the realisation of an archaeological area in the city centre, and various modernising projects of the Agro Romano, many of which never came about. This made sense for his approach, which aimed at exploring the dynamic of urban and territorial public planning and the rivalry between the civil engineering office and the hydraulic office of Rome. However, in my view, this approach is limiting when the target is that of understanding a more complex and wider social process of the making of an entire area. Furthermore, my research has shown that the role of the public sphere in the management of water resource was not only or mainly about planning. Indeed, the main role of the public departments was that of conceptually removing the social context of water, defining water as 'natural' and creating a new space for its 'correct' management, structuring a legal framework for the organising of water access, distribution, and use, showing the relations between water and disease, and monitoring water quality. As regards the realisation of infrastructural projects that could mould the territory according to one or more modernising designs, this was mainly in the hands of private actors.

The conflictual dimensions of infrastructures thus went beyond the rivalry between public offices. The Roman case shows that the attempts to rationally manipulate space by means of water infrastructures is only one of the multiple rationalities involved in the struggle for water access, distribution, and use. For this reason, concepts like urban metabolism, which stresses the rationality of planning, grasps only part of the broader process. More precisely, the urban metabolism concept that underpins part of the environmental history on infrastructures appears descriptive and socially neutral and therefore is unable to fully explain the causes of the urbanisation of nature process. Water infrastructures could be seen as the result of a complex process of negotiation and compromise between public offices, businessmen, local communities, powerful stakeholders, and user groups. With Maria Kaika, we can argue that water infrastructures represent the reification of social relations, though not only from a strict Marxist point of view, as conceptual abstraction that obscures the exploitation of human labour. In a broader sense, water infrastructures are unstable structures that physically embed the social dynamic for water, conditioning who can use it and for what purpose, but also subject to continuous negotiations between different actors.

All these points bear on the methodology I have adopted. They confirm the historiographical importance of approaching the matter of social change as it is acted by a multifaceted assemblage. To fully explain a

social phenomenon, we have to look at it through different elements and agencies. This can transform our understanding of how things happened by expanding the traditional historical analysis of social phenomena as separate fields. For example, it is quite reasonable to investigate the making of Italian water legislation from a strictly legal point of view, which means analysing the evolution of the legal theories around water and the output of these in terms of the legal code. However, I think this perspective can grasp only some of the possible causes of changes in the Italian water legislation. By contrast, understanding the contemporary evolution of the conceptualisation of water resources made by the hydraulic engineers as something purely natural; the medical debate on water quality and on the importance of aqueducts as the safest way of water provision; the rapid development of hydroelectric technology; and, more generally, the social and political struggle for water control and use provides us with the context and background of which the changing legal theory was part. Thus, the changes in the legal code have to be considered as an effort at understanding and at arranging these complex, diverse social phenomena into a coherent set of norms. In the end, such an approach can also be fruitful outside the field of urban infrastructures for anyone interested in expanding our knowledge of past societies and the mechanisms of social change.