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Water Use and the Making of a New Socio-Natural Landscape

Rome and Its Surroundings at the Turn of the Twentieth Century

Abstract: In the last decades of the nineteenth century, Rome was in a phase of transformation. In order to assume the role of cultural and political capital of the Kingdom of Italy, the city underwent a process of new urban infrastructure construction and demographic expansion. Rome's demand for water increased as a result of this process, and measures initiated by the state, the urban authorities, and private sector agents consequently began to concentrate water resources from the city's surroundings. The three main aims of these measures were to irrigate the countryside, to increase the quantity, quality, and coverage of the drinking water supply, and to meet the growing energy needs of the city. However, the social struggle about access to, distribution of, and use of the resource influenced the realisation of infrastructures and the utilization of water. As a result, the physical features and social role of the traditional landscape of Rome and its vast countryside began to change – in short, the area surrounding Rome underwent a process of urbanisation. Although such urbanisation was experienced by many European cities at the turn of the twentieth century, the case of Rome may shed light on how multifarious and sometimes contradictory the phenomenon was.

Keywords: irrigation, land settlement, hydroelectricity, beauty of nature, hinterlands, conflicts

Introduction

Starting in September 1870, Rome entered a period of intense socio-natural change. The city became the capital of the young Italian state even though there were no infrastructural, economic, or social assets to justify this choice. To some extent, it was a product of the relevance assigned to the notion of Rome in the political discourse of the Italian Risorgimento.[1] At any rate, the decision meant that the city, whose actual conditions more closely resembled those of a large rural town than those of a great European capital, had to be elevated to the level of the Risorgimento's political ideals. On the one hand, this took the shape of a monu-

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1 Romolo Murri, L'idea universale di Roma. Dalle origini al Fascismo, Milan 1937.

mental discourse that changed the historical topography of the city.[2] On the other hand, the infrastructural, economic, and health conditions of the city had to be adapted according to European standards.

Embanking the Tiber, making municipal aqueducts safe, improving the water distribution system, constructing new sewers, generating hydropower, and providing water for irrigation were some of the major challenges the new public authorities in Rome and its surroundings faced. In order to fulfil these requirements, local and national public authorities had to extend their control over the water resources available in the area around the city. Effectively, Rome and its surroundings engaged in a phase of socio-ecological transition at the turn of the twentieth century that changed the nature of the region and produced a new socio-natural landscape.[3] What were the characteristics of this transition? As with many Western cities, the key features of Rome's socio-ecological transformation were intensification and externalisation of the flow of resources (water, food, energy, raw materials etc.) into and out of the city, the realisation of large infrastructure projects to assure a constant supply of these resources, and the urbanisation of the surrounding landscape.[4]

In this paper, I will focus on the latter two aspects. I will explore in detail the creation of water infrastructure works to expand the supply of water for drinking and irrigation as well as of energy to Rome and its surroundings between 1870 and 1922. Furthermore, I will scrutinise how water access, distribution, and use were organised by these facilities and what their impact was on the urbanisation of the Roman countryside (Agro Romano). The main argument is that expanding the food catchment area for Rome to larger parts of its surroundings represented a considerable part of the project of renewal of the Roman area at the turn of the twentieth century. However, the waters around Rome were primarily engineered to produce hydroelectricity and increase the supply of drinking water. This fact along with the creative use of land and water by migrants contributed to the urbanisation of the Agro Romano.

The article is structured into five sections. In the first section, I will examine the renewal projects relating to the Roman countryside. The second section investigates the supply of drinking water to Rome and the expansion of its distribution network, while the third discusses the increasing energy needs of the Italian capital. In the fourth section, I will analyse the engineering projects that aimed to produce hydroelectricity and irrigate the Roman countryside using the River Aniene. In the final section, I seek to investigate the practical effects of this process for the making of a mixed (urban/rural) landscape in a portion of the Roman countryside.

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2 Bruno Tobia, Una Patria per gli Italiani, spazi, itinerari, monumenti nell'Italia unita, 1870–1900, Rome 1991; Bruno Tobia, L'Altare della Patria, Bologna 1998.

3 Cf. Marina Fischer-Kowalski/Jan Rotmans, Conceptualizing, Observing, and Influencing Social-Ecological Transitions, in: Ecology and Society 14/2: 3 (2009), n.pag., http://www.ecologyandsociety.org/vol14/iss2/art3/.

4 Cf. Sabine Barles, The Main Characteristics of Urban Socio-Ecological Trajectories: Paris (France) from the 18th to the 20th Century, in: Ecological Economics 118 (2015), 177–185.

The settlement of "uncultivated" lands and the Roman countryside

The attempts to promote modern agriculture in the Agro Romano were an important element in the making of the Roman environs at the turn of the twentieth century, with measures to stimulate settlement and intensive cultivation of abandoned lands forming a recurring, cross-party topic in the Italian political debate from the beginning of the Risorgimento to the fascist period.[5] The idea of extending the arable surface by means of reclaiming and human settlement was by no means new in the nineteenth century. Rather, as Fernand Braudel has pointed out, progress and failures in the process of taming the lowlands had been part of the history of the Mediterranean countries since at least the sixteenth century.[6] During the nineteenth century, however, the settlement and cultivation of abandoned – or seemingly abandoned – lands was perceived as a way of pursuing a material and moral rebirth of the country by members of both the Italian landed aristocracy and the urban bourgeoisie.[7]

Beginning in 1870, when Rome became part of the Kingdom of Italy, the modernisation policies of the new state pertaining to the city focused on its countryside, which appeared to the members of the new ruling class as "something similar to the Don River steppe" given the fact that the landscape had a harsh and deserted appearance.[8] In fact, this territory of more than 200,000 hectares was organised into large latifundia owned by a small group of members of the Roman aristocracy. Only 3,000 people lived there.[9] The vast plots were rented out to a group of contractors called *Mercanti di Campagna*, who sublet smaller patches of land to free-range sheep and cattle breeders, while only a quarter of the area was cultivated with wheat.[10] This meant that the productivity of the Roman countryside was quite limited. In addition, the Agro Romano was dotted with water-meadows due to its physical configuration, and malaria was a serious concern both in the countryside and in the city itself between May and November.[11] The fact that there already existed more than 90 pamphlets, books, and treatises on the topic of agricultural improvements in the Roman countryside in the 1870s shows the social and cultural relevance of the issue in the political debate.[12]

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5 Lando Bortolotti, Il mito della colonizzazione in Italia, 1850–1950, in: Storia Urbana 57 (1991), 87–168.

6 Fernand Braudel, Civiltà e imperi del Mediterraneo nell'età di Filippo II, vol. 1, Turin 2010, 53–70.

7 Bortolotti, Il mito della colonizzazione, 91. The contemporaries spoke of lands to be redeemed (*terre irredente*).

8 Raffaele Pareto, Relazione sulle condizioni agrarie ed igieniche della Campagna di Roma, della commissione di indagine ministeriale sull'Agro Romano, in: Antonio Parisella/Susanna Passigli (eds.), Antologia dell'Agro Romano, vol. II, Villa d'Agri 2005, 11. English translations of this and all following quotations by the author.

9 The number of landowners was 200. See Lando Bortolotti, Roma fuori le mura: L'Agro romano da palude a metropoli, Rome/Bari 1988, 13–15.

10 Ibid.

11 Ibid. For a contemporary overview of Roman agriculture in the 1870s, see Direzione dell'Agricoltura, Sulle Condizioni dell'Agricoltura e Pastorizia della Provincia di Roma, in: Ministero dell'Interno, Direzione Generale di Statistica (ed.), Monografia della città di Roma e della Campagna Romana presentata all'esposizione universale di Parigi del 1878, vol. 1, Rome 1878, LXXXVI–CXXIII.

12 F. Giordano, Condizioni Topografiche e fisiche di Roma e della campagna Romana, in: Ministero dell'Interno, Direzione Generale di Statistica (ed.), Monografia della città di Roma, vol. 1, I–LXXXVI. Moreover, more than 70 legal measures had been taken to reduce the number of water-meadows and expand irrigation in the Roman countryside in the centuries before 1870.

It was not by chance that on 20 October 1870, one month after the Italian troops entered the city, the Ministry of Agriculture, Industry, and Commerce together with the Ministry of Public Works appointed a committee consisting of several prominent Italian engineers, agronomists, and deputies with expertise in land reclamation.[13] The *Regia Commissione per il Risanamento dell' Agro Romano* (Royal Committee for the Renewal of the Roman Countryside) was to devise "a set of legal, administrative, technical, and economic measures in order to promote land reclamation, irrigation, and renewal of the Agro Romano."[14] One of the committee members' major concerns was the limited extent of irrigation in the city's surroundings: In 1870, an area of less than 1,000 hectares was irrigated.[15] According to Roman landowners and tenants, this was primarily due to a lack of available water for irrigation.[16] This was only part of the problem, however. In fact, underground and surface water were relatively abundant in the area.[17] The scarcity of water for irrigation was not a matter of a physical deficit of water itself, but rather one of an absence of facilities for collecting and distributing it to landowners at affordable prices.[18] As a result, engineering projects were initiated over the following decades to implement a more efficient water system that included the draining of marshlands, sewer works, aqueducts, and widespread, organised irrigation.

As an example of this, the Roman municipal authorities signed an agreement in 1885 with the private water provider to the Italian capital, the *Società Acqua Pia Antica Marcia* (SAPAM) for the construction of a 25-kilometre-long water main through the east and south-east Roman countryside to provide water to eight centres of settlement and land reclamation at distances of six to eight kilometres from the city.[19] The volume of the *Carta Idrografica D'Italia* on the Roman region published in 1892 addressed the problem of irrigation of the Agro Romano in depth (see Figure 1).[20] Begun in the mid-1870s, the project of the *Carta Idrografica* continued for almost forty years; it was the product of heterogeneous institutional initiatives that overlapped and interlaced with each other.[21] The engineers who drafted the map of the Roman region were the head of the Hydraulics Department of the Ministry of

13 Mirella Scardozzi, La bonifica dell'agro romano nei dibattiti e nelle leggi dell'ultimo trentennio dell'Ottocento, in: Rassegna Storica del Risorgimento LXIII/2 (1976), 181–208, 181.

14 Ibid.

15 Atti della Giunta per l'Inchiesta Agraria e sulle Condizioni della Classe Agricola, vol. XI/I: Provincie di Roma e Grosseto, 306.

16 Bortolotti, Roma fuori le mura, 89.

17 Raffaele Canevari, Cenni sulle Condizioni altimetriche e Idrauliche dell'Agro Romano, in: Annali del Ministero di Agricoltura, Industria e Commercio, vol. 71, Rome 1874, 25.

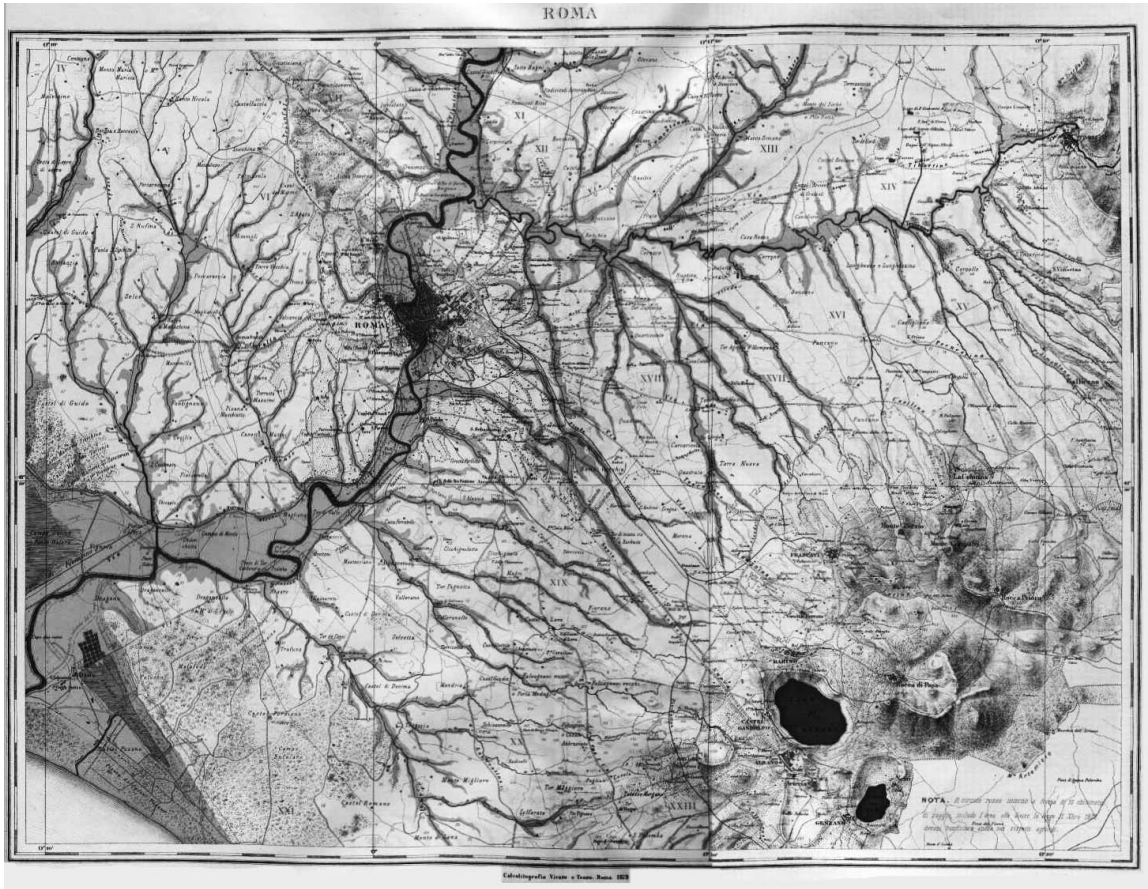
18 Ministero di Agricoltura, Industria e Commercio, Direzione Generale Agricoltura, Carta Idrografica D'Italia. Il Lazio, Rome 1892, 8–9.

19 S.P.Q.R. [official publication of the Rome City Council], Comune di Roma e Società dell'Acqua Pia Antica Marcia, Raccolta di documenti, Rome 1904, 3–4.

20 Ministero di Agricoltura, Il Lazio.

21 Alice Ingold, Cartografare le acque come risorse "naturali" nell'Ottocento: La "Carta Idrografica d'Italia" e gli ingegneri delle miniere, in: Contemporanea 13/1 (2010), 3–26, 6. On the long genesis of the project and the jurisdictional conflicts between the Ministry of Agriculture, the Ministry of Public Works, and the Ministry of Finance, see ibid., 6–11. See also Ingegneri e acquedotti nell'Italia unita, in: Paolo Buonora et al. (eds.), Gli ingegneri e l'Unità d'Italia. Saperi, usi, conflitti nel governo della città e del territorio (Atti del convegno Senato della Repubblica, Chiostro del Convento di Santa Maria sopra Minerva, Sala Capitolare, Roma 14–15 dicembre 2011), Rome 2012, 141–148.

Figure 1: Hydrographic map of the Roman area



Source: Ministero di Agricoltura, Industria e Commercio, Carta Idrografica D'Italia. Il Lazio, Rome 1892. Public domain.

Agriculture from 1888 to 1897 and his assistant.[22] Their plan was for the numerous streams crossing the Agro Romano to form the framework for a network of irrigation channels.[23] More specifically, they identified a set of streams in the Roman countryside within a range of ten kilometres from the city (Figure 1) that could be used for the regular irrigation of at least 2,000 hectares of land. According to the authors of the document, using the secondary watercourses of the lower basin of the Tiber for irrigation would have provided "a significant advantage to public health and a relief to the working classes, who in this way could find stable employment" in the agricultural sector.[24]

In short, starting in 1870, the Roman countryside was the target of numerous development projects and designs. One critical aspect of all these projects was that of finding and conducting water within the vast Agro Romano and providing it to landowners, tenants, and farmers at affordable prices. Moreover, as will be explained in more detail in the following section, water in the Roman area was a staple resource for many modernising projects at the turn of the twentieth century, in particular for industrial uses. This made the competition for water resources fierce – and also meant that agriculture was not necessarily the most economically rewarding use of water.

The waters of Rome

A constant and wide-reaching supply of drinking water was one of the first prerequisites for modern cities to transcend their traditional boundaries and expand into the surrounding territory. In 1871, the population of Rome – 244,484 people – was crowded into a space of little more than 400 hectares in close proximity to the River Tiber.[25] Fifty years later, the city had grown beyond the barrier of the ancient Aurelian Walls, and the boundaries between city and countryside had begun to blur in some areas of its eastern surroundings. The creation and expansion of a modern aqueduct was essential in this context. Prior to September 1870, Rome had been supplied by three aqueducts: the Vergine aqueduct, the Paolo aqueduct, and the Felice aqueduct. These structures were the products of restoration and reuse of ancient Roman aqueducts by the papal regime during the sixteenth and early seventeenth centuries.[26] As a result, the distribution of water they provided differed significantly from any modern concept of home water supply: They supplied public and semi-public fountains, washbasins for laundry, and watering places for animals; other branches served to irrigate private gardens, villas, and vegetable patches as well as for industrial purposes.[27] Private use was usually

22 Giuseppe Zoppi and Eugenio Perrone, see Ingold, Cartografare le acque, 16.

23 Ministero di Agricoltura, Il Lazio, 6–14.

24 Ibid., 14.

25 Eugenio Sonnino/Maria Rosa Protasi/Rossana Rosati, Aspetti Demografici, Sanitari e Territoriali di Roma dal 1870 al 1940, in: Roma Moderna e Contemporanea 1–2 (1999), 17–56, 52. The given number is the overall population of Rome as per 31 December 1871.

26 Katherine Wentworth Rinne, The Waters of Rome: Aqueducts, Fountains, and the Birth of the Baroque City, New Haven/London 2010, 43–52.

27 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.

limited to religious institutions (churches, monasteries, convents, hospitals) and the palaces of the Roman aristocracy.[28] Generally speaking, the three aqueducts were old facilities in need of continuous maintenance, the volume of water they could carry was limited, and their coverage network could hardly be expanded beyond the existing city.[29]

As a result, the expansion of the city after 1870 was interlaced with the development of the modern Marcio aqueduct (see Figure 2) constructed by SAPAM. The waterworks company was established in 1867 by a joint venture between British businessmen, the *Compagnie Générale de conduites de l'eau de Liege*, and the Roman aristocracy.[30] In fact, Pope Pius IX had conceded in 1865 to a group of British businessmen and the Italian architect Nicola Moraldi the right to exploit eight springs in the Aniene valley for 99 years in order to reconnect Rome to the most abundant water source in its entire region.[31] The total amount of water provided by these springs was 3,493 litres per second.[32] The construction of the necessary water catchment structures, the delivery mains, and the distribution network would take 60 years in total.[33] The first water main of the Marcio aqueduct was operational as early as September 1870, however, and by 1887 Rome was receiving a volume of 1,700 litres of water per second.[34] Water abundance was not the only positive feature of the Aniene springs: They were located 318 meters above sea level and thus at a higher altitude than any point of the vast, hilly territory of Rome and its surroundings.[35] With regard to water quality, they were also very pure (*purissime*) due to the absence of bacteria and other organic substances.[36]

The Marcio project would eventually provide an essential service outside the existing city of Rome as well, namely to its countryside and to urban settlements within 25 kilometres from the capital. For example, the Roman municipal authorities attempted in 1885 to expand the supply of drinking water to the eastern part of the city's countryside, and they sought the support of SAPAM to do so.[37] In December of the same year, the city council and SAPAM signed an agreement commissioning the latter to construct a 20-kilometre-long water main through the Agro Romano that would carry water to twelve water towers built by the Roman municipality for distribution to the same number of settlement centres at distances of six to eight kilometres from the city centre.[38] In addition, in order to provide for the needs of the rural population that could not afford a private water supply, the Roman authorities built eight public fountains, several watering places, and four washbasins.[39]

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28 Ibid., 130.

29 S.P.Q.R., Cinque Anni di Amministrazione Popolare a Roma 1907–1912, Rome 1912, 122–123.

30 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.

31 Ibid.

32 Stefano Battilossi, Acea di Roma 1909–2000. Da azienda municipale a gruppo multiservizi, Milan 2001, 165.

33 Ibid., 162.

34 Ibid., 165.

35 Angelo Celli/A. Bajardi/Oddo Casagrandi, Studio batteriologico sull'acqua Marcia delle sorgenti alla sua distribuzione: contributo alla batteriologia delle acque condotte e sorgive, in: Annali d'Igiene Sperimentale 4 (1903), 729–853.

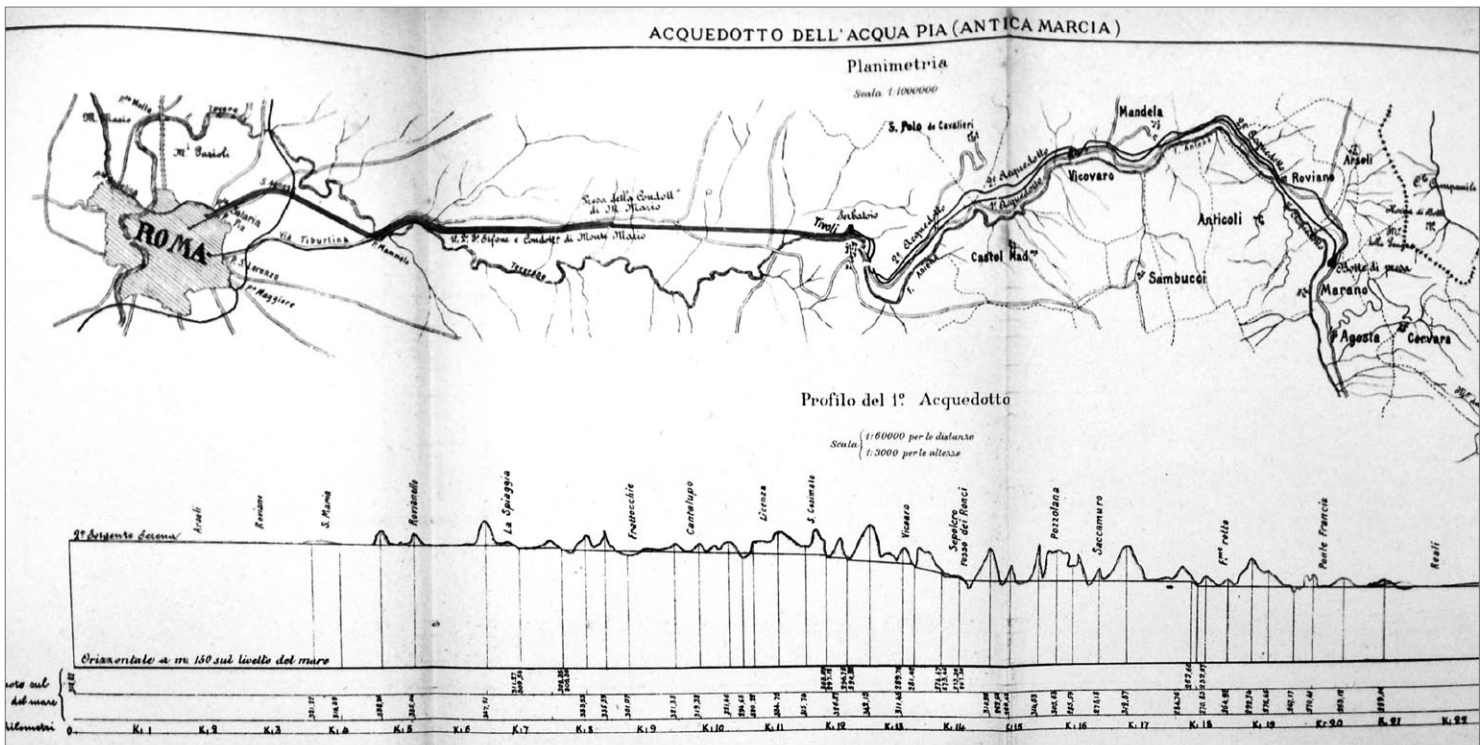
36 Angelo Celli, Relazione sulla analisi batteriologica sulle acque del sottosuolo di Roma, Rome 1886.

37 S.P.Q.R., Raccolta di documenti.

38 Archivio Storico Capitolino (ASC), Ripartizione V, Lavori Pubblici, Servizio Idraulico, Carteggio, busta 13, fascicolo 2.

39 Ibid.

Figure 2: The Marcio aqueduct



Source: Berno Domenico, Sull'acqua Pia (Antica Marcia) sua conduttura e distribuzione in Roma, Rome 1892. Public domain.

By 1903, the distribution network of the Marcio aqueduct spanned 250 kilometres and covered an area of 12,000 hectares from the Aniene valley to the port city of Fiumicino on the Tyrrhenian seaside, serving around 600,000 people.[40] As will be explained in detail in the final section, the supply of drinking water to these centres played a key role in shaping the early urbanisation of part of the Roman countryside.

Energy for the capital

The projects for the improvement of Rome were not limited to agricultural applications. Industry, and more specifically the production of energy, likewise played an important role in the development of the Italian capital. Until 1870, the city's illumination was provided by the *Società Anglo Romana Gas* (Anglo-Roman Gaslight Company), which had established a gasometer in the area of the Circo Massimo in 1852. The amount of energy produced by this enterprise was insufficient to assure a rapid modernisation of Rome, however.[41] As a result, the Italian government granted the Roman city council permission in 1881 to divert three cubic meters of water per second from the Aniene upstream of Tivoli, 25 kilometres east of Rome, to meet the city's energetic needs primarily related to street illumination, transport, and the establishment of various public manufactures.[42] However, this measure was never implemented due to the high costs of the undertaking and the strong opposition of the community of Tivoli.[43]

Nevertheless, the attempts to ensure sufficient energy to meet the growing needs of the capital received a boost from the rapid evolution of electric technology. In fact, applied engineering made amazing progress during the 1880s from the first practical application of electricity production and distribution by Thomas Edison in Menlo Park, California and on Pearl Street in New York.[44] During the International Exhibition at Turin in 1884, Lucien Gaulard and John Dixon Gibbs installed their transformers to light the exhibition buildings, the Turin railway station, and Venaria Reale (the Turin royal palace). Following this sensational event, numerous Italian businessmen, engineers, and politicians realised the great potential for production and distribution of electricity in a country like Italy that was poor in fossil fuels but rich in water and waterfalls.[45]

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40 Celli/Bajardi/Casagrandi, Studio batteriologico sull'acqua Marcia, 783.

41 Battilossi, Acea di Roma, 29–30.

42 Relazione della commissione composta dai consiglieri municipali Baccarini, Manara e Balestra, Sulle derivazioni d'acqua dall'Aniene, Rome, 31 December 1889, in: Archivio Centrale dello Stato (ACS), Fondo Ministero Agricoltura, Industria e Commercio (MAIC), Direzione Generale Agricoltura, Versamento V, busta 392.

43 Ibid.

44 Thomas P. Hughes, Networks of Power: Electrification in Western Societies 1880–1930, Baltimore/London 1983, 37–42.

45 Renato Giannetti, La conquista della forza: risorse, tecnologia ed economia nell'industria elettrica italiana 1883–1940, Milan 1985; Bruno Bezza (ed.), Energia e sviluppo, l'industria elettrica italiana e la società Edison, Turin 1986; Francesco Saverio Nitti, La conquista della Forza. L'elettricità a buon mercato. La nazionalizzazione delle forze idrauliche, Rome/Turin 1905; Alfonso Afan de Rivera, Acqua, Elettricità, Trazione, questioni ferroviarie urgenti, Naples 1898. The latter two works provide a comprehensive introduction to the debate about hydroelectricity among contemporaries in Italy at the turn of the twentieth century.

The Roman area was at the forefront of this development. In August 1886, a hydroelectric power station equipped with Gaulard/Gibbs transformers illuminated the city centre of Tivoli within a range of two kilometres, and a thermoelectric power plant equipped with transformers built by the Hungarian company *Ganz & Co.* was established in Rome in the same year by the Anglo-Roman Gaslight Company to supply several private manufacturing sites within a range of six kilometres.[46] Following the success of these first applications of electricity in the Roman context, the municipal authorities signed another contract with the Anglo-Roman Gaslight Company for the provision of hydroelectricity in 1889.[47] In order to realise this project, the company purchased the old papal powder factory in Tivoli and other disused industrial buildings, and the constructed power plant used four cubic meters of water per second from the Aniene.[48] The water was conducted through cast-iron pipes to nine Pelton hydraulic turbines that powered six single-phase generator modules producing 1,472 kW. This alternate-current, single-phase electricity was transported to Rome over 26 kilometres by way of overhead copper wires, where it was received by a substation equipped with 32 single-phase power transformers.[49] The first successful transport of energy between Tivoli and Rome was achieved on 4 July 1892, securing the Anglo-Roman Gaslight and (henceforth) Electricity Company the appreciation of the international engineering community.[50]

This event marked a new age of relations between Rome and its surrounding region. In fact, over the following decades, the Anglo-Roman Gaslight and Electricity Company progressively acquired the rights to exploit further rivers and waterfalls to produce electricity within an area extending from southern and eastern Lazio to southern Umbria.[51] By the 1930s, Rome boasted a vast hydroelectric hinterland that supplied its growing power needs.

It was by no means a linear and harmonious development process, however. Rather, many local communities perceived it as an effective dispossession of their right to water resources.[52] Moreover, producing electricity was not the only possible use for the Aniene's waters. In fact, an entire volume of the *Carta Idrografica D'Italia* was published on the river in 1891.[53] As with the aforementioned volume about the Roman region published in 1892, the author was the chief engineer of the Hydraulics Department of the Ministry of Agriculture, who stated that

46 Angelo Banti, Il primo traporto di energia elettrica a distanza Tivoli-Roma nel quarantesimo anniversario 1882–1932, Rome 1932, 56–57.

47 Azienda Comunale Elettricità e Acque di Roma, Raccolta delle convenzioni intercorse tra il Comune di Roma e la società Anglo Romana dal 1867 al 1912 per l'illuminazione a gas ed elettrica della città di Roma, Rome 1912, 85–129.

48 Banti, Il primo traporto, 7.

49 Ibid., 9–16. Here too, the electric materials were provided by *Ganz & Co.* of Budapest.

50 Ibid.

51 Ibid., 87–95.

52 Giampaolo Gallo, Illustrissimo signor direttore, grande industria e società a Terni fra Otto e Novecento, Terni 1983, 133–157. For example, in the 1910s, many Umbrian councils and institutions including the region's prefect tried to prevent the transport of energy produced by the hydroelectric station at Papigno near Terni to Rome.

53 Ministero di Agricoltura, Industria e Commercio, Direzione Generale dell'Agricoltura, Carta Idrografica D'Italia. L'Aniene, Rome 1891.

> "The River Aniene is very important for the capital of the Kingdom. Its copious springs provide [Rome] with the highest-quality and most abundant drinking water. It is the only watercourse that can provide Rome with a considerable motive force for its industrial development. Finally, the waters [of the Aniene] can irrigate a vast portion of the Roman countryside."[54]

Nevertheless, as mentioned in the first section, the fact that the same author was searching for alternative sources of water for the irrigation of the Roman countryside – in the shape of the secondary streams of the Tiber basin – one year later is evidence of the strong competition for the Aniene and the fact that many rural communities and activities had to find different sources for the water they needed.

Water, landscape, and the invention of an industrial faith

In the previous section, we learned that the Aniene was an important element in the projects for the renewal of Rome and its surroundings. The new modern aqueduct supplying Rome drew water from its springs, and the engineers of the Hydraulics Department of the Ministry of Agriculture began to focus on the potential motive force of the river for the town of Tivoli – and to a lesser extent on the creation of an irrigation channel for the Roman countryside.

At the turn of the twentieth century, Tivoli was a manufacturing city with 13,000 inhabitants situated on a rocky outcrop 25 kilometres east of Rome (see Figure 1).[55] During the fifteenth century, the community had built a barrage to protect the town from flooding by the Aniene. In addition, since the Renaissance, the river's waters had progressively been channelled into a complex underground network that conducted water to private and public fountains and various water mills – mainly to grind grain and olives – as well as to two ironworks, the above-mentioned powder factory, and a paper mill.[56] This made Tivoli the main manufacturing centre of the Roman area during the early modern period. In 1826, a devastating flood of the Aniene caused many casualties and the collapse of numerous buildings in the town.[57] As a result, the papal government provided funding and technical expertise for an ambitious infrastructure project involving the diversion of the river through two tunnels dug into the mountain above the town; the Aniene's overflow was discharged into an artificial waterfall upstream of the urban settlement by means of a set of sliders.[58] In summary, a complicated and multi-layered set of infrastructure facilities, regulations, and uses affected both the River Aniene and the local community. Moreover, the Tivoli waterfalls were considered

54 Ibid., 5.

55 Ministero di Agricoltura, Industria e Commercio, Direzione Generale della Statistica, Annali di Statistica, Statistica Industriale, fascicolo LXV, Notizie sulle condizioni industriali della provincia di Roma, Rome 1903.

56 Guido Pescosolido, Lo sviluppo industriale di Roma e del Lazio dal 1870 alla seconda Guerra Mondiale nella riflessione storiografica, in: Lucio Avagliano (ed.), L'Italia Industriale nelle sue regioni, bilancio storiografico, Naples 1988, 183–198.

57 Monsignor Francesco Saverio Massimo, Relazione storica del traforo nel Monte Catillo in Tivoli per l'inalveazione del fiume Aniene, Rome 1838.

58 Ibid.

one of the most spectacular sights of a Grand Tour, as evidenced by numerous paintings, drawings, and prints.[59]

As a result, the development projects for Rome and its environs that planned to use the Aniene had to take into account the presence of a local community that regarded the river as its material support and an element of its cultural identity. In 1884, three companies – the *Società Italiana per Condotte d'acqua* (Italian Water Conduits Company), the *Società per le Forze Idrauliche* (Hydraulic Forces Company), and *James Wilson & Co.* – submitted to the Italian Ministry of Public Works their ideas for collecting large amounts of water in and around Tivoli in order to dig an irrigation canal for the Roman countryside and produce energy. The projects presented by the first two companies envisaged diverting 12 to 15 cubic meters of water per second upstream of the famous *Cascatelle* waterfalls by means of a canal. The third project drafted by the engineer Vescovali and supported by the enterprise of *James Wilson & Co.*, on the other hand, planned to construct a dam downstream of the *Cascatelle*.[60]

Tivoli itself was naturally not indifferent to these plans, and thought particularly little of the former two ideas. In fact, these projects not only endangered the *Cascatelle*, which were among the most appreciated scenic attractions in Tivoli, but would also have effectively secured a monopoly over the relevant hydropower of the Aniene for the respective involved company. The terms of the matter were clearly stated by a respected citizen of Tivoli, Luigi Coccanari, subprefect of Mirandola, who said that

> "Tivoli has all the favourable conditions to become a relevant industrial centre and, if the government helps it, could compete with the most important centres of the world […]. As a result, if the waters were diverted from here to [different] industrial centres […], a huge national treasure […] would vanish […]. In addition, the specific beauties of one of the most studied and famous landscapes in the world would disappear. These beauties belong to the holy artistic heritage of Italy, which represents the Italians' most revered and illustrious primacy […]."[61]

He concluded with a rhetorical question: "Would the Italian Government allow the dispossession of what the Papal Government had reserved for Tivoli's manufactures and arts?"[62] These words subsume the key aspects of the strategy pursued by Tivoli to protect its material interests and unique landscape: The papal regime had effectively recognised the town's jurisdiction over the Aniene, and Tivoli had consequently managed the river for centuries –

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59 For an example, see Paris Musées, Tivoli: variations sur un paysage au XVIIIème siècle, exhibition catalogue, Paris 2010.

60 Raffaele Canevari, Relazione sulle operazioni e lavori della Società per le Forze Idrauliche e sul progetto da lei presentato pel Canale del Lazio, Rome 1885; Consiglio Superiore dei Lavori Pubblici, estratto dell'adunanza generale del 31 Maggio 1884, oggetto: domanda dell'Ingegner Cav. Vescovali per derivazione d'acqua dall'Aniene a uso di forza motrice e d'irrigazione, in: ACS, Fondo MAIC, Direzione Generale Agricoltura, Versamento V, busta 392; 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 per derivare acqua dal fiume Aniene ad uso d'irrigazione e forza motrice in seguito all'accesso sul luogo in adempimento al disposto del decreto prefettizio del 18 Aprile 1884, Rome 1886.

61 Luigi Coccanari, Le acque dell'Aniene in riguardo a Tivoli ed agli interessi Nazionali. Considerazioni del Cav. Luigi Coccanari a difesa dell'utile e del bello, Mirandola 1888, 4.

62 Ibid., 18.

secular rights that could not simply be disregarded by the new Italian leadership. In addition, Tivoli had the natural and social prerequisites to become an industrial centre. Finally, cultural heritage could not be sacrificed on the altar of modernity, as Coccanari highlighted:

> "Until the glorious miracle of Italian unification and independence, the ideals of the arts and those of the fatherland awakened Italy and made it respected in [the period of its] servitude. [There would be] trouble if the materialistic and immoral concept of *L'Argent fait tout* were to prevail even among us."[63]

Hence if Italy had to proceed along the path of modernity in order to reach its deserved position among the respected Western nations, it could not do so at the expense of its heritage, which represented a strong element of the Italian cultural identity. In short, the preservation of the *Cascatelle* was a valid argument to protect the material interests of Tivoli, since modernity and heritage went hand in hand in the Italian political discourse.

The members of the Tivoli city council were likely aware of this fact and made extensive use of the *Cascatelle* argument. In a particular deliberation that was published so as to assure the widest possible circulation of its contents, the council determined several conditions for its consent to any infrastructural projects to do with the Aniene.[64] The very first point of the list was that "the singular beauties of […] the Cascatelle must be preserved".[65] Nevertheless, these cultural aspects were not disconnected from more mundane material issues. In fact, the third point of the council's list stated that "a huge amount of water must be assured for the creation of a very important industrial centre in Tivoli; [in fact] this represents the foundation of the city's hopes, future, and resources."[66]

A further example of the connection between the protection of scenic beauty and the pursuit of material interests was provided in a political meeting convened by several civic organisations in Tivoli in June 1888 to reinforce the political stance of the town's citizenship on the use of the Aniene. The manifesto stated that "in order to reach our goal, namely to satisfy the needs of modern civilisation and preserve our artistic heritage, we trust in our rights and in our unity. It is not a matter of parties; it is a matter of our mutual benefit and of our future."[67]

This meeting was attended by several members of the Italian Parliament, including Menotti Garibaldi, the first son of the hero of the Italian Risorgimento. He reassured Tivoli's citizens by stating 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

63 Ibid., 16. Coccanari was referring to the defeat of the French army at Sedan in 1870 as a negative example of a country that had sacrificed the ideals of the arts and the fatherland in favour of material interests.

64 Comune di Tivoli, Sulla derivazione di acqua dall'Aniene. Memoria deliberata dal Consiglio Comunale di Tivoli nell'adunanza ordinaria del 25 Aprile 1888, Tivoli 1888.

65 Ibid., 8.

66 Ibid., 9.

67 Consiglio Comunale di Tivoli, Comizio Popolare per la questione delle acque dell'Aniene tenuto in Tivoli il giorno 10 Jun. 1888, Tivoli 1888, 4–5.

> of this meeting is to understand the criteria and hopes of the population of Tivoli […] since the destiny of Tivoli is to become the Italian Manchester or the Italian Le Creusot."[68]

Indeed, the protection of Tivoli's cultural heritage was accompanied by the creation of a political discourse that aimed to make the community the prime industrial district of the Roman area. One document expounding the historical rights of Tivoli to the Aniene explained that

> "Formerly the old Aniene had been the terror of our Tivoli [since it] devastated lands, destroyed houses, claimed victims. Now that our city has tamed it with enormous sacrifices, it is righteous and proper that [the Aniene] must be used for our ideals, for our hopes […] of becoming the Italian Manchester."[69]

It was unclear how a town of fewer than 15,000 inhabitants situated on a rocky outcrop that made transports to and from it difficult could become the "Italian Manchester". Nevertheless, it is worth noting that the early engineering projects concerning the Aniene also involved a significant rural element. The creation of a canal for the irrigation of the Roman countryside did not figure in the discussions among the local community, however. This likely played a role in the struggle for power over the river and in the practical realisation of the infrastructure projects. Indeed, the *Società Italiana per Condotte d'acqua* withdrew its proposal in 1885, instead focusing its attention and investments on the realisation of the Canale Villoresi, an irrigation canal with a length of 86 kilometres (taking into account only the main channel) leading from the River Ticino across the scarcely irrigated countryside north of Milan before emptying into the River Adda.[70] In 1891, Vescovali declared that he and *James Wilson & Co.* could abandon any project for irrigation of the countryside, since their main goal was the production of energy.[71] The *Società per le Forze Idrauliche*, which had been bought in 1887 by the Anglo-Roman Gaslight Company, likewise gave up its plan of a major irrigation canal for the Roman environs – thereby abandoning the first section of its canal that the engineer Canevari had already begun digging – in order to focus on more profitable investments into hydroelectricity.[72]

Ultimately, the community and city council of Tivoli accepted Vescovali's offer to build a dam downstream of the town:

> "[We] prefer the project of the engineer Vescovali, [even if this project] sacrifices the last fall of the peculiar and enchanting Cascatelle […] because this is less detrimental

68 Ibid., 11.

69 Consiglio Comunale di Tivoli, Memoria relativa ai diritti che ha la città di Tivoli sulle acque dell'Aniene presentata dalla commissione all'uopo incaricata ed approvata dal Consiglio Comunale nella seduta del 4 Maggio 1892, Tivoli 1892, 7.

70 Giorgio Bigatti, Il Canale Villoresi: Ipotesi, progetti, realizzazione, in: Giorgio Bigatti (ed.), Il Villoresi: l'ultimo naviglio, Trucazzano 2010, 31–104.

71 Vescovali to the Ministry of Agriculture, Industry and Commerce, Rome, 11 February 1890, in: ACS, Fondo MAIC, Direzione Generale Agricoltura, Versamento V, busta 392.

72 Banti, Il primo traporto, 7.

compared to the other [projects] […] which would undermine the efficiency and expansion of the manufacturing plants."[73]

This had an impact on the final decision regarding the projects. In fact, it was only few weeks later, on 20 August 1892, that the Prefect of Rome awarded the contract to Vescovali because his project "did not damage the interests of Tivoli since the water intake was […] after the water falls and the Cascatelle".[74] To be more precise, the Prefect determined that Vescovali could use all the water "that runs from the great falls and from the Cascatelle into the downstream riverbed" without depriving the community of Tivoli.[75]

However, the long decision-making process had caused Vescovali troubles, in particular concerning the collection of the financial resources necessary to realise his ideas.[76] When the engineer died in 1895, his project still existed only on paper,[77] and the Anglo-Roman Gaslight Company ultimately bought the water concession from his heirs in 1899.[78] In this way, the company was able to build a new power station in Tivoli that was supplied with a larger amount of water than the power station built in 1892.[79] The new power plant (*Nuova Acquoria*, see Figure 4) provided 68,000 kW, making it one of the main hydroelectric sources of Rome's power supply until the 1930s.[80] The construction of this facility altered the landscape of Tivoli, and the *Cascatelle* were partially canalised to produce hydroelectricity.[81] However, as will be further explored in the next section, this time there was no local "uprising" to protect the landscape. Rather, the fact that the produced electricity was enabling Tivoli's industrial dream to come true made the community quickly forget its natural beauties.

A missed turning point for Roman agriculture and the making of a mixed landscape

In the previous section, I explored the struggle for control of, access to, and distribution of the water of the River Aniene in Tivoli at the turn of the twentieth century. The final outcome of this struggle was the predominance of industrial uses of water over agricultural and landscape purposes. But what were the consequences of this result on the structure of the Roman area? For one thing, Tivoli developed an industrial economic basis. In fact, as early as 1903,

73 Consiglio Comunale di Tivoli, deliberazione del consiglio Comunale di Tivoli, sessione ordinaria di primavera. Oggetto: provvedimenti della proposta presentata dalla Giunta al Consiglio Comunale di Roma, in: ASC, Titolario post-unitario, Titolo 8 personale, busta 92, fascicolo 1, sottofascicolo 4.

74 Prefetto di Roma, Decreto di concessione derivazione d'acqua dall'Aniene, 20 Aug. 1892, in: ASC, Titolario post-unitario, Titolo 8 personale, busta 92, fascicolo 1, sottofascicolo 4.

75 Ibid.

76 Eredi Angelo Vescovali to the Prefect of Rome, 8 January 1896, in: ACS, Fondo Angelo Vescovali, scatola 2, MS 2/102.

77 Ibid.

78 Consorzio Idroelettrico dell'Aniene, Governatorato di Roma, Elettricità e gas di Roma, Gli Impianti di Tivoli, Rome 1929.

79 Banti, Il primo traporto, 7–9.

80 Ibid.

81 Ibid.

hydroelectricity supplied several large paper factories, an agricultural tools manufactory, a copper plant, two mechanical factories, a pasta factory, two oil factories, two textile plants, a tannery, a factory for the production of oxygen and hydrogen, two marble sawmills and one for wood, as well as several small electric power stations for the illumination of Tivoli and other towns in the Roman surroundings.[82] In addition, hydroelectricity allowed a faster connection between Rome and Tivoli by means of an electric railway.[83] This was obviously not sufficient to make Tivoli the anticipated "Italian Manchester", but it was enough to make the small town one of the most relevant industrial centres in the Roman area around 1900.[84]

At the end of the long struggle over the Aniene in Tivoli, water was used to produce electricity, and the local community exchanged its historical relations with the river for a ticket to the industrial revolution. Nevertheless, most of the energy produced in Tivoli and along the Aniene was conducted to Rome to facilitate the development of various industrial districts and the Roman public transport system.[85] Electricity usage in the capital increased rapidly from less than one million kW in 1895 to almost 50 million kW in 1912.[86] On the other hand, the Roman water infrastructure did not make much allowance for agricultural use of water, restricted the possibilities for water distribution, and allowed providers to regulate access to the resource by means of contracts and tariffs. As a result, the project for renewal of the Roman countryside was undermined by a lack of relevant infrastructure dedicated to the development of irrigated cultivation. Only minor watercourses and local sources of water remained available to those aiming to improve agricultural yields. How did this affect the projects of settlement and intensive cultivation of the Roman countryside?

A good case in point was that of Tor Pignattara, a rural settlement located alongside the Via Casilina, one of the ancient Roman consular streets, around six kilometres east of the Aurelian Walls (see Figure 3). As early as 1883, this settlement comprised a parish, a rural school, a rural health centre (*Stazione Sanitaria Rurale*), a police station (*Carabinieri*), some shops serving basic needs, and several facilities offering accommodation for permanent and seasonal workers.[87] The overall population of the community ranged between 300 and 500 inhabitants.[88] Its source of drinking water was the underground water main of the Marcio aqueduct, which supplied the local water tower, a public fountain, a washtub, and a watering place from 1889.[89] In addition, the area was crossed by a stream named Marranella, which local cultivators were forced to use for lack of an irrigation canal. In the 1900s, Tor Pignattara was attractive not only for rural workers from the Roman countryside but also for peasants escaping the overcrowded farmlands of Southern Italy in search of a better future. In fact,

82 Ministero di Agricoltura, Industria e Commercio, Direzione Generale della Statistica, Notizie sulle condizioni industriali della Provincia di Roma, 85.

83 Ibid., 8.

84 Grazia Pagnotta, Roma industriale, tra dopoguerra e miracolo economico, Rome 2009, 225. Tivoli remained one of the few industrial centres near Rome until after WWII. In the early 1950s, there were several relevant industrial plants in Tivoli, like a factory for military equipment, a Pirelli tyre factory, a cement plant, and marble quarries.

85 S.P.Q.R., Cinque Anni, 164.

86 Battilossi, Acea di Roma, 32.

87 Giuseppe Pinto, Le acque potabili dell'Agro Romano, Rome 1883, 52–53.

88 Ibid.

89 ASC, Ripartizione V, Lavori Pubblici, Servizio Idraulico, carteggio, busta 13, fascicolo 2, Distribuzione di cento once d'Acqua Marcia nell'Agro Romano, Tor Pignattara.

according to Stefania Ficacci, who has studied this particular Roman neighbourhood, the typical dwellers of villages like Tor Pignattara were migrants who had sold their small plots of land in southern Lazio or Abruzzo in order to raise money to start a family-run business.[90] Tor Pignattara offered low cost, tax-free lands, a growing population with increasing needs, and a relative proximity to the capital and its job opportunities. As a result, from 1910 onward and particularly after the Great War,

> "[a]longside the workshops of farriers, blacksmiths, inns and a coaching house [existing since] the nineteenth century, coffee toasting, bakeries, glassmakers, lamp factories, and raw material deposits appeared. All these activities discharged the residues of their industrial processing into the Marranella."[91]

The Marranella thus directly fulfilled the essential needs of a growing human settlement. In addition, the water of secondary streams was relevant within the Roman countryside at the turn of the twentieth century for the construction of buildings as well as for many other activities. In fact, even though Tor Pignattara was included in the administrative boundaries of the suburbs (a first step towards the formal inclusion of this rising neighbourhood in the city proper, and thus in the concerns of the municipal offices) in 1911, its connection to the city centre remained inconvenient. The railway encircling Rome created a barrier since transport was infrequent and expensive, and as a result only male workers employed in the city visited it regularly.[92] Many basic items like shoes, clothes, glasses or lamps had to be manufactured or repaired directly in the village. The Marranella therefore represented an integral part of the development of community, in particular because most of the mentioned activities required comparatively small quantities of water, making simple tools like buckets or hand pumps sufficient to satisfy the industrial water needs. In addition, since many of the inhabitants of Tor Pignattara had strong ties to rural culture – and also due to their financial situation – the type of houses they built were single-story buildings with one or two rooms and a small vegetable garden in the backyard to bolster the family's revenue.[93] The stream also represented a resource for this complementary activity.

By 1921, the population of Tor Pignattara had risen to 9,523,[94] and further urban settlements also began to appear alongside the Marranella at the time in close connection with the small town, which represented the commercial zone of the urban archipelago growing in the Roman countryside just outside the railways encircling the immediate suburbs.[95] The open water course of the river did not serve a specific purpose like an aqueduct or similar infrastructure facility; instead, it could be tapped by the various users according to their individual needs. As a result of the population growth and urbanisation of the area, what was originally a rural settlement slowly became part of the outskirts of Rome.

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90 Stefania Ficacci, Tor Pignattara. Fascismo e Resistenza di un quartiere romano, Milan 2007, 16.

91 Ibid., 17.

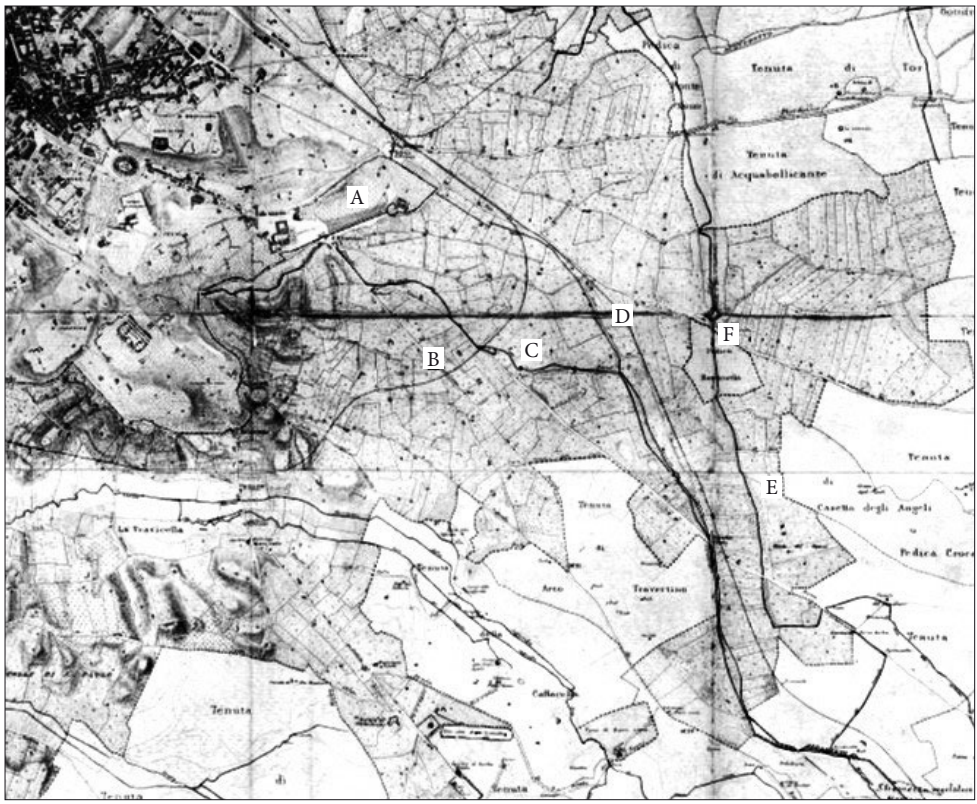
92 Ibid.

93 Mario Sanfilippo, La costruzione di una capitale, Roma 1911–1945, vol. 2, Cinisello Balsamo 1992, 106. See also Ficacci, Tor Pignattara, 14.

94 Mario Benigni, La Pastorale nelle Borgate Romane: Torpignattara tra il 1904 e il 1932, in: Ricerche per la Storia religiosa di Roma 3 (1979), 181–218, 183.

95 Ficacci, Tor Pignattara, 15.

Figure 3: Detail of the eastern suburbs of Rome, 1870



A: Aurelian Walls
B: Railway
C: Acqua Mariana canal
D: Felice aqueduct
E: Marranella
F: Tor Pignattara

Source: Filippo Troiani, in: Archivio Storico Capitolino (ASC), Fondo Capitolino/17719 (29), Digital collection, Piante e vedute di Roma e del Lazio, nineteenth century.

Another case in point was that of a suburb that appeared outside the Porta San Giovanni, enveloped by the Rome-Civitavecchia railway and intersected by the Acqua Mariana canal (see Figure 3), which was used for both agriculture and milling.[96] In 1870, the area in question was strictly rural. One of the first relevant changes in this regard occurred in 1889, when the Mediterranean Railways Company (*Società Strade Ferrate del Mediterraneo*) established a freight yard at an intersecting point between the Acqua Mariana canal and the Rome-

96 In Grottaferrata, the canal provided water to the aqueduct of the Saint Nile Abbey and to a public washing place.

Civitavecchia railway.[97] It is unknown whether the presence of the canal was a relevant aspect for the location of the freight yard, but it was certainly important for the actual construction of the buildings and other works related to the railway, since most of the building materials like concrete and various types of mortars and limes had to be processed and mixed directly at the construction site.[98] Contemporary building manuals and the regulations of the Public Works Department prescribed good practices for the processing of building materials, and water played an important role in these procedures: For example, it was used to wash building materials like sand to purify them as well as to prepare the building mixtures, which had to be done immediately before their application.[99]

As a result, the construction companies commissioned to realise the plans for the Tuscolana railway station entered into an agreement with the *Consorzio Privato dell'Acqua Mariana* (CPAM, Private Consortium of Acqua Mariana) that managed the canal stipulating the use of 300 cubic meters of water per day for the construction work, which lasted from June 1889 to the first months of 1890.[100] The project would not remain a singular event; in fact, between 1889 and 1891, the *Società Strade Ferrate del Mediterraneo* completed a new set of local railways, various train stations, and numerous roadman's houses in the Roman area. The canal water was often essential for completion of the respective construction works, as in the cases of the Frattocchie, Capannelle, and Ciampino stations.[101] In the course of the latter project, the CPAM also provided drinking water from the springs feeding the canal near Ciampino to assure basic public services such as drinking and washing as well as the filling of the locomotives' boilers.[102]

The nexus between the Acqua Mariana canal and the construction industry in the area was exemplified not only by the building projects linked to the expansion of the railway system. A further example of this relationship was provided in 1899, when a chemical fertiliser factory of the *Società Solfato di Rame* was constructed near the Tuscolana railway station. Here, too, the canal's water was crucial for the erection of the buildings.[103] The trend increased around 1910 within and outside of the sphere of influence of the CPAM.[104] Yet another link

97 Archivio di Stato di Roma (ASR), Consorzio Privato dell'Acqua Mariana (CPAM), busta 16, domande d'acqua fino al 1900, Impresa di costruzione, Fratelli Vitali e Travella to the President of the CPAM, Rome, 21 June 1889.

98 Giorgio Muratore (ed.), Cantieri Romani del Novecento. Maestranze, materiali, imprese, architetti nei primi anni del cemento armato, Rome 1995, 295–296.

99 Ibid. Muratore refers to a document by the Public Works Department on building norms. For an example of contemporary building manuals, see Carlo Formenti, La pratica del fabbricare, Milan 1893.

100 ASR, CPAM, busta 16, domande d'acqua fino al 1900, Impresa di costruzioni, Fratelli Vitali e Travella to the President of the CPAM, Rome, 17 June 1889, 21 June 1889, and 21 August 1889. See also the president's reply, Rome, February 1890.

101 ASR, CPAM, busta 16, domande d'acqua fino al 1900, Impresa di costruzioni, Cecchetti to the CPAM, Rome, 9 October 1889 and 15 February 1890; reply, Rome, 14 January 1890.

102 ASR, CPAM, busta 9, Strade ferrate del Mediterraneo/acquisti d'acqua, Copia autentica dell'istromento di vendita di tre oncie d'acqua mariana fatta dall Eccmo Consorzio della medesima a favore della Società Italiana per le strade ferrate del mediterraneo, Rome, 19 April 1890, Notaro Tommaso Monti.

103 ASR, CPAM, busta 16, domande d'acqua fino al 1900, Stabilimento Solfato di Rame to the CPAM, Rome, 14 April 1899.

104 ASR, CPAM, busta 11, Contravvenzioni e Citazioni, see for example Report by the Guardian to the President of the CPAM, Rome, 18 March 1909, 15 February 1910, 2 April 1912. See also CPAM, nota delle contravvenzioni elevate dal Guardiano, 16 December 1912 to 12 December 1913.

between the canal and the development of an industrial district was the relevance of water for many industrial processes. Besides power generation, the watercourse was also used to fill the boilers and condensers of various factories, to process grain and sugar in distilleries as well as sodium sulphate, sodium hydroxide, lye, and bleach in chemical factories, and for many other purposes.[105]

Another element with a certain importance for the spontaneous establishment of an industrial district was the relatively early electrification of the area. In fact, the CPAM began exploiting the canal for commercial purposes in order to fund the electrification of the syndicate plants in 1909. This involved an agreement with the Anglo-Roman Gaslight Company, which installed a grid of primary and secondary distribution lines and voltage transformers alongside the watercourse at the CPAM's expense.[106] This allowed freelancers and small entrepreneurs who established workshops and factories in the area to easily obtain a supply of electricity. The presence of a watercourse managed for industrial purposes thus attracted the establishment of industrial activities.

Finally, the Acqua Mariana canal also provided another important service for entrepreneurs and independent craftsmen: a possibility for the removal of industrial waste and human faeces. Prior to the installation of a proper sewer system in the community between 1918 and 1922, the canal represented the main waste disposal infrastructure. As early as 1900, 25 mostly illegal private sewers discharged their waste into the canal,[107] and the Mayor of Rome consequently had to forbid irrigation using Acqua Mariana water in 1901.[108] As a result, agriculture was marginalised in the area from the early 1900s and eventually gave way to the development of an industrial suburb.

Does this mean that the renewal of the Roman countryside ended up paving the way for uncontrolled urban expansion? Yes and no. Looking at the area of the Roman environs analysed in this chapter, we see that irrigated agriculture did also develop near the rural section of the Acqua Mariana canal, effectively from the Alban Hills to the vicinity of the industrial plants close to the Tuscolana railway station. In fact, starting in 1910, the CPAM worked in close connection with the Ministry of Agriculture to provide water for irrigation to many estates. One of these was the *Podere Saccardo*,[109] a ten-hectare plot of land that was still "an overgrown corner of the Agro Romano" at the turn of the twentieth century but by 1913 had become "a first-class horticultural estate" visited by the Italian royal couple.[110] Another example was the so-called *Roma Vecchia* estate owned by the Torlonia family, which to this

105 See for example ASR, CPAM, busta 9, Società Molini e Pastificio Pantanella, Copia contratto Consorzio Acqua Marina e Società Molini e Pastificio Pantanella per la concessione all'uso di sei once d'acqua, Rome, 21 December 1898. See also ASR, CPAM, busta 9, Società la Varecchina; ASR, CPAM, busta 9, Società Aerolievito Dr. De Vecchis and Co.; ASR, CPAM, busta 14, Società Cervisia Fabbrica Romana Lievito e Distillerie Italiane.

106 ASR, CPAM, busta 16, fascicolo relazioni diverse dal 1871, President of the CPAM to the consortium assembly, report, 15 February 1909.

107 ASR, CPAM, busta 19, Comune di Roma 1/inibizione di irrigazione, CPAM, rapporto di verifica degli imbocchi nel canale mariano degli spurghi di case e di fogne Rome, 11 May 1900.

108 ASR, CPAM, busta 19, Comune di Roma 1/inibizione di irrigazione, Mayor of Rome to the President of the CPAM, Rome, 12 May 1900.

109 ASR, CPAM, busta 15, fascicolo Saccardo Domenico, CPAM to Saccardo Domenico, contratto di fornitura di acqua per irrigazione nella stagione estiva 1916, Rome, 1 June 1916.

110 Onorato Traverso, L'esposizione al Podere Saccardo, in: Bullettino della Reale Società Toscana di orticultura, series 3, 18/5 (May 1913), 115–116.

Figure 4: The new power station of Tivoli

Source: Angelo Banti, Il primo traporto di energia elettrica a distanza Tivoli-Roma nel quarantesimo anniversario 1882–1932, Rome 1932. Public domain.

day remains one of the largest green areas of Rome and is partly cultivated.[111] In general, the riverine estates along the canal in the area between the Alban Hills and the intersection of the Acqua Mariana canal and the Felice aqueduct saw a rapid increase in irrigation and cultivation beginning in the 1910s.[112] Wherever infrastructure exclusively dedicated to agriculture existed, and where the offered supply covered the demands of medium and large estate owners, the chances of expanding the irrigated acreage and improving rural productivity increased. Conversely, where the uses of available water were not clearly defined and a myriad different users and purposes competed for access to it, rural applications were likely to yield to other, mostly industrial ones. Under this aspect, the outcome of the battle for the River Aniene in Tivoli marked a missed turning point for the Roman countryside, since part of the vast Agro Romano was subsequently structured according to urban and industrial priorities.

111 ASR, CPAM, busta 15, fascicolo Torlonia D. Giovanni, CPAM, Contratto d'affitto d'acqua per irrigazione a favore del Sig. P.D. Giovanni Torlonia per la tenuta detta Roma vecchia, Rome, 8 May 1916. The agreement lasted until 1930. The same applies to the estates on the boundaries between the Agro Romano and the Alban Hills (*Tenuta del Casalotto*, *Tenuta* of the Zootechnic Institute, *Tenuta Quadrato* or *Tor di Mezza Via*, *Tenuta di Gregna e Sant'Andrea*), were the use of water for rural purposes went uncontested.

112 Ibid.

Conclusion

In this article, we have followed the trajectory of a portion of the Roman countryside which, in the period between 1870 and 1922, changed from being an almost deserted pastoral region to a set of populous suburbs interspersed with rural areas. This transformation was facilitated by a set of overlapping agencies and contingencies that were connected – sometimes indirectly – by water. Together with the aqueducts, the simple resource of water collected into fountains and wells or conducted into artificial canals and natural streams caused thousands of people to move into the region. Why? The answer has to consider the material aspect of water. In fact, from a material point of view, water can be considered a flexible object enabling humans and machines to accomplish various tasks.[113] The ways in which access to water as well as its distribution and use were organised opened up a spectrum of activities it could support: A watercourse, or in this case a section of a watercourse managed for industrial purposes, promoted industrial uses and the creation of commercial districts. Conversely, where water was organised and managed for rural purposes, the likelihood of finding irrigated and fertile agricultural countryside increased. Nevertheless, the final choice of how to use water was always individual and thus corresponded to the expectations, purposes, and needs of the people and communities that employed it. The effect of individual choices on the manner in which water was used was more pronounced where control over the respective watercourse and the forms of its usage were not strictly determined, as in the case of Tor Pignattara. Here, a rural settlement became an urban island not least because the watercourse running through it was open to diverse and uncontrolled private utilization.

In the end, what does the socio-natural trajectory of Rome between 1870 and 1922 show in theoretical terms? If we wish to grasp how the process of socio-ecological transition unfolded in a specific context, we need to consider not only the role of infrastructure facilities for supplying the metabolism of cities and expanding the urban fabric beyond the traditional boundaries. We must also examine what type of infrastructures were realised and what were the possible alternative scenarios that could produce different landscapes. Furthermore, such analysis needs to consider how infrastructures and resources were used in the daily practise of the different people that lived in and developed the respective area.