WATERS AND WELFARE:
RIVERS, INFRASTRUCTURE, AND THE TERRITORIAL IMAGINATION IN GRAND DUCAL TUSCANY, 1549–1609

by

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Waters And Welfare: Rivers, Infrastructure, and the Territorial Imagination in Grand Ducal Tuscany, 1549–1609

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ABSTRACT

Over the central decades of the sixteenth century, the Tuscan ducal state formed in the midst of a flood crisis. A cooling climate, excessive rainfall, and deforestation, among other environmental changes now associated with the Little Ice Age, caused rivers and streams to more frequently and violently brim over and lay waste to urban and rural property. Under dukes Cosimo I de' Medici and his sons Francesco I and Ferdinando I, the Tuscan government founded specialized offices and appointed staffs of technicians and bureaucrats to rectify this disorderly aquatic topography. Studying the administrative and cartographic records they produced, in concert with environmental legislation, utopian development proposals, and manuscript and print treatises on architecture, engineering, and political economy, this dissertation explores the arduous practical and intellectual work of alluvial planning on the novel scale of the territorial state in the decades before alluvial hydraulics coalesced as a branch of the physical sciences.

Moving from the muddy labors of architects and engineers dispatched to mitigate flooding and project alluvial laws across ducal dominions, to the grandiose ideations of a new class of technocrats who proposed ambitious schemes for transforming intractable waterways into useful systems of commercial infrastructure, this dissertation argues that the problems of water elicited novel ways of imagining territory as a design problem. For the arrayed actors engaged in ordering this space, absolutist forms of planning emerged in the sixteenth century as attractive solutions for grappling with environmental crisis and securing state welfare in an increasingly interconnected and competitive world.

Beyond revealing the much earlier legacies of improvement ideologies and projects for infrastructurally-enabled capitalist circulation most often associated with Enlightenment Europe and global modernity, this research demonstrates that early political economy, as it developed in Renaissance Italy, was conceived as a fundamentally architectural enterprise. Challenging a prevailing tendency to view early modern territorial states as abstract or conceptual entities—relations of sovereignty, bundles of laws and rights crystallizing in bounded, Euclidean space—this research shows how in the crucible of the sixteenth century, states were also conceived as material creations to be physically sculpted at scale.

Thesis Advisor: Arindam Dutta
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Donetti pointed me in the direction of relevant sources at the Biblioteca Nazionale Centrale di Firenze and the Gabinetto dei Disegni e delle Stampe degli Uffizi, respectively. Brian Brege gave generously of his time and ideas on Tuscany's imperialist ambitions, which greatly enriched my thinking, while Leslie Geddes helped me to interpret Renaissance aquatic maps. Emanuela Ferretti clarified tricky archival questions, helped me to better understand the work of early modern aquatic engineering, and pointed me in the direction of valuable Italian scholarship in our field. Luca Mannori kindly gifted me his important book. And all along the way, a number of colleagues and friends engaged me in fruitful conversation and kept me company: Mathilde Bonvalot, Matteo Chirumbolo, Jason di Resta, Davide Ferri, Philip Geisler, Ingrid Greenfield, Sarah Guérin, Nicholas Herman, Stephanie Leitzel, Christine Kleiter, Linda Mueller, Steffi Schloerb, Lunarita Stirpetti, Robert Vogt, and Luc Wodzicki. Special thanks are owed to Alexandria Brown-Hedjazi, Brenna Larson, Ariella Minden, and Meta Valiusaityte, for cheering me on and keeping me going. I am also grateful to Michele Ricceri and Jane Ireland for opening their homes to me in Florence, a city that has since come to feel like a beloved second home.

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LIST OF ILLUSTRATIONS

A NOTE ON THE TEXT

Translations

All translations to English from Italian or Latin are my own. I quote in English in the body text, and provide the original Italian or Latin in the footnotes. As much as possible, I have endeavored in the footnotes to retain the original orthography of the source documents.

Abbreviations

I have used the following abbreviations to refer to archival collections, libraries, and reference texts:

ASA	Archivio di Stato di Arezzo
ASF	Archivio di Stato di Firenze
ASL	Archivio di Stato di Lucca
ASP	Archivio di Stato di Pisa
BR	Biblioteca Riccardiana
BNCF	Biblioteca Nazionale Centrale di Firenze
BM	Biblioteca Marciana
BRP	Biblioteca Roncioniana di Prato
DBI	Dizionario Biografico degli Italiani
GDLI	Grande Dizionario della Lingua Italiana
MAP	Medici Archive Project
RCT	Royal Collection Trust

Units of Measure

braccia	Unit of length equaling 21.6 inches
passo	Unit of length equaling 64.75 inches
staioro	Unit of area equaling 0.14 acre
panora	Unit of area equaling 1/12 of a *staioro* or 0.0117 acre

Dates

Until 1750, Florence and many other Tuscan cities celebrated the New Year on March 25, the feast of the Annunciation (the system is called the Stile dell'Incarnazione). I have adhered to this style, transcribing the dates as they appear in source documents. Any early modern dates from January 1 to March 24, then, would by our modern calendar be ascribed to the following year.

Money

During the early modern period, a range of different currencies were used in Italy, as in the rest of Europe. In this context, the preeminent money of account, based on an older

Carolingian system of accounting and lasting into the eighteenth century, was the £/s/d (lira, soldo, denaro) system, in which 1 lira = 20 soldi = 240 denari. In different places, these abstract values were converted into local minted currencies for everyday transactions. During the Republican period in Florence, this minted currency was the gold florin and smaller silver coins, the silver grosso and the denaro (introduced in 1252, 1237, and 1260, respectively). When initially minted, these Florentine coins corresponded briefly to the £/s/d system, but over time, they diverged from that money of account due to coin debasement and fluctuating price ratios between gold and silver. As this occurred, the florin also came to be used as a money of account.[1]

In the late fifteenth century, Florentines began to refer to the florin as a scudo or ducat, and from the early sixteenth century, the terms florin, scudo, and ducat were used synonymously in documents. Then in 1530, the ducal government replaced the gold florin with the gold scudo, which was valued at roughly 7.5 lire or 150 soldi in the mid-sixteenth century.[2]

In everyday usage, the coins used varied widely and changed over time, and it is difficult to render their values in modern terms. Historians typically rely on purchasing power to gain a sense of their values: in 1550, for example, the daily wage of a low-skilled construction laborer would have been approximately 12 soldi.[3] If such a worker were to be fined the 10 scudo penalty levied by the Ufficiali dei Fiumi from 1547 for disturbing riverbanks (for example), this would mean paying a fine equivalent to almost half (~40%) of his annual earnings.

[1] Richard A. Goldthwaite, *The Economy of Renaissance Florence* (Baltimore: Johns Hopkins University Press, 2009), 610–14.
[2] Goldthwaite, 56–57.
[3] Goldthwaite, 613.

INTRODUCTION

Sometime in 1534, Girolamo di Pace (1478?–1562), a hydraulic engineer from the Tuscan town of Prato, commenced a project that would occupy him for well over twenty years. Across four large paper sheets, each measuring almost one half meter tall by one to two meters in length, he composed a colossal cartographic study of the Arno River, Tuscany's principal watercourse and one of central Italy's longest rivers (figure 1).[1] Extending nearly six meters when placed end-to-end, these sheets pictured a 20-kilometer-long segment of the alluvial landscape immediately upstream and downstream of Florence, between the riverside town of Pontassieve-Rosano and the Florentine neighborhood of Ugnano, where the Greve Torrent flows into the Arno. Using a trace of umber ink and careful washes of brown, green, and blue watercolor, Girolamo depicted a scaled plan for canalizing and straightening the river to contain its erratic forces and mitigate its destructive effects in Florence and its countryside.[2]

In the main, Girolamo's proposal, preserved today in the Roncioniana Library in Prato, involved rectifying two large channel segments on either side of Florence. These were delimited on the plan by thick green bands, signifying planted lines of trees and shrubs, called *posticci,* meant to fortify the banks. The first segment runs upstream between the weirs of Rovezzano and San Niccolò, while the second continues downstream of the city from the Santa Rosa weir to the confluence of the Greve. Along both shorelines, stepped landings arranged symmetrically and at regular intervals would

[1] This study is catalogued in Loredana Maccabruni and Carla Zarrilli, eds., *Arno: fonte di prosperità, fonte di distruzione: storia del fiume e del territorio nelle carte d'archivio: mostra per il 500 anniversario dell'alluvione di Firenze (1966–2016)* (Firenze: Edizioni Polistampa, 2016), 58-60.
[2] Its scale is approximately 1:2600. Maccabruni and Zarrilli, 58.

have allowed boats to dock and ferries to transit from one side of the river to the other, linking waterborne traffic with the street network that stretched beyond the Arno's north and south banks. To the east, snaking across the study's final sheet, Girolamo showed the perilous journey the river followed on its way to his proposed channel. Here, in stark contrast with the neat lines that framed the rest of his design, frenetic swaths of blue seeped beyond the confines of the Arno's winding bed, marking out the lands and settlements vulnerable to the river's worsening depredations.

An eternal hazard for cities like Florence, alluvial flooding was becoming a critical issue in Tuscany. By the 1530s and 1540s, the Arno and other rivers in the region would swell to dangerously high levels during autumn and winter rains, breaching their banks with greater frequency than in the years before. As these successive inundations washed through the city, Girolamo seemed to tinker with his plan, studying the river's mighty current and evaluating the merits of different defensive strategies. At some point, for example, he returned to his final sheet, drawing a straight new channel from the Rovezzano weir to the mill at Girone to cut off the large and troublesome meander—a volatile flood zone—that wended its way between them (figure 2). Another later amendment can also be found downstream, on his first sheet. Here, the engineer traced two faint dotted lines to straighten the final stretch of the Greve (figure 3). This intervention would have moved the mouth of the torrent slightly to the east to flow into the Arno in correspondence with the Mugnone River, which came down to meet it from the north. By feeding these tributaries together into the Arno, their overlapping currents, he perhaps reasoned, might offset one another and minimize risks of corrasion along the opposing shore.

But for all the time Girolamo ruminated on this plan, updating his ideas in response to changes he observed in the river's behavior, he never toyed with that stretch of the Arno bisecting the intramural zone of Florence. In fact, the city's trace is conspicuously absent from his study altogether, leaving a ghostly Florence-shaped white space on the map (figure 4). This was no careless omission: Girolamo, as we will soon see, came to understand that allaying the dangers of alluvial disarray in the city required thinking expansively beyond the urban scale. Indeed, as he worked over the years to understand the vexatious problems of flooding, he continued to enlarge his perspective on the wider aquatic environment, and envisioned new ways to reorganize it.

He was not alone in doing so. An early protagonist in my story, Girolamo was among a growing class of technical and political operatives tasked by Florence's new ducal government to bring order to Tuscany's unruly waterways. While his particular plan for the Arno never came to fruition, leaving no paper trail and many unanswered questions about the precise conditions of its creation, his design bears clues that indicate he likely produced it in an official capacity, first as a Court technician and, from 1550, as state engineer and salaried bureaucrat.[3] For one, his inclusion of a master plan for the Cascine dell'Isola, at the time a private hunting park and agricultural estate of the Medici family, is a probable sign that Alessandro I de' Medici (r. 1532–1537), the young first Duke of Florence, was the proposal's intended audience. In this zone between the Arno's northern bank and the Mugnone, Girolamo traced a row of eight strip fields, flanked on

[3] Girolamo di Pace's name first appears in a bureaucratic list of salaries on 6 May 1550. ASF, Capitani di Parte Guelfa, Numeri Neri, 8, 147v. On the proliferation of permanent salaried positions within the ducal bureaucracy of Tuscany from the mid-sixteenth century, see R. Burr Litchfield, *Emergence of a Bureaucracy: The Florentine Patricians, 1530–1790* (Princeton: Princeton University Press, 1987), Pt. 2, "The New Bureaucracy of the Medici Dukes in the Sixteenth and Seventeenth Centuries," 65–126.

their east and west ends by two round ponds encircled by ring roads, and enclosed on all sides by forested tracts of land (figure 5). Whether or not this scheme addressed a specific commission, the occasion of revisioning the Arno seems to have presented Girolamo with an opportunity to engage the duke with an appealing geometrical design for his farm properties.[4] The map, moreover, bears signs of frequent handling, evincing its life as a working document. Deep crease lines indicate how it would have been folded, accordion-like, for possible transport across government offices and the ducal court. Girolamo's proposal, finally, may have even been priced out in whole or in part: a slip of paper appended to the map lists the tax contributions owed by landowners fronting the river to fund project expenses (figure 6). Because this form was heavily damaged, its entries can only be read in fragments, but lines scrawled across its cover sheet indicates that the tally was completed by men by the names of Mariotto di Pagolo and Niccolo di Chimenti, "estimators of the Mercanzia of Florence," the city's merchant court.[5] Commonly drawn up in the planning phases of large river works, estimates of this kind show how hydraulic projects were conceived as the collective burden of ducal subjects, and especially those who stood to benefit from them.[6] All said, the ducal government may very well have entertained Girolamo's proposal as a plausible course of action.

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[4] If this is true, it also evinced the practice, not infrequent in ducal Tuscany, whereby public works projects were seized on by the Medici princes as occasions to extract some sort of private benefit. As Giorgio Spini put it, "without a precise distinction between the public interest of the state and the private interest of the prince, he could voluntarily exercise his power to enrich himself." Giorgio Spini, "Introduzione," in *Architettura e politica da Cosimo I a Ferdinando I*, ed. Giorgio Spini (Florence: Leo S. Olschki, 1976), 15. See also Giuseppe Vittorio Parigino, *Il tesoro del principe: funzione pubblica e privata del patrimonio della famiglia Medici nel Cinquecento*, Accademia toscana di scienze e lettere "La Colombaria" 180 (Firenze: L.S. Olschki, 1999). For more on the relationship between the "private" and "public" realms in general in models of the early modern Italian state, see Giorgio Chittolini, "The 'Private,' the 'Public,' the State," *The Journal of Modern History* 67 (1995): S50–S55.

[5] BRP, Carta Fiume Arno. "Stima fatta per me mariotto di pagolo e niccolo di chimenti maniscalchi stimatori et ser della mercatantia della citta di Firenze: v^{o} mulo n^{o} con basto esua fornimenti per valuta di y 70 a stanza di giuliano salviati ne modi q contro a Francesco cignioni apresso a pagolacco."

[6] This was following an old tradition in Roman law, in which the public policing of waterways and

Although the ambitious scheme it depicted never came to fruition, I have chosen to spotlight this artifact because it is demonstrative of many of the aquatic and territorial planning practices and ideas explored in this dissertation. These include a growing sense, stemming from increased flooding, that Tuscan rivers were fundamentally disordered; a conviction that they should be useful, and configured in ways to support and augment the commercial economy; a surging, oftentimes utopian optimism about the political governance of nature, a space we today call the "environment"; and the materialization of what I call "aquatic territory" as a spatial and geographical category, in tandem with the appearance of a new kind of technocratic expert entrusted with its care and improvement. As we will see, the basic contents of Girolamo's map—the present state of the unruly watercourse, overlaid with different designs for reconfiguring its bed and the lands that bordered it—were iterated in various ways and in countless proposals from this period, written and drawn, realistic and speculative, executed and unrealized, to quell the worsening ravages of alluvial flooding and improve the utility of waterways to state and society.

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When Girolamo turned his hand to redesigning the Arno, Florence was emerging, after four decades of political upheaval, as the capital of a new ducal state. But its rise, at first, was shaky, and its independence far from assured.[7] During the Italian Wars,

construction of works to facilitate river navigation were to be funded by public taxes. The erection of embankment defense works, on the other hand, were in Roman law only mentioned as a private matter. Luca Mannori, *Il Sovrano tutore: pluralismo istituzionale e accentramento amministrativo nel principato dei Medici (Secc. XVI-XVIII)* (Milan: Giuffrè, 1994), 383–85.

[7] The history of the early ducal period, as recounted only briefly in the next few paragraphs, is told in vivid detail in Eric Cochrane, *Florence in the Forgotten Centuries, 1527–1800: A History of Florence and the Florentines in the Age of the Grand Dukes* (University of Chicago Press, 1973), 1–66; John M. Najemy, *A History of Florence 1200–1575* (Oxford: Blackwell, 2006), 446–468; and helpfully summarized in Ann E. Moyer, *The Intellectual World of Sixteenth-Century Florence: Humanists and Culture in the Age of Cosimo*

Florence had ricocheted repeatedly between Medicean and Republican hands as France battled Spain and the Holy Roman Empire for control of the peninsula.[8] The invasion of the city by the Spanish troops of Charles V in 1529 spelled an end to this violent cycle, for when Florence's republican government surrendered after nine months of siege, the Habsburgs, allied with Pope Clement VII, appointed Alessandro, Duke of Penne and illegitimate son of Lorenzo de' Medici, duke of Urbino, to lead the city. In 1532, this arrangement was formalized, with Alessandro declared "duke of the Florentine Republic," now a hereditary monarchy in all but name.

But the trouble had not yet passed: only five years later, Alessandro was assassinated by his own cousin, and in an emergency meeting, a council of elder statesmen appointed the 17-year-old Cosimo de' Medici, another cousin from a cadet branch of the family and the closest legitimate heir, to succeed the slain Alessandro. Given the vague title "*capo e primario*," Cosimo's power was tested soon thereafter when a faction of exiled Florentines hostile to Medici rule organized an army to overthrow him. In August of 1537, before the troops could reach the city, Cosimo defeated the uprising at Montemurlo in a victory that earned him the title of duke.

In the wake of this incredible turbulence, Cosimo I's ascension to the ducal throne after Montemurlo is often seen as a turning point in Tuscan history, the dawn of a prolonged era of peace and prosperity.[9] In many ways it was: finally secure in his

I (Cambridge, United Kingdom: Cambridge University Press, 2020), 1–28. On early attempts by the Medici rulers to assure the independence of the Florentine duchy, see Giorgio Spini, *Cosimo I e l'independenza del principato mediceo* (Florence: Vallecchi, 1980).

[8] For an overview of the Italian Wars, see Michael Mallett and Christine Shaw, *The Italian Wars, 1494–1559: War, State and Society in Early Modern Europe*, Modern Wars in Perspective (New York: Pearson, 2012).

[9] This was a central narrative of Eric Cochrane's study of Medici Tuscany. See his *Florence in the Forgotten Centuries, 1527–1800*, bk. I, "How Cosimo de' Medici turned a worn-out republic into a well-run monarchy," 1–92. It was also, as Ann E. Moyer has pointed out, a belief held by many of the writers

position, the young prince set out to restore some measure of stability in Florence and its countryside and consolidate his power over the state.[10] While Cosimo both retained some of the old city state's administrative structures and also established new ones, his government's chief priority lay in politically integrating the vast and heterogeneous dominions inherited from the Republic, a patchwork quilt of towns and villages with varied degrees of local autonomy that spanned the Arno River basin and a number of other neighboring river systems.[11] Yet as the new duke and his councilors worked to streamline government, centralize administration, define and fortify frontiers, and revive cultural and economic life in the ducal capital and across the state, their ambitions were often challenged by the threat of unruly waters.

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and historians who supported the Medici and lived through Cosimo's turbulent ascension to power: "They agreed, when they reflected later on the history of their city, that the turning point was the government of Duke Cosimo." See her *The Intellectual World of Sixteenth-Century Florence*, 4. As Alessio Assonitis and Henk Th. van Veen have suggested, their encomiastic writings on the duke (on which many 20th-century historians have relied) are probably one key reason for the admiring tone of much of the modern scholarship on Cosimo as duke. "Introduction," in *A Companion to Cosimo I de' Medici*, ed. Alessio Assonitis and Henk Th. van Veen, Renaissance Society of America Texts and Studies Series, volume 17 (Leiden: Brill, 2022), 1–4.

[10] This was especially true from 1543, when Charles V's imperial troops were withdrawn from the Fortezza da Basso, an urban fortress built into Florence's city walls to the northwest. This evacuation, which Cosimo secured with a payment to the emperor, granted him *de facto* independence, "though he was obliged to operate within an imperial orbit." Moyer, *The Intellectual World of Sixteenth-Century Florence*, 10.

[11] The literature on the formation and structure of the ducal state of Florence and grand ducal state of Tuscany is vast. For an orientation to the scholarship and the current scholarly consensus, see Andrea Gamberini and Isabella Lazzarini, "Introduction," in *The Italian Renaissance State*, ed. Andrea Gamberini and Isabella Lazzarini (Cambridge, UK: Cambridge University Press, 2012), 1–6; Jonathan Davies, *Culture and Power: Tuscany and Its Universities 1537–1609*, Education and Society in the Middle Ages and Renaissance, 34 (Leiden: Brill, 2009), chap. 1; and Luca Mannori, "Effetto domino. Il profilo istituzionale dello Stato territoriale toscano nella storiografia degli ultimi trent'anni," in *La Toscana in età moderna (secoli XVI–XVIII). Politica, istituzioni, società: studi recenti e prospettive di ricerca*, ed. Mario Ascheri and Alessandra Contini (Florence: Leo S. Olschki, 2005). Elena Fasano Guarini and Luca Mannori are leading scholars in this area, and their "pactist" model of the early ducal state—one in which the traditional communal privileges and statues of outlying towns coexisted, by means of a host of idiosyncratic agreements, with new overarching administrative structures and laws formulated at the center—is the one most widely accepted by historians today. See Elena Fasano Guarini, *Lo stato mediceo di Cosimo I* (Florence: Sansoni, 1973); Elena Fasano Guarini, "Potere centrale e comunità soggette nel Granducato di Cosimo I," *Revista storica italiana* 89 (1977): 491–538; Elena Fasano Guarini, "Center and Periphery," in *The Origins of the State in Italy, 1300–1600*, ed. Julius Kirshner (Chicago: University of Chicago Press, 1995), 74–96; Mannori, *Il Sovrano tutore*; Luca Mannori, "Il pensiero giuridico e storico-politico," in *Storia della civiltà toscana*, ed. Elena Fasano Guarini, vol. III: Il principato (Florence: Le Monnier, 2003), 311–32.

But they were also invigorated by it. In response to this situation, in the 1540s the Medici government began to take more targeted action, recruiting men like Girolamo to address the aquatic disorder afflicting their dominions. Trained as builders and artisans, architects and engineers, and sometimes as administrators and secretaries, these men were drawn from a variety of different spheres into the state's burgeoning bureaucratic orbit. Hired on as permanent functionaries, they were tasked, in an increasingly specialist capacity, with ordering Tuscany's unpredictable waterways. They were sometimes flanked by interlopers, within and beyond the Medicean bureaucratic machinery, allured by the challenges and rewards of working to improve state lands and waters. The collective efforts of this group at comprehending and resolving the urgent environmental, political, and economic problems of water, on the vast and largely unintelligible scale of the consolidating territory, form the subject of this dissertation—alongside the insights they developed, in the process, on the nature of early modern statecraft.

The Challenge of Aquatic Territory

In many ways, the problem before them was a novel one. This is not to say that waterways lay beyond government oversight earlier; to be sure, governments in Tuscany had since the communal era formed commissions to steward the surface waters within their jurisdictions and to legislate on their proper use and care.[12] But during the Middle Ages and early Renaissance, the region's acute political fragmentation precluded the

[12] The 1183 Peace of Constance, an agreement between Frederick I Barbarossa, Holy Roman Emperor, and the communal cities of the Lombard League, granted cities the right to manage and administer waterways, roads, and other state lands (considered part of the *iura regalia* that the Emperor conceded to the cities on the heels of his loss at the 1176 Battle of Legnano). Lorenzo Tanzini, "Le magistrature sulle acque nelle città comunali toscane," in *Fiumi e laghi toscani fra passato e presente. Pesca, memorie, regole*, ed. Franek Sznura (Florence: Aska Edizioni, 2010), 96.

management of entire watersheds by any single authority. Indeed, while neighboring municipalities sometimes collaborated to steward the roads and pathways that interlinked them, no such collaboration is attested for rivers. Rather, waterways were at once connective routes and highly contested resources, shared by private individuals and communities alike and frequently the object of heated disputes among them. Hostile towns were even known to weaponize watercourses in war, turning them at strategic points to either inundate or starve an enemy—a tactic Florence considered, as recently as the early sixteenth century, as a means of bringing an insurrectionist Pisa into submission.[13] The word "rivalry" can itself, in fact, be traced back to this context of ancient riparian contention: stemming from the Latin term *rivalis*, it referred to neighbors who shared the same river.[14]

Against this backdrop of fracture, the formation of the ducal state in sixteenth-century Tuscany and its progressive integration under the Medici princes made comprehensive administration of the territory's aquatic resources a novel political reality.[15] With the territorial state as their stage, the protagonists of my story sought ever

[13] In the early 14th century, for example, the Pistoiese diverted the Bure and Calice rivers to inundate Prato. Tanzini, 111–12. In 1430, when Florence was engaged in conflict with Lucca, Filippo Brunelleschi assisted the Florentine government by attempting to deviate the Serchio River away from Lucca. See Paola Benigni and Pietro Ruschi, "Brunelleschi e Leonardo: l'acqua e l'assedio," in *Leonardo e l'Arno*, ed. Roberta Barsanti (Ospedaletto-Pisa: Pacini editore, 2015), 99–129. Later, in 1503 and 1504, Leonardo da Vinci, Niccolò Machiavelli, and Piero Soderini worked with the Florentine government to plan a diversion of the Arno away from Pisa, although it was never executed. For more on this project, see Emanuela Ferretti, "Fra Leonardo, Machiavelli e Soderini. Ercole I d'Este e Biagio Rossetti nell'impresa «del volgere l'Arno» da Pisa," *Archivio Storico Italiano* 2, no. 117 (660) (2019): 235–72; Benigni and Ruschi, "Brunelleschi e Leonardo: l'acqua e l'assedio"; and Roger D. Masters, *Fortune Is a River* (New York: Free Press, 1998). Contrary to what Masters states, Ferretti points out that no evidence exists showing Leonardo's involvement beyond the project's initial planning phases, when the Florentine government took initial (aborted) steps to execute the diversion. Ferretti, "Fra Leonardo, Machiavelli e Soderini," 241, n.23.

[14] Lucien Febvre, "Sensibility and History: How to Reconstitute the Emotional Life of the Past," in *A New Kind of History: From the Writings of Febvre*, ed. Peter Burke, trans. Keith Folca (London: Routledge and Kegan Paul, 1973), 20. I am grateful to Erin Freedman for bringing Febvre's essay to my attention. See also Johannes C. Bernhardt, Markus Koller, and Achim Lichtenberger, "Mediterranean Rivers in Global Perspective," in *Mediterranean Rivers in Global Perspective* (Leiden: Brill, 2019), 2.

[15] Indeed, such centralizing forces were a prerequisite to any kind of state-wide public works management.

more ambitiously than in the centuries prior to redesign Tuscany's rivers to quell floods, reclaim land from water, and physically interconnect the state. During the rule of Cosimo and his sons Francesco I (r. 1574–1587) and Ferdinando I (r. 1587–1609), these men, many of whom staffed new waters, lands management, and defense bureaucracies established by the duchy, initiated hydraulic improvements that unfolded on a greater scale and frequency than in the centuries prior. Many such examples of these works will be discussed in the coming chapters.

To date, the history of early ducal Florence and Tuscany's sustained struggles to control water—its perennial and complex "*problemi delle acque*"—have inspired fruitful study across a range of subfields. Building on the foundational work of Giorgio Spini and his collaborators in the 1970s, historians of ducal politics have devoted significant study to the formation and development of the institutions that organized this labor in the watery landscape.[16] Preeminent among them was the Ufficiali dei Fiumi (Officers of the Rivers) of Florence, founded in 1549 as a branch of the Capitani di Parte Guelfa (Captains of the Guelf Party), an older Florentine land and property court to protect and order rivers by building defensive structures and reinforcements and by policing their uses.[17] They were complemented in these tasks by the Ufficiali dei Fossi (Officials of the

Mannori, *Il Sovrano tutore*, 277–79.

[16] See the essays in Giorgio Spini, ed., *Architettura e politica da Cosimo I a Ferdinando I* (Florence: Leo S. Olschki, 1976), especially Spini, "Introduzione"; Anna Cerchiai and Coletta Quiriconi, "Relazioni e rapporti all'Ufficio dei Capitani di Parte Guelfa - Parte I, Principato di Francesco I dei Medici," in *Architettura e politica da Cosimo I a Ferdinando I*, ed. Giorgio Spini (Florence: Leo S. Olschki, 1976), 185–257; and Anna Maria Galleriani and Benedetta Guidi, "Relazioni e rapporti all'Ufficio dei Capitani di Parte Guelfa - Parte II, Principato di Ferdinando I," in *Architettura e politica da Cosimo I a Ferdinando I*, ed. Giorgio Spini (Florence: Leo S. Olschki, 1976), 259–329.

[17] Cerchiai and Quiriconi, "Relazioni e rapporti - Parte I"; Galleriani and Guidi, "Relazioni e rapporti - Parte II"; Danilo Barsanti and Leonardo Rombai, *La "guerra delle acque" in Toscana: storia delle bonifiche dai Medici alla riforma agraria* (Florence: Edizioni Medicea, 1986); Leonardo Rombai, "La 'politica delle acque' in Toscana: un profilo storico," *Rivista geografica italiana* 99, no. 4 (1992): 613–50; Mannori, *Il Sovrano tutore*, 379–404; Giuseppe Pansini, "Le piante dei popoli e strade e lo stato della viabilità nel Granducato di Toscana alla fine del secolo XVI," in *Piante di popoli e strade. Capitani di*

Ditches) of Pisa, founded in 1547 to build and maintain urban sewers and ditches that drained the marshlands around that city, and to facilitate the work of river maintenance and flood defense in the Pisan countryside as well.[18] Analogous offices were later established for Siena and Pistoia (1561) and Grosseto (1581).[19] In concert with historians of architecture, planning, and geography, scholars of these administrations have empirically reconstructed a number of the principal hydraulic interventions planned and executed over the latter half of the sixteenth century and early years of the seventeenth, fleshing out a map of Tuscany's early modern aquatic territory—a space that emerges as distinctly wetter than the one we know today.[20] Yet a third body of work by cultural and art historians has examined the political symbolism of iconographies of aquatic control in

Parte Guelfa, 1580–1595, ed. Giuseppe Pansini (Florence: Leo S. Olschki, 1989), 7–19; Carlo Vivoli, "'Provisione, et ordini concernenti la iurisditione, et obligho delli Ufitiali de'fiumi, et lor ministri.' La legislazione medicea in materia di strade, ponti e fiumi," in *La legislazione medicea sull'ambiente*, ed. Giovanni Cascio Pratilli and Luigi Zangheri, vol. 4: Scritti per un commento (Florence: Leo S. Olschki, 1998), 75–94.

[18] On the Ufficiali dei Fossi and its predecessors, see Ranieri Fiaschi, *Le magistrature pisane delle acque* (Pisa: Nistri-Lischi Editore, 1938); Elena Fasano Guarini, "Regolamentazione delle acque e sistemazione del territorio," in *Livorno e Pisa: due città e un territorio nella politica dei Medici*, ed. Mario Mirri et al. (Pisa: Nistri-Lischi, 1980), 43–47; Danilo Barsanti, "Le piante dell'Ufficio Fiumi e Fossi di Pisa," *Società e storia* 10, no. 36 (1987): 479–81.

[19] Vivoli, "La legislazione medicea in materia di strade, ponti e fiumi," 84–87.

[20] See again Cerchiai and Quiriconi, "Relazioni e rapporti - Parte I", and Galleriani and Guidi, "Relazioni e rapporti - Parte II". Also: Marco Piccardi, *Tra Arno e Bisenzio: cartografia storica, fonti documentarie e trasformazione del territorio* (Signa: Comune di Signa, 2001); Leonardo Rombai, "Le acque interne in Toscana tra medioevo ed età moderna. Il caso delle Maremme," in *Incolti, fiumi, paludi. Utilizzazione delle risorse naturali nella Toscana medievale e moderna*, ed. Alberto Malvolti and Giuliano Pinto (Florence: Leo S. Olschki, 2003), 17–42; Emanuela Ferretti, "'Imminutus crevit': Il problema della regimazione idraulica dai documenti degli ufficiali dei fiumi di Firenze (1549–1574)," in *La città e il fiume: Secoli XIII–XIX*, ed. Carlo Travaglini, Collection de l'École française de Rome 394 (Rome: École française de Rome, 2008), 105–28; Emanuela Ferretti, "Il corso del fiume e le opere idrauliche," in *Navigare in Arno: acque, uomini e marmi tra Firenze e il mare in età moderna*, by Emanuela Ferretti and Davide Turrini, Le terre del Rinascimento. Quaderni didattici 1 (Firenze: Edifir, 2010), 9–26; Tanzini, "Le magistrature sulle acque nelle città comunali toscane"; Saida Grifoni and Leonardo Rombai, "Del dirizzare i corsi a'grandissimi fiumi: gli ingegneri dei fiumi e gli interventi idraulici nel bacino dell'Arno da Cosimo I a Ferdinando I," in *Fiumi e laghi toscani fra passato e presente. Pesca, memorie, regole*, ed. Franek Sznura (Florence: Aska Edizioni, 2010), 177–209; Emanuela Ferretti and Davide Turrini, "Regimare le acque e navigare il fiume. Il basso corso dell'Arno fra Medioevo ed Età Moderna," in *Leonardo e l'Arno*, ed. Roberta Barsanti (Ospedaletto-Pisa: Pacini Editore, 2015), 79–98; Saida Grifoni, *Lungo l'Arno: paesaggi, storia e culture: dal Falterona fin là dove il tosco fiume ha foce* (Florence: Aska, 2016).

courtly art, literature, and urban theatre. Many of these studies have suggested, for example, that fashioning an image of the prince as a kind of benevolent hydraulic despot was integral to legitimating his right to rule.[21] But despite the richness and range of these studies, they have tended, following the overwhelmingly encomiastic tones of a venerable tradition of ducal historiography, to present the Medici princes as exclusive shapers of watery territory.[22] While Cosimo and his sons were certainly "consummate project manager[s]"[23] and directly ordered certain interventions—above all, new water supply infrastructures in cities like Florence and Pisa,[24] but also some of the larger meander cuts along the Arno and select new canals, such as the Canale dei Navicelli—watery territory as an entity was far too complex for any one potentiate to manage independently. More than mere tools, the technicians and bureaucrats who worked within the ducal bureaucracies to carry out the daily work of aquatic policing, planning, and

[21] For example: Claudia Conforti, "L'invenzione delle allegorie territoriali e dinastiche del giardino di castello a Firenze," in *Il giardino come labirinto della storia: convegno internazionale, Palermo 14–17 aprile 1984*, ed. Gianni Pirrone (Palermo: Centro Studi di Storia e Arte dei Giardini, 1984), 190–97; Suzanne B. Butters, "Pressed Labor and Pratolino. Social Imagery and Social Reality at a Medici Garden," in *Villas and Gardens in Early Modern Italy and France*, ed. Mirka Benes and Dianne Harris (Cambridge: Cambridge University Press, 2001), 61–87; Felicia M. Else, "Controlling the Waters of Granducal Florence: A New Look at Stefano Bonsignori's View of the City (1584)," *Imago Mundi* 61, no. 2 (2009): 168–85; Suzanne B. Butters, "Princely Waters: An Elemental Look at the Medici Dukes," in *La Civiltà Delle Acque Tra Medioevo e Rinascimento*, ed. Arturo Calzona and Daniela Lamberini, Ingenium: Centro Studi L. B. Alberti, n. 14 (Florence: Leo S. Olschki, 2010), 389–411; Claudia Lazzaro, "River Gods: Personifying Nature in Sixteenth-Century Italy: Personifying Nature in Sixteenth-Century Italy," *Renaissance Studies* 25, no. 1 (2011): 70–94; Anatole Tchikine, "'L'anima Del Giardino': Water, Gardens, and Hydraulics in Sixteenth-Century Florence and Naples," in *Technology and the Garden*, ed. Michael G. Lee and Kenneth I. Helphand, Dumbarton Oaks Colloquium on the History of Landscape Architecture (Washington, DC: Dumbarton Oaks Research Library and Collection, 2014), 129–53; Emanuela Ferretti, *Acquedotti e fontane del Rinascimento in Toscana: Acqua, architettura e città al tempo di Cosimo I dei Medici*, Acquae. Studi e testi sulle terme 8 (Florence: Leo S. Olschki, 2016); Felicia M. Else, *The Politics of Water in the Art and Festivals of Medici Florence: From Neptune Fountain to Naumachia* (New York: Routledge, 2018).

[22] Two notable exceptions are Giovanna Casali and Ester Diana, *Bernardo Buontalenti e la burocrazia tecnica nella Toscana Medicea* (Florence: Alinea Editrice, 1983), and Gigi Salvagnini, *Gherardo Mechini architetto di Sua Altezza: architettura e territorio in Toscana, 1580–1620* (Salimbeni, 1983).

[23] Assonitis and van Veen, "Introduction," 3.

[24] On these, see Ferretti, *Acquedotti e fontane del Rinascimento in Toscana*.

construction were key agents in crafting landscapes and projecting ducal power across the space of the state. The chapters that follow therefore study in great detail the practices of these actors, who were entrusted with solving problems on the ground—with very literally "muddling through"[25]—to realize the aquatic order so urgently desired. The result, I hope, is a far more composite, intricate, and ultimately interesting story about how territory was controlled and created in practice. Rather than emerging as a natural outcome of some unmitigated and centralized mandate, this space, as we will see, formed as a product of these practitioners' ongoing and contingent labor, which involved anticipating risks, interpreting the meaning and scope of ducal laws, and understanding variegated environments.[26] Through their work, in government offices and across the countryside— empirical acts of surveying and tax collecting, recording, repairing, and building, debating and projecting—practical technicians, from architects to engineers to builders, embodied the power of the state in the landscape, while funneling to the metropole crucial information about the nature of the wider aquatic environment and proposals for how it ought to be managed and organized.

[25] Charles E. Lindblom coined the phrase "muddling through" to characterize an iterative approach to policymaking based on "a succession of incremental changes" which, as he argued, responds better to administrators' and politicians' more-often-than-not imperfect and limited state of knowledge about the social world than drastic, "once-and-for-all" propositions. See his "The Science of 'Muddling Through,'" *Public Administration Review* 19, no. 2 (1959): 79–88. James C. Scott endorsed the "science of muddling through" as an alternative to the blunt tool of high-modernist state simplifications. See his *Seeing Like a State: How Certain Schemes to Improve the Human Condition Have Failed* (New Haven, CT: Yale University Press, 1998), 327–28. For an elegant discussion of this incremental approach to planning in the context of the developmental state, see Sophus A. Reinert, "State Capitalisms Past and Present: The European Origins of the Developmental State," in *The Oxford Handbook of State Capitalism*, ed. Geoffrey T. Wood, forthcoming.

[26] I take inspiration here from Karl Appuhn's examination of the role of the Venetian *provveditore sopra boschi*, who, he states, "performed a double act of interpretation. For mainland residents he interpreted the intent and scope of Venetian forestry laws, and for the Republic's leaders he interpreted the extent and composition of the forest landscapes of the *terraferma*." Karl Appuhn, *A Forest on the Sea: Environmental Expertise in Renaissance Venice* (Baltimore, MD: Johns Hopkins University Press, 2009), 145.

As they labored to order and stitch together watery territory, moreover, these actors could not rely on any preexisting body of knowledge to guide them. Hydraulics and hydraulic engineering were, to be sure, burgeoning areas of practical and theoretical interest in fifteenth- and sixteenth-century Italy, supported by empirical investigation and renewed study of ancient texts.[27] But the ingenious water devices and hydraulic machines that so fascinated Renaissance architects and engineers in this period were, for the most part, localized water control measures—dams and locks, weirs and water screws, pulleys and pneumatic pumps—that did not involve manipulating rivers in a coordinated manner across their courses.[28] That particular feat remained an imposing technical challenge of an altogether different, even Icarian nature. Giorgio Vasari (1511–1574), for example, memorably cautioned on the travails of "tinkering with rivers" in his *Le vite de' più eccellenti pittori, scultori, e architettori* (1550 and 1568). In his life of Niccolò Tribolo (1500–1550), for example, he denounced the artist for "abandoning sculpture, in which it

[27] For an overview of hydraulic engineering during the Renaissance, see Sara Taglialagamba, "Hydraulics in Renaissance Science," in *Encyclopedia of Renaissance Philosophy*, ed. Marco Sgarbi (Cham: Springer International Publishing, 2020), 1–10, and Constantino A. Fasso, "Birth of Hydraulics during the Renaissance Period," in *Hydraulics and Hydraulic Research: A Historical Review*, ed. Günther Garbrecht (Rotterdam: Balkema, 1987), 55–79. See also Matteo Valleriani, "From 'Condensation to Compression': How Renaissance Italian Engineers Approached Hero's 'Pneumatics,'" *Übersetzung Und Transformation*, 2007, 333–53; Matteo Valleriani, "Sixteenth-Century Hydraulic Engineers and the Emergence of Empiricism," in *Conflicting Values of Inquiry: Ideologies of Epistemology in Early Modern Europe*, ed. Tamás Demeter, Kathryn Murphy, and Claus Zittel, Intersections: Interdisciplinary Studies in Early Modern Culture 37 (Leiden: Brill, 2015), 41–68.

[28] The literature on hydraulic devices and machines in the Renaissance is immense. For an orientation to recent studies, see the essays in A. Fiocca, Daniela Lamberini, and Cesare Maffioli, eds., *Arte e scienza delle acque nel Rinascimento*, 1. ed (Venezia: Marsilio, 2003), and Pamela O. Long, "Hydraulic Engineering and the Study of Antiquity: Rome, 1557–70," *Renaissance Quarterly* 61 (2008): 1098–1138; Tchikine, "'L'anima Del Giardino': Water, Gardens, and Hydraulics in Sixteenth-Century Florence and Naples"; Ferretti, *Acquedotti e fontane del Rinascimento in Toscana*; Pamela O. Long, *Engineering the Eternal City: Infrastructure, Topography, and the Culture of Knowledge in Late Sixteenth-Century Rome* (Chicago: University of Chicago Press, 2018); Sara Taglialagamba, "Leonardo's *Edifici d'acqua*," in *Leonardo Da Vinci: Nature and Architecture*, ed. Constance J. Moffatt and Sara Taglialagamba, Leonardo Studies 2 (Leiden: Brill, 2019), 330–44; Leslie A. Geddes, *Watermarks: Leonardo Da Vinci and the Mastery of Nature* (Princeton: Princeton University Press, 2020); Paolo Galluzzi, *The Italian Renaissance of Machines*, trans. Jonathan Mandelbaum (Harvard University Press, 2020).

may be said with truth that he was most excellent and caused everyone to marvel," to instead "attempt to straighten out the rivers" near Prato. His failure in this endeavor, as Vasari noted, "brought him blame and loss, rather than honor and profit," and portended his ignominious demise.[29] Perhaps chastened by the news of Tribolo's humiliation, the fortification engineer Giovanni Camerino (d. 1570) proceeded cautiously when asked by Cosimo's son and successor Francesco I to advise on repairs to the Montone River in eastern Tuscany. "In truth," he responded to Francesco, then prince-regent, "for never having troubled with rivers, I would not want to make any mistake that in exchange for holding honor, would return me to shame, though I will never fail to do what is recommended unto me."[30] What is cast into sharp relief in such utterances, and what this dissertation seeks to center, is just how difficult alluvial design and terraforming—and, relatedly, the material work of state building—were in this period. These tasks demanded strenuous and dangerous physical labor, to be sure, but they also imposed new epistemological problems. On the territorial scale, after all, it was impossible to build a workable model or test case for carving up the earth's surface, or to know in advance whether and by how much the likelihood of success offset the risk of disastrous failure. And while redrawing the courses of unruly rivers came to seem, over time, like a more conventional kind of technical procedure—an inevitable result, perhaps, of the slow accumulation of knowledge and experience gained over decades of work across the ducal

[29] "... così il Tribolo lasciando la scultura, nella quale si può dire con verità che fusse molto eccellente e facea stupire ognuno e datosi a volere dirizzare fiumi, l'una non seguitò con suo onore et utile, percioché non gli riuscí rassettare i fiumi e si fece molti nimici ...." Giorgio Vasari, *Le vite de' più eccellenti pittori scultori ed architettori nelle redazioni del 1550 e 1568*, ed. Paola Barocchi and Rosanna Bettarini, vol. 6 (Firenze: Sansoni, 1967), 482.

[30] ASF, Mediceo del Principato, 516a, fol. 960r, 31 July 1565, Giovanni Camerino to Francesco I de' Medici (MAP DOC ID# 20707). "Quanto all'assetare del fiume [Montone] mi dicie ch'io pensi al rimedio, di che in verità per non aver mai travagliato con fiumi non vorei far qualche errore che in cambio d'aver honore mi tornassi vergognia pur non mancherò mai a quanto mi commenderà."

dominions, and of theoretical advances in the study of river hydraulics by the students and associates of Galileo who, beginning around the 1630s, pioneered the "*scienze delle acque*" as a branch of the physical sciences[31]—it remained, for all of this, a no less challenging feat. Then, as ever, engineering environments was a delicate game.

The coming chapters not only reconstruct the working methods of state experts, however, but also attend to their ideas: the technical, political, and economic insights they developed as they carried out their work in the landscape. Drawing inspiration from the reciprocal cultural and material approaches of the Anglo-American tradition of environmental history[32] and the history of science and technology,[33] this dissertation

[31] The Cassinese monk and mathematician Benedetto Castelli is credited with inaugurating the theoretical study of fluid dynamics with his publication, *Della misura dell'acque correnti* (Stamparia Camerale, 1628). In this book, he articulated for the first time the hydraulic law of continuity, which described flow rates along a cross-sectional area. Taglialagamba, "Hydraulics in Renaissance Science," 5–6. Castelli's work is often seen as a turning point in early modern hydraulics, inaugurating the Italian so-called "science of waters." See Cesare Sergio Maffioli, *Out of Galileo: The Science of Waters 1628-1718* (Rotterdam: Erasmus Publishing, 1994); Cesare S. Maffioli, *La via delle acque (1500–1700). Appropriazione delle arti e trasformazione delle matematiche* (Florence: Leo S. Olschki, 2010).

[32] The literature is vast. Foundational studies include Donald Worster, "Appendix: Doing Environmental History," in *The Ends of the Earth: Perspectives on Modern Environmental History*, ed. Donald Worster, Studies in Environment and History (Cambridge: Cambridge University Press, 1989), 289–308; Keith Thomas, *Man and the Natural World: Changing Attitudes in England 1500–1800* (Penguin UK, 1991); William Cronon, *Nature's Metropolis: Chicago and the Great West*, 1st ed (New York: W. W. Norton, 1991); Donald Worster, *The Wealth of Nature: Environmental History and the Ecological Imagination* (New York: Oxford University Press, 1994); Carolyn Merchant, *The Death of Nature: Women, Ecology, and the Scientific Revolution* (San Francisco: Harper, 2000).

[33] Steven Shapin, *A Social History of Truth: Civility and Science in Seventeenth-Century England* (Chicago: University of Chicago Press, 1994), and Steven Shapin and Simon Schaffer, *Leviathan and the Air-Pump: Hobbes, Boyle, and the Experimental Life* (Princeton University Press, 2011) were both pathbreaking in situating the production of science in its social and political contexts. The work of Pamela O. Long and Eric H. Ash on early modern practical technicians and artisans has also been especially informative. See for example, Pamela O. Long, "Power, Patronage, and the Authorship of Ars: From Mechanical Know-How to Mechanical Knowledge in the Last Scribal Age," *Isis* 88, no. 1 (1997): 1–41; Pamela O. Long, *Openness, Secrecy, Authorship: Technical Arts and the Culture of Knowledge from Antiquity to the Renaissance* (Baltimore: Johns Hopkins University Press, 2001); Eric H. Ash, ed., *Expertise: Practical Knowledge and the Early Modern State*, Osiris, 2nd ser. v. 25 (Chicago: University of Chicago Press, 2010); Pamela O. Long, *Artisan/Practitioners and the Rise of the New Sciences, 1400–1600*, The OSU Press Horning Visiting Scholars Publication Series (Corvallis, OR: Oregon State University Press, 2011); Pamela O. Long, "Multi-Tasking 'Pre-Professional' Architect/Engineers and Other Bricolage Practitioners as Key Figures in the Elision of Boundaries Between Practice and Learning in Sixteenth-Century Europe: Some Roman Examples," in *The Structures of Practical Knowledge*, ed. Matteo Valleriani (Cham: Springer International Publishing, 2017), 223–46; Eric H. Ash, *The Draining of the Fens: Projectors, Popular Politics, and State Building in Early Modern England* (Baltimore: Johns

illuminates the connections between territorial planning in practice and the emergence of efforts to codify and theorize it as a technopolitical project. I will argue that the challenge Tuscan technocrats undertook to transform volatile and unpredictable rivers into useful networks of infrastructure led them to think about statecraft—about, quite literally, crafting territory—in a concrete, physical sense. It was the immense and intractable materiality of rivers that forced them to think in this way. Due to their dynamic fluidity and spatial expansiveness, waterways posed a unique set of issues, ones that do not readily appertain to other kinds of connective infrastructures. To flow in an orderly manner, after all, rivers and streams must be carefully regulated at every point along their routes. Unlike roads or footpaths, which can sustain their basic functions despite the occasional obstacle—overgrown brush here, a muddied dip there—watercourses can scarcely tolerate impediments, which act as destructive bottlenecks—"reverse salients," to borrow Thomas P. Hughes's expression[34]—that undermine the viability of the network altogether. In the early modern period, this meant that territorial flood mitigation demanded a means of conceptualizing aquatic territory as a homogeneous space, and acting upon it—at its margins and rural interstices, as much as at its metropolitan centers—as a vast and continuous *material* entity. Such a task, in turn, demanded centralized methods of technical and political coordination and action on the regional

Hopkins University Press, 2017); Long, *Engineering the Eternal City*. My ideas are also indebted to newer work that seeks to move past the nature-culture binary implicit in the separation of these fields: see for example Dolly Jørgensen et al., *New Natures: Joining Environmental History with Science and Technology Studies* (Pittsburgh, Pennsylvania: University of Pittsburgh Press, 2013).

[34] According to Thomas P. Hughes, "the historian finds reverse salients arising in the dynamics of the system during the uneven growth of its components and hence of the overall network ... in the case of a technological system, inventors, engineers, and other professionals dedicate their creative and constructive powers to correcting reverse salients so that the system can function optimally and fulfill system goals." *Networks of Power: Electrification in Western Society, 1880–1930* (Baltimore: Johns Hopkins University Press, 1983). I am grateful to Aleksandr Bierig for drawing this helpful analogy.

scale. Indeed, the challenges of managing this environmental system occasioned a novel line of argumentation among ducal technocrats in the new monarchical state about the merits of absolute rule, ideas that, while of a piece with the encomia, sermons, and commentaries of writers and historians of the Court (and conditioned by its social parameters) arose from a very different set of circumstances indeed: the pragmatic challenges of physically ordering a territory.[35] It is this logic of planning, this threshold of theorization that started to be breached in sixteenth-century Tuscany—about the relationship between the state as an abstraction, and the very real, physical spaces it controlled and which symbolized it—that makes environmental engineering in this particular time and place so illuminating,[36] and that we shall gradually trace over the course of the following chapters.

In fact, at a time when the Medici dukes endeavored to extend their authority over a collage of cities, towns, and feudal estates with varied degrees of local autonomy and customary privileges, the problems of water presented a unique arena for the practical advancement of homogenizing policies and integrationist ambitions. As early as the 1540s, for example, a succession of severe floods precipitated a slew of river protection laws that overrode preexisting local legislation and applied to all of Florence's dominions. In this sense, Tuscan waterways were emblematic of the kinds of "legal corridors" Lauren Benton described as holding together still-"lumpy" and "politically fragmented" space like a gigantic "tangle of strings."[37] Yet if a politically and legally

[35] On the Court sources and the more abstract political exigencies motivating their presentation of Cosimo and his sons as absolute rulers, see especially Samuel Berner, "Florentine Political Thought in the Late Cinquecento," *Il Pensiero Politico* Anno III, no. 2 (1970): 177–99, and Mannori, "Il pensiero giuridico e storico-politico," 323–24.
[36] I am grateful to Robert Fredona for encouraging me to think in these terms.
[37] Lauren Benton, *A Search for Sovereignty: Law and Geography in European Empires, 1400–1900* (Cambridge: Cambridge University Press, 2009), 12, 18.

unified alluvial regime could facilitate flood management and defense, it also suited the task of consolidating aquatic circulatory infrastructures to service the state's commercial economy. In addition to reorganizing the mint, treasury, and tax system, after all, the economic policies of Cosimo and his sons—what Judith C. Brown some decades ago memorably characterized as a systematic political economy—aimed chiefly at promoting industrial development throughout Tuscany.[38] A distinct territorial economic geography began to crystallize during his rule, with different zones increasingly specialized in specific extraction, manufacturing, or exchange, activities.[39] Such economic specialization and regional market integration depended vitally on the state's ability to create and maintain a viable network of roads and, crucially, rivers, which conveyed much heavier cargoes at less cost.[40] In this manner, well-ordered waterways—systems on the edge of nature and infrastructure—were both the causes and emblems of what Sophus

[38] Judith C. Brown, "Concepts of Political Economy: Cosimo I de' Medici in a Comparative European Context," in *Firenze e la Toscana dei Medici nell'Europa del '500*, vol. 1: Strumenti e veicoli della cultura; Relazioni politiche ed economiche (Florence: Leo S. Olschki, 1983), 279–93; Cesare Ciano, *I primi Medici e il mare. Note sulla politica marinara toscana da Cosimo I a Ferdinando I*, Biblioteca del Bollettino Storico Pisano 22 (Pisa: Pacini Editore, 1980), 9–10, 35. Sophus A. Reinert has made an especially forceful and compelling case for taking Medicean political economy seriously. See Sophus A. Reinert, "Introduction," in *A Short Treatise on the Wealth and Poverty of Nations (1613)*, by Antonio Serra, ed. Sophus A. Reinert, trans. Jonathan Hunt, Economic Ideas That Built Europe (New York: Anthem Press, 2011), 1–86, and Sophus A. Reinert and Robert Fredona, "Political Economy and the Medici," *Business History Review* 94, no. 1 (2020): 125–77.

[39] For instance, textile production (Florence and Pisa), agriculture (Siena and Grosseto), commercial imports and exports (Pisa and Livorno), mining (Pietrasanta, Montecatini di Volterra and Campiglia) and glassmaking (Prato, Montelupo, and Arezzo). See Brown, "Concepts of Political Economy," 286–87; Oscar Schiavone, "Cosimo I de' Medici and the Tuscan Territory," in *A Companion to Cosimo I de' Medici*, ed. Alessio Assonitis and Henk Th. van Veen (Leiden: Brill, 2021), 344; Franco Franceschi and Luca Molà, "Regional States and Economic Development," in *The Italian Renaissance State*, ed. Andrea Gamberini and Isabella Lazzarini (Cambridge, UK: Cambridge University Press, 2012), 444–66.

[40] On market integration as a key to economic growth in this period, see Stephan R. Epstein, *Freedom and Growth: The Rise of States and Markets in Europe, 1300–1750*, Routledge Explorations in Economic History (London ; New York: Routledge, 2000), and its discussion in the Tuscan case in Franceschi and Molà, "Regional States and Economic Development."

Reinert has dubbed a "Renaissance" variety of state capitalism and, as the final two chapters explore, powerful sites of a utopian circulatory promise.[41]

Indeed, while at its core a story about sixteenth-century Tuscany and its struggle to tame unruly rivers, this dissertation is also a study of the protean evolution of political economy before what Steven L. Kaplan and Reinert call the "economic turn" of the eighteenth century.[42] While a "gradual, cumulative process that touched upon much of Europe, with variable degrees of intensity and significant time lags from place to place," by the 1750s and 1760s, a new consciousness had taken hold in the self-styled "commercial societies" of Europe of the primacy of economic matters to all manner of affairs of government and public life.[43] But while those decades marked a kind of discursive watershed, broadly economic concerns—in their fully public sense, and not merely in terms of *oikonomia*, the ancient tradition of household management[44]—can also be traced back to much earlier moments.[45] Building upon the work of Judith C. Brown, Cesare Ciano,[46] and, more recently, Robert Fredona, Sophus Reinert, William Caffero, Maria Fusaro, Jeffrey Miner, Philipp R. Rössner, Corey Tazzara, Francesca

[41] Reinert, "State Capitalisms Past and Present". In a recent article, Philipp Robinson Rössner observed that early modern writers were often adamant about the "vivacity of circulation," a concept that went far beyond money, monetary circulation, or the velocity of money, capturing social and economic dynamics in a wider sense." While speaking of eighteenth-century German cameralist writers, such imagined vivacity can be traced back to sixteenth-century Italy. See his "Introduction: Cameralism, Capitalism, and the Making of the Modern Economic Mind," *History of Political Economy* 53, no. 3 (June 1, 2021): 381.
[42] Sophus A. Reinert and Steven L. Kaplan, "The Economic Turn in Enlightenment Europe," in *The Economic Turn: Recasting Political Economy in Enlightenment Europe*, ed. Sophus A. Reinert and Steven L. Kaplan (London: Anthem Press, 2019).
[43] Reinert and Kaplan, 1. As they explain, "it involved primordially the economic sphere ... but not just, for we construe the 'economic' as simultaneously material and symbolic, as relating to the production, distribution and consumption of goods and services, but also to their organization and regulation, to the discourses that generate or are generated by these practices, and to the conflicts that are inseparable from them."
[44] Xenophon, *Xenophon: Memorabilia. Oeconomicus. Symposium. Apologia.*, trans. E. C. Marchant and O. J. Todd (Cambridge, MA: Harvard University Press, 1923).
[45] Reinert and Kaplan, "The Economic Turn," 4.
[46] Brown, "Concepts of Political Economy"; Ciano, *I primi Medici e il mare. Note sulla politica marinara toscana da Cosimo I a Ferdinando I.*

Trivellato, and many others, who have trailblazed a vibrant "new history of political economy" that reveals the societies and states of the Italian Renaissance to have been an especially fruitful ground for the development of a novel kind of capitalist consciousness ranging across private enterprise and government alike,[47] this dissertation explores interconnected efforts to create and theorize some of its most fundamental spatial and material preconditions. By studying how engineers and government advisors sought to make aquatic territory *useful*—by attending to the problems they saw as they traversed and gazed upon the landscape, and the precise nature of and justifications for the environmental and infrastructural solutions they proposed and debated in an effort to rectify it—one of my aims in the following chapters is to demonstrate how early conceptions of political economy, rooted in the promise of boundless and unfettered circulation, both domestically and abroad, can be traced back in part to efforts to improve the waterways of the ducal countryside. Indeed, the insights of technocrats who worked to overcome these practical challenges evince the much wider social diffusion of early political-economic discourse in the early modern Mediterranean world. While much has appropriately been made, for example, of the merchant as a primordial kind of "Economic Man" and special bearer of political-economic expertise, [48] my story reveals

[47] For a helpful orientation to this growing scholarship, see Robert Fredona and Sophus A. Reinert, "Italy and the Origins of Capitalism," *Business History Review* 94, no. 1 (2020): 5–38, and the other essays in their co-edited special issue, "Italy and the Origins of Capitalism," *Business History Review* 94, no. 1 (2020), which emerged from a conference held at the Harvard Business School on March 1, 2019.

[48] The literature on the importance of merchants in the development of capitalism is vast; for an overview of this historiography, much of which is by an early generation of business historians active from the 1930s to the 1960s, see Fredona and Reinert, "Italy and the Origins of Capitalism". On this theme, see also Sophus A. Reinert and Robert Fredona, "Merchants and the Origins of Capitalism," in *The Routledge Companion to the Makers of Global Business*, ed. Teresa da Silva Lopes, Christina Lubinski, and Heidi J. S. Tworek (London: Routledge, 2019), 171–88, and Reinert and Fredona, "Political Economy and the Medici". On mercantile expertise, see Eric H. Ash, *Power, Knowledge, and Expertise in Elizabethan England* (JHU Press, 2004); Thomas Leng, "Epistemology: Expertise and Knowledge in the World of Commerce," in *Mercantilism Reimagined: Political Economy in Early Modern Britain and Its Empire*, ed. Philip J. Stern and Carl Wennerlind (Oxford: Oxford University Press, 2014), 98–113; Sophus A. Reinert,

how the interests of this group were shared and advanced by a constellation of state actors, from practically-trained architects, engineers, and technicians, to learned administrators and cameralist advisors, who came to recognize that supporting the development of industry and commerce—not only through fiscal policy and incentives, but by *physically* ordering the territory and its waterways to mitigate the destructive chaos of flooding and provision the infrastructures that, as one observer put it, "liberate the going and coming to everyone"[49]—would redound to the worldly benefit of all.[50]

Attending to this past also helps us to see, then, how prevailing narratives about the origins of natural improvement and infrastructural projects as consciously-planned, meliorist state enterprises typically begin far too late. Due on the one hand, perhaps, to the enduring influence of Marxian and Weberian theories of political economy and state formation, and, on the other hand, to a countervailing urban bias underlying the venerable tradition of Anglo-American studies of Renaissance and early modern Italy,[51]

"Authority and Expertise at the Origins of Macro-Economics," in *Antonio Serra and the Economics of Good Government*, ed. Rosario Patalano and Sophus A. Reinert, 2016, 112–42.

[49] Scipione Ammirato, *Discorsi del signor Scipione Ammirato sopra Cornelio Tacito, nuovamente posti in luce* (Florence: Filippo Giunti, 1598), 305.

[50] As Robert Fredona points out, lawyers and jurists constitute an important third constellation of actors that demand scholarly attention in this history: "until we take the jurists of the thirteenth through the sixteenth centuries seriously," he writes, "we remain ignorant of the bulk of the prehistory (no, history) of the practical and theoretical interactions of government and merchants, of states and commerce, indeed of "political economy" *avant la lettre*. Robert Fredona, "Angelo Degli Ubaldi and the Gulf of the Venetians: Custom, Commerce, and the Control of the Sea Before Grotius," in *New Perspectives on the History of Political Economy*, ed. Sophus A. Reinert and Robert Fredona (New York, NY: Springer Berlin Heidelberg, 2017), 29–73; See also Corey Tazzara, *The Free Port of Livorno and the Transformation of the Mediterranean World* (New York and Oxford: Oxford University Press, 2017), 14.

[51] As far back as 1995, in fact, Edward Muir noticed that "although ecological politics had its origins in the United States and ecological histories of North America are now commonplace, English-speaking *italianisti* have completely passed over the topic." Edward Muir, "The Italian Renaissance in America," *The American Historical Review* 100, no. 4 (1995): 1117–18. While this urban bias is present in much earlier Italian historiography as well, scholars in Italy have, especially since the 1980s, developed a rich body of work in the area of rural and agricultural history. For a bibliographical survey of this scholarship, see Alfio Cortonesi and Susanna Passigli, *Agricoltura e allevamento nell'Italia medievale: contributo bibliografico, 1950–2010*, Reti medievali 26 (Firenze, Italy: Firenze University Press, 2016). I am grateful to Robert Fredona for directing my attention to this collection. But environmental histories of Italy, especially for the early modern period, while growing in recent years, are still relatively rare. In their

environmental, economic, and political historians have tended to focus on the histories of profit-driven natural management and terraforming enterprises as they took form in the large imperial states of seventeenth- and eighteenth-century northern Europe.[52] From England to Scotland to France to Germany to Sweden, scholars have not only uncovered the economic motivations underlying assorted enclosure, scientific agriculture, canal construction, and drainage schemes (to name only some such endeavors), but also have also linked them to burgeoning utilitarian and capitalist imaginaries in these cultures about the wealth-producing potentials of an ordered natural world.[53] Yet all these

magisterial survey (written in Italian) of environmental history as a field, Marco Armiero and Stefania Barca not only paint a helpful picture of the main directions this scholarship has taken, but also seek to correct the shortcomings they see in Italian historiography's slow and halting engagements with its methods. See their *La storia dell'ambiente: un'introduzione* (Rome: Carocci Editore, 2004). In a similar spirit, in their call for bringing approaches from the environmental humanities to bear on studies of Italy, Serenella Iovino, Enrico Cesaretti, and Elena Past recently asked, "What does this reconsideration mean for a country steeped in the tradition of humanism and the Renaissance, with their emphasis on human potential and accomplishments, and later shaped by the neo-idealistic philosophy of figures such as Benedetto Croce and Giovanni Gentile and their privileging of a dematerialized mind over the tangible claims of the physical world?" See their "Introduction," in *Italy and the Environmental Humanities: Landscapes, Natures, Ecologies*, ed. Serenella Iovino, Enrico Cesaretti, and Elena Past, 2017, 5.

[52] Karl Appuhn's work on Venice and its *terraferma* is a notable exception. See his "Inventing Nature: Forests, Forestry, and State Power in Renaissance Venice," *The Journal of Modern History* 72, no. 4 (2000): 861–89, and *A Forest on the Sea: Environmental Expertise in Renaissance Venice* (Baltimore, MD: Johns Hopkins University Press, 2009).

[53] Thomas, *Man and the Natural World*; Chandra Mukerji, *Territorial Ambitions and the Gardens of Versailles* (New York, NY: Cambridge University Press, 1997); Richard H. Drayton, *Nature's Government: Science, Imperial Britain, and the "Improvement" of the World* (New Haven, CT: Yale University Press, 2000); Margaret Schabas and Neil De Marchi, *Oeconomies in the Age of Newton* (Durham, NC: Duke University Press, 2003); Margaret Schabas, *The Natural Origins of Economics* (Chicago: University of Chicago Press, 2005); Paul Warde, *Ecology, Economy and State Formation in Early Modern Germany*, Cambridge Studies in Population, Economy, and Society in Past Time 41 (Cambridge, UK: Cambridge University Press, 2006); Chandra Mukerji, *Impossible Engineering: Technology and Territoriality on the Canal Du Midi* (Princeton: Princeton University Press, 2009); Fredrik Albritton Jonsson, "Rival Ecologies of Global Commerce: Adam Smith and the Natural Historians," *The American Historical Review* 115, no. 5 (2010): 1342–63; Fredrik Albritton Jonsson, *Enlightenment's Frontier: The Scottish Highlands and the Origins of Environmentalism*, The Lewis Walpole Series in Eighteenth-Century Culture and History (New Haven: Yale University Press, 2013); Fredrik Albritton Jonsson, "Natural History and Improvement: The Case of Tobacco," in *Mercantilism Reimagined: Political Economy in Early Modern Britain and Its Empire*, ed. Philip J. Stern and Carl Wennerlind (Oxford, UK: Oxford University Press, 2014), 117–33; Vittoria Di Palma, *Wasteland: A History* (New Haven: Yale University Press, 2014); Paul Slack, *The Invention of Improvement: Information and Material Progress in Seventeenth-Century England* (Oxford, UK: Oxford University Press, 2015); Eric H. Ash, "Reclaiming a New World: Fen Drainage, Improvement, and Projectors in Seventeenth-Century England," *Early Science and Medicine* 21, no. 5 (2016): 445–69; Ash, *The Draining of the Fens*; David Alff, *The Wreckage of*

enterprises were premised on a much older idea, first theorized in Italy and then emulated elsewhere, that it was the state's duty to govern and design this space in ways that stimulated industrial and commercial development.[54] Indeed, when Adam Smith, like any number of other eighteenth-century economic thinkers, called "good roads, canals, and navigable rivers … the greatest of all improvements," he was merely echoing an older chorus of precepts articulated 200 years prior—and perhaps even earlier than that—in Tuscany.[55]

In its focus on these constructed, material infrastructures, this dissertation also contributes to histories of architecture and planning in Renaissance Italy, first and foremost by arguing for a radical expansion of the range of its objects and scales of investigation beyond the design of edifices and monuments. Although it is an accepted truth today that architecture as a discipline and profession dedicated to building design first emerged during the Renaissance, this view is more a product of nineteenth- and early-twentieth-century historiographies than it is of the full richness of architectural thought and activity during the fifteenth and sixteenth centuries in Italy and other parts of Europe. In fact, throughout this period architecture remained a highly promiscuous discipline, and was understood by contemporaries as such.[56] In practice, after all, the title

Intentions: Projects in British Culture, 1660–1730, Alembics: Penn Studies in Literature and Science (Philadelphia: University of Pennsylvania Press, 2017); Richard W. Hoyle, *Custom, Improvement and the Landscape in Early Modern Britain* (New York: Routledge, 2017).

[54] The translation of these ideas and their emulation in practice is the focus of Sophus A. Reinert, *Translating Empire: Emulation and the Origins of Political Economy* (Cambridge, MA: Harvard University Press, 2011), and his "Rivalry: Greatness in Early Modern Political Economy," in *Mercantilism Reimagined: Political Economy in Early Modern Britain and Its Empire*, ed. Philip J. Stern and Carl Wennerlind (Oxford: Oxford University Press, 2014), 348–70.

[55] Adam Smith, *An Inquiry into the Nature and Causes of the Wealth of Nations*, ed. Edwin Cannan (New York: Modern Library, 1994), 170.

[56] I am grateful to Niall Atkinson for discussions on this topic and for encouraging me to think in these terms.

of "architect" was a fluid identifier, and men who called themselves architects in some contexts might have (as I have seen on more than a few occasions) called themselves engineers or master builders in others.[57] They busied themselves not only with the design and production of buildings, but also industrial machinery, mechanical devices, artillery and all variety of public works, from fortresses, to earthworks, to roads, bridges, to fountains, rivers, canals, and countless other structures and systems. Moreover, this vast diversity in their expertise and functions was not merely a concomitant of the exigencies of the day-to-day work, but sanctioned by the era's most canonical and well-known work of architectural theory, the *De re aedificatoria* by Leon Battista Alberti (1443–1452), venerated still today as the modern discipline's founding text.[58] The book, which is both indebted to and builds on Marcus Vitruvius Pollio's *De architectura*, has several often overlooked sections on all variety of terraforming enterprises and public works, a great many aquatic.[59] And in discussing these myriad subjects, Alberti devoted attention not only to the formal appearance of structures like roads, rivers, and ports, but also to their functions within urban settlements and their agencies in configuring the spaces between them. As this dissertation will make clear, these are matters of fundamental political, economic, and environmental import, deemed central, evidently, to the titular practice of "architecture" during the Renaissance.[60] This is a fact too often elided; to understand

[57] See also Long, *Openness, Secrecy, Authorship*; Long, "Multi-Tasking 'Pre-Professional' Architect/Engineers"; Long, *Artisan/Practitioners*; Wolfgang Lefèvre, *Picturing Machines 1400–1700* (Cambridge, Mass.: MIT Press, 2004); Wolfgang Lefèvre, "Architectural Knowledge," in *The Structures of Practical Knowledge*, ed. Matteo Valleriani (Cham: Springer International Publishing, 2017), 247–70.
[58] Leon Battista Alberti, *On the Art of Building in Ten Books*, trans. Joseph Rykwert, Neil Leach, and Robert Tavernor (Cambridge, MA: MIT Press, 1988).
[59] Vitruvius Pollio, *Vitruvius: Ten Books on Architecture*, trans. Ingrid D. Rowland (New York, NY: Cambridge University Press, 1999); Alberti, *On the Art of Building in Ten Books*, for example, bk. IV:6–8; V:12, and X.
[60] I plan to elaborate on this in a future study.

architectural history in the strict, pared-down terms of the contemporary profession is to flatten the rich and inter- (or, perhaps more appropriately, pre-disciplinary) ways that early moderns made sense of it. To recover the full richness of architectural thought and practice in this period, historians of Renaissance architecture would do well to heed calls by Niall Atkinson and Lauren Jacobi to see the built environment not as collections of discrete monuments, but rather as spatial networks and systems of relations.[61] Indeed, once we address this history and its "bricolage practitioners" on their own terms,[62] it becomes increasingly clear that the state, its territory, and infrastructures were the proper objects not only of premeditated design in some vague or merely metaphorical sense, but also of architecture *qua* architecture.

Aquatic Territory as a Problem of Government

The chapters of this dissertation explore how state functionaries, technical experts, and government advisors approached the problem of ordering aquatic territory. The project begins its investigation in the mid-sixteenth century, when Tuscany's ducal government formed the Ufficiali dei Fiumi in an effort to respond to the onslaught of punishing flood surges. It proceeds up until the first few years of the seventeenth century, which coincides with the end of the rule of Tuscany's third duke, Ferdinando I de'

[61] Niall Atkinson, *The Noisy Renaissance: Sound, Architecture, and Florentine Urban Life* (University Park, PA: The Pennsylvania State University Press, 2016); Lauren Jacobi, *The Architecture of Banking in Renaissance Italy: Constructing the Spaces of Money*, First Edition (New York: Cambridge University Press, 2019). The ways that Atkinson and Jacobi study early modern architecture, in fact, resemble approaches and ways of thinking about the built environment as a legally-, politically-, and institutionally-constituted entity that has had far greater uptake among historians of modern and contemporary architecture. For an orientation to this scholarship, see Aggregate, ed., *Governing by Design: Architecture, Economy, and Politics in the Twentieth Century*, Culture, Politics, and the Built Environment (Pittsburgh, PA: University of Pittsburgh Press, 2012).
[62] Long, "Multi-Tasking 'Pre-Professional' Architect/Engineers."

Medici, and marks a moment when aquatic territorial planning became fully integrated into political economic theory in Italy. These years not only bookend a period of intensified hydraulic planning activity in the Medicean duchy, but also allow us to glimpse the emergence of a distinct line of thinking on the problem of aquatic territorial management. The chapters therefore trace an arc that moves from practices on the ground to discourses in the halls of power, showing how in early ducal Tuscany, the acute problems of water gave rise to a way of conceptualizing the late Renaissance state as a material space to be centrally planned. Its territory and its ecologies—what we might today call its environment—had, in other words, to be designed.

After a brief discussion of the environmental stage of this story, focusing on aquatic and climatic volatility in the region in the sixteenth century, Chapter One explores the state's official response to aquatic disorder by tracing the formation and early work of the Ufficiali dei Fiumi. Seeking to adopt the perspective of this office, it asks, in particular, how its administrators and technicians approached their mandate to bring order to territorial waterways. What did it mean, riffing somewhat on James C. Scott's expression, to *see* like a river functionary in the service of the new ducal state?[63] How, in other words, did this office seek to put its arms around the problem they were tasked with resolving? By studying the practices of the magistrates, architects, and engineers entrusted with enforcing ducal river laws, surveying and recording issues in the landscape, and ordering and planning repairs, my investigation shines a light on the intricate workings of an early modern environmental bureaucracy, while foregrounding

[63] Scott, *Seeing Like a State*.

the sheer complexity of waterways as natural entities that ducal experts struggled to understand, depict, and control.

Over time, some of the Ufficiali dei Fiumi's functionaries came progressively to diagnose some of the sources of the office's persistent incapacities, and began to elaborate novel methods for how the state might more effectively combat inundations. This is where Girolamo di Pace, with whom we began, enters the story once again. Chapter Two examines his ideas about territorial flood mitigation. In 1550, after working for several years as a court technician under Dukes Alessandro and Cosimo, Girolamo joined the Ufficiali dei Fiumi as a salaried engineer. In 1558, after nearly a decade of work for the administration (and, it should be said, on the heels of another severe regional flood in 1557), he penned the first comprehensive survey of Tuscany's aquatic territory. Addressed to Cosimo I, it identified the causes of alluvial disorder and prescribed various remedies for resolving it. Analyzing Girolamo's missive to the duke—an early (if not the first) practical handbook on territory-wide flood mitigation,[64] of which he or an associate or follower made at least three manuscript copies—I argue that he came, through his empirical work in the countryside, to understand aquatic territory as vast and intricate environmental system whose regulation required coordinated planning and maintenance on the regional scale. He viewed the task of rationalizing the aquatic landscape not merely as a technical challenge, but also (and perhaps even more so) as a political one, which demanded the full logistical and coercive power of the ducal state. If Girolamo's insights are anything like those of his compatriots in the Ufficiali dei Fiumi or his

[64] Andrea Bacci composed a study on Rome's Tiber River that came out in the same year, although it is written more as a learned Aristotelian study of the movements of natural waters, with a section on preventing floods, than it is a practical handbook. Andrea Bacci, *Del Tevere dell'eccell. dottore medico e filosofo Andrea Baccio libro quarto* (Rome: Vincenzo Luchino, 1558).

superiors in the ducal government, they reveal that ducal technocrats were very lucidly conceiving of Tuscany as an expansive and homogenous regional space from the middle decades of the sixteenth century, some decades before it was first cartographically represented as such.

After his death, Tuscany's rivers office implemented some of Girolamo's recommendations, clamping down on bans against disrupting the flow of rivers and implementing directives to more actively monitor the state of territorial waterways. Yet despite these measures, the Ufficiali dei Fiumi continued to struggle against water's relentless and unruly forces. Soon enough, these matters came to attract the attention of a wider constellation of experts—from men employed by the state but not necessarily in one of its rivers offices, to foreign artisans and technicians seeking patronage—who tried their hands at quelling the disorders of flooding. I call them projectors: inspired by the modest headway made under the Cosmian administrations, these men devised a host of utopian projects for recasting aquatic space in vast regions of the Tuscan territory. Chapter Three explores how some of these actors came to weigh in on the vexing problems of water in the final third of the sixteenth century. By studying their projects, their written blueprints for aquatic territory, this chapter traces a rising preoccupation with not merely containing flood damage, but also reimagining the utility of waterways as a vast circulatory infrastructure to facilitate traffic and commerce. This shift from enacting largely ad-hoc and reactive methods of crisis control, to projecting about ways the aquatic landscape could be reshaped to be commercially useful, points to an incipient way of thinking about aquatic territory in its entirety as a space that could be manipulated and centrally planned for public benefit. By attending to engineers' insights about the

wealth-producing potentials of a rectified aquatic landscape, moreover, this chapter reveals how technocrats were active participants in an emerging political-economic discourse, quite statist in its contours, in early modern Italy.

The fourth and final chapter places Tuscan discourses on aquatic territorial planning in the wider context of Italian statecraft and political economic theory in the late-sixteenth and early-seventeenth centuries. It explores how efforts by Tuscany and other Italian principalities to rationalize waterborne navigation may have inspired an articulated conception of the aquatic landscape as a form of connective infrastructure—a circulatory architecture underpinning economic growth—in late-Renaissance political-economic thought. The writings of the Piedmontese priest and diplomat Giovanni Botero, an admirer and shrewd analyst of Medicean statecraft, intelligent observer of the comparative development of foreign states and empires at the dawn of the first global age, and an alluvial aficionado, forms the chapter's central case study. His political-economic writings adumbrate how on-the-ground experiments in territorial design ongoing in Tuscany, as in other peninsular polities, were brought into a widening constellation of affairs of state in early modern Italy, framing hydraulic infrastructure as a government apparatus that improved both the waters of nature and the wealth of nations.

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In 1860, the Swiss historian Jacob Burckhardt, a father of cultural history and towering figure in the historiography of the Italian Renaissance, saw this era as a time when the state emerged as a "calculated and conscious creation, as a work of art."[65]

[65] Jacob Burckhardt and S. G. C. Middlemore, *The Civilization of the Renaissance in Italy*, Modern Library papberback ed, The Modern Library Classics (New York: Modern Library, 2002). I am grateful to Sophus A. Reinert for drawing this parallel.

While Burckhardt's at times romantic, at times violent vision of the Renaissance as the birth of the modern era has long ago fallen by the wayside, his conception of the state as a "work of art" merits, at least in the light of this research, our earnest reconsideration. While this metaphor vividly captured a sense of the individual, human agency to which Burckhardt attributed so many of the era's institutional and cultural developments, the expression also suitably sums up how the protagonists of this study thought about and aimed to manipulate the landscapes and environments of their consolidating state. For in early ducal Tuscany, engineers, planners, and politicians came to see territory as a space to be carefully chiseled and sculpted into form. Many would soon follow their example.

THE SETTING

While the creation of a ducal state in the middle of the sixteenth-century in Tuscany made large-scale territorial intervention politically possible in a way it was not before, it was a palpable and rising sense of apprehension about the region's aquatic volatility that made it seem a desirable course of action to pursue in this moment. To be sure, flooding was a perennial problem in premodern Tuscany, and governments in the region had worked for centuries to manage these risks within their jurisdictions. But during the years the Medici rose to power, a set of intersecting environmental and anthropogenic changes made the dominion's unruly waterways a more urgent and compelling government problem than they had been in the past.

Stretching from the Apennine Mountains to the Tyrrhenian Sea, Tuscany's undulating and variable landscape—aestheticized by generations of travelers, writers, and artists from the days of the Grand Tour, and now a fixture of Italy's tourist imaginary—was for many of its premodern denizens instead a fearsome topographical minefield with an aquatic ecology in constant and chaotic flux.[1] Millennia of tectonic activity and geological sedimentation sculpted a horst and graben system of precipices and drop-offs, intermontane basins, and lowland sinks that alternately propelled or slowed water as it journeyed across the landscape.[2]

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[1] Johann Wolfgang von Goethe, *Italian Journey (1786-1788)*, trans. W. H. Auden and Elizabeth Mayer, Penguin Classics (London: Pantheon Books, 2011); D. H. Lawrence, *Sketches of Etruscan Places and Other Italian Essays*, ed. Simonetta De Filippis, The Works of D. H. Lawrence (Cambridge: Cambridge University Press, 1992); Frances Mayes, *Under the Tuscan Sun: At Home in Italy*, First Broadway books trade paperback edition (New York: Broadway books, 1997); Jason Wilson, "Under the Crushing Weight of the Tuscan Sun," *The New Yorker*, March 11, 2016, http://www.newyorker.com/books/page-turner/under-the-crushing-weight-of-the-tuscan-sun.

[2] Enrica Caporali, Massimo Rinaldi, and Nicola Casagli, "The Arno River Floods," *Giornale Di Geologia Applicata*, no. 1 (2005): 177–80. For more on the geomorphology of the northern Appennine region, see

In general, Tuscany's rivers and streams chart a path from northwest to southeast, pouring forth from its alpine reaches and emptying into the sea or collecting as lakes and marshes in its coastal lowlands.[3] The largest hydrographic network in the region is formed by the Arno and its major tributaries—the Chiana, Sieve, Greve, Bisenzio, Pesa, Elsa, Nievole, and Era.[4] Other major river systems include the Serchio and Magra catchment areas in northwest Tuscany, nestled between the Appenines and coastal Apuan Alps, and the basins south of the Arno anchored around the Cecina, Cornia, Bruna, Ombrone, and Albegna rivers (figure 7).[5] Their flow rates are highly dependent on regional rainfall patterns, which can vary considerably depending on relief elevation and the time of year. During the arid summer months, for example, especially in Tuscany's low-lying plains, rivers and streams could dry to a trickle. By contrast, during the fall and winter seasons, when precipitation was heaviest, a few days of continuous rain in the mountains was all it might take for watercourses to swell beyond their banks and wreak widespread havoc.[6]

While these general hydrographic conditions prevailed in Tuscany for millennia, records of historical flood events only go back as far as the twelfth century, when urban communities first spread alongside its rivers in significant numbers. In 1762, the Sienese

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Renzo Mazzanti and Livio Trevisan, "Evoluzione della rete idrografica nell'Appenino centro-settentrionale," *Geografia, fisica, dinamica quaternaria I* 1 (1978): 55–62.

[3] Franco Cazzola, "Risorse contese: le zone umide italiane nell'età moderna," in *Il padule di Fucecchio. La lunga storia di un ambiente "naturale,"* ed. Adriano Prosperi (Rome: Edizioni di Storia e Letteratura, 1995), 13–14.

[4] Caporali, Rinaldi, and Casagli, "The Arno River Floods," 177.

[5] Gianni Cortecci et al., "The Serchio River Catchment, Northern Tuscany: Geochemistry of Stream Waters and Sediments, and Isotopic Composition of Dissolved Sulfate," *Applied Geochemistry* 23, no. 6 (June 2008): 1513–43; Marco Piccardi and Enzo Pranzini, "Le foci del Serchio e del Fiume Morto nelle restituzioni cartografiche pre-geodetiche," *Studi costieri* 23 (2016): 21–58; M. Bolla Pittaluga, R. Luchi, and G. Seminara, "On the Equilibrium Profile of River Beds: Equilibrium Profile," *Journal of Geophysical Research: Earth Surface* 119, no. 2 (February 2014): 317–32.

[6] Ugo Losacco, *Notizie e considerazioni sulle inondazioni d'Arno in Firenze*, 1967, 405; Caporali, Rinaldi, and Casagli, "The Arno River Floods," 177.

engineer and cartographer Ferdinando Morozzi (1723–1785) published several of these together in his book, *Dello stato antico e moderno del fiume Arno, e delle cause e de' rimedi delle sue inondazioni* (*On the ancient and modern state of the Arno, and the causes of remedies of its inundations*).[7] Based on years of research in Florentine libraries and archives, the bulk of this study forms a running chronological compilation of excerpts of historical accounts—government records, diary accounts, and chronicles—of Arno River floods from 1177 to 1761.[8] It has, interestingly, become an essential point of reference for modern geological and climatological study of Tuscany's hydrography, and while the fragmentary nature of its findings should be borne in mind, the publication serves as a useful tool for understanding general trends in the region's alluvial activity during the Middle Ages and early modern period.[9]

Over the seven centuries Morozzi chronicled in his study, irregular and unpredictable flooding was a constant. He counts some 54 inundations of the Arno in this period, some grouped together in successive years, others separated by a distance of decades. In an effort to better understand these natural shocks and their causes, Morozzi organized the flood dates he gathered into a table at the end of his book (figure 8). It first classified each inundation into different columns by approximate magnitude—either "*medie*" or "*massime*"—based on the degree of damage he discerned it to have caused

[7] Ferdinando Morozzi, *Dello stato antico e moderno del Fiume Arno, e delle cause e de' rimedi delle sue inondazioni. Ragionamento istorico mattematico dell' ingegnere Ferdinando Morozzi di colle di valdelsa. Parte Prima, contenente la storia della inondazioni* (Florence: Stamperia di Gio. Battista Stecchi, 1762). On Morozzi, see Calogero Farinella, "Orazio Ferdinando (Ferdinando) Morozzi," in *Dizionario Biografico Degli Italiani* (Rome: Istituto della Enciclopedia Italiana, 1986), https://www.treccani.it/enciclopedia/orazio-ferdinando-morozzi_(Dizionario-Biografico).

[8] It also listed dates of known Tiber River floods in Rome, against which Morozzi compared the flood activity of Tuscan watercourses.

[9] The publication, the fruit of Morozzi's efforts to understand the persistent volatility of the Arno and other rivers in Tuscany, reminds us that these problems were by no means resolved by the early Medicean state.

from the testimony of eyewitness accounts, and then calculated the temporal duration between flood surges of each type over this epoch.[10] From analysis of this data, a few key moments of exceptionally damaging alluvial activity can be identified.

The earliest of these came in November of 1333. The Florentine historian Giovanni Villani (ca. 1280–1348), whom Morozzi quoted at length, described the terrifying specter in his *Nuova Cronica*.[11] On the first day of that month, "it began to rain in Florence and around the countryside, and in the mountains, and continued this way four days and four nights, the rain growing beyond all measure and usual manner, as if the sluice gates of heaven had opened."[12] As the rain poured, the Arno and other rivers swelled and breached their banks so disastrously, "washing all the seedings, levelling trees, and pummeling mills … as well as any buildings and homes not built securely; whence many people perished."[13] The river breached its banks along its entire course, causing widespread suffering far beyond the city of Florence. The inundation began in the Arno's upstream stretches of the Casentino, the plains of Arezzo, and the Upper Valdarno, and flooded the towns of the Lower Valdarno as far as Pisa, whose countryside was already perpetually waterlogged.[14] In Florence, the magnitude of this 1333

[10] Morozzi in his preface explains that he had wished to "commence his history from the earliest times of remote antiquity, if any records had been left to us; but we are so much in the dark, that it seemed impossible to carry this out." "Io volentieri cominciata avrei la mia Storia fino dai primi tempi della più remota antichità, se ci fossero state lasciate ricordanze; ma noi siamo tanto allo scuro, che impossibile me sembra il ciò eseguire." Morozzi, *Dello stato antico e moderno del Fiume Arno*, 2.
[11] Giovanni Villani, *Nuova cronica*, 3 vols., Biblioteca di scrittori italiani (Parma: Fondazione Pietro Bembo, 1990).
[12] "A Dì primo Novembre 1333, cominciò a piovere diversamente in Firenze, e dintorno al paese, e nellalpi [sic], e montagne, e così seguì al continuo quattro dì, e quattro notti, crescendo la piova sformatamente, e oltre al modo usato, che pareano aperte le cateratte del cielo." Giovanni Villani quoted in Morozzi, *Dello stato antico e moderno del Fiume Arno*, 11.
[13] "... e consumò ogni sementa fatta, abbattendo, e divellendo alberi, e mettendosi inanzi, e menandone ogni mulino, e gualchiere ... e ogni deficio [sic], e casa, che appresso l'Arno fosse non forte; onde perirono molte genti." Giovanni Villani quoted in Morozzi, 11.
[14] Giuseppe Aiazzi, ed., *Narrazioni istoriche delle più considerevoli inondazioni dell'Arno, e notizie scientifiche sul medesimo. Con un appendice sull'alluvione del 4 Novembre 1966* (Verona: L'Arco dei

catastrophe moved people to monumentalize its frenzied rampage through the city. When the floodwaters receded, a stone plaque was erected on the exterior façade of a building at the corner of Via San Remigio and Via dei Neri, indicating the height the waters climbed in the city's urban core (figure 9).[15] This gesture inaugurated a tradition of flood marking in Florence—a form of dire commemoration preserved for only the most extreme deluges—which permitted later generations to compare the relative severity of the worst disasters over time.[16]

Yet even when not terrible enough to receive the dubious honor of a stone plaque, later floods were sometimes measured by observers against the yardstick of the autumn inundation of 1333, giving us some sense of when conditions were particularly severe. The Arno floods of 1379 and 1380, for example, moved the chronicler Baldassare Buonaiuti, alias Marchionne di Coppo Stefani, to remark on how the river "grew immeasurably, to a degree it had not grown since the flood of the year 1333, and did great damage in the country and in the city."[17] By this metric, 1456, 1465, and 1515 also seem to have been notable flood years.

The next exceptionally volatile alluvial season would not come again until the 1540s. Several large back-to-back floods struck Florence and its countryside during this decade, causing variable degrees of damage and leaving vast areas underwater. The first of these washed through in 1543. An anonymous source described how on the evening of

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Gavi, 1967), 2–6.

[15] This is also reproduced in Morozzi, *Dello stato antico e moderno del Fiume Arno*, 14.

[16] This also happened in Rome; see Pamela O. Long, *Engineering the Eternal City: Infrastructure, Topography, and the Culture of Knowledge in Late Sixteenth-Century Rome* (Chicago: University of Chicago Press, 2018), chap. 1.

[17] "…crebbe Arno si smisuratamente, che cresciuto non era infino a quello dì tanto mai, da poi che fu lo diluvio dell'anno 1333 e fece gran danno nel Contado, e nella Città." Marchionne di Coppo Stefani quoted in Morozzi, *Dello stato antico e moderno del Fiume Arno*, 21.

November 6, "great tremors arose through the air, of lightning, and water, and wind, and thunderbolts."[18] By morning, the Arno had swelled to such an extent that it caused homes in the neighborhood of San Niccolò, as well as its church, to flood for several days while it stormed.[19] The river visited chaos upon the city again the following November. This time, after days of heavy snow, "the Arno river grew so large that the fields around the city became like a lake, and a great part of the city flooded as well."[20] An anonymous source described water levels climbing as high as four *braccia* in the city, with the neighborhoods of Santa Croce and San Niccolò suffering the brunt of the damage.[21] "Great quantities of timber, animals, trunks, beds, barrels, kegs, and many other household items" were reportedly washed up in the floodwaters.[22]

Only a few years later, in 1547, came "the greatest flood that the men of this century have ever seen."[23] It began in the mountains around the Mugello valley north of Florence and caught the attention of a number of sixteenth-century commentators, well-known writers and anonymous diarists alike.[24] In his 1583 *Istoria de' suoi tempi*, the historian Giovanni Battista Adriani (1511–1579) recounted how a terrible rainstorm on the night of August 12 caused alpine streams to overflow, "breaking off and uprooting a

[18] "Si levarono grandissimi romori per l'aria, di tuoni, baleni, e d'acqua, e vento, e saette." Magliab. Cod. 389, Classe XXV, cited by Morozzi, 26.
[19] Morozzi, 26.
[20] "Venne il fiume d'Arno sì grosso, e fu sì gran piena, che fece il piano di fuora intorno alla Città, tutto come un lago, e dentro in Firenze allagò una gran parte della Città." Magliab. Cod. 17 Classe XXV, cited in Morozzi, 27.
[21] Morozzi, 27.
[22] "Si vidde per detta piena venire gran quantità di legnami, simile d'uomini, e bestie cariche, casse, letti, botti, barili, finalmente tutto quello, che s'appartiene a una casa." Morozzi, 27.
[23] "E fu la maggior piena, che gli uomini di questo secolo infino allora ne avessero veduta." Morozzi, 28.
[24] The two main historians Morozzi consults are Giovanni Battista Adriani and Bernardo Segni, whose histories of Florence he quotes at length. He also cites passages from an archival record by a certain Piero di Fedele Amadori da Figline, in addition to three anonymous manuscripts in the Biblioteca Magliabechiana. Morozzi, 27–30.

great many of the largest trees, and ruining mills, and houses."[25] This runoff collected in the Sieve and Bisenzio Rivers before emptying into the Arno on either side of Florence. In some places, he recalled, "there was a distance of 40 *braccia* from the bottom of the riverbed to the height of the water, whence one can understand what a tempest it was."[26] Damage to life and property was widespread. In the countryside, "an infinite number of animals were washed away, and none survived, and the nearby fields, and vineyards, and fruit trees were all flattened."[27] The city fared no better: as the Arno washed through, it ruptured 250 *braccia* of shoreline, and went on to flatten homes and buildings, destroy grain stores, soak government papers, and fill the *piazze* with mud and snapped trees. In the end, as Adriani grimly described, "no less than 100 people perished, and over 70 bodies were recovered along the riverbanks."[28]

Grasping to understand the proximate causes of these disasters, Morozzi's sources often pointed to excessive precipitation in the days leading up to a flood. But eyewitnesses of these inundations also made much more general remarks about the extreme and unseasonable weather they experienced during these years, from punishing rains in the summer months to heavy snowfall in the mountains, and not only in Tuscany: in his account of the terrible 1547 flood, for example, Bernardo Segni (1504–1558) had observed that "it was very rainy *throughout* Italy these years."[29] Sixteenth-century

[25] "Troncando, e sbarbando una quantità d'alberi grandissima, et rovinando mulini, e case vicine a' Fiumi." Giovanni Battista Adriani, quoted in Morozzi, 27.
[26] "In alcuni luoghi dal piano del letto del Fiume alla sommità dell'acqua era uno spazio di quaranta braccia: donde si può comprender qual tempesta ella fusse." Giovanni Battista Adriani, quoted in Morozzi, 27–28.
[27] "Trasse seco infinito numero di bestiame, e quanto ella aggiunse non campò nulla: et i campi vicini pieni di viti, e d'alberi fruttiferi furono tutti spianati." Giovanni Battista Adriani, quoted in Morozzi, 28.
[28] "Perirono nel Mugello, e dal Ponte a Sieve in verso la Città non meno di cento persone, e più di sessanta corpi furono trovati sopra i greti." Giovanni Battista Adriani, quoted in Morozzi, 28.
[29] "E questo anno fu molto piovoso per tutta l'Italia." Bernardo Segni, quoted in Morozzi, 28, emphasis mine.

Tuscans were probably noticing local effects of what historical climatologists have dubbed the Little Ice Age, a period of general global cooling.[30] Although its manifestations differed regionally, and while scholars continue to debate the precise timing of this epoch and its distinct phases, most agree that this climatic shift contributed to abnormally high levels of precipitation and more severe storms in north-central Italy during the early and middle decades of the sixteenth century.[31]

But any effects the climatic changes of the Little Ice Age had on the region's aquatic ecology were probably compounded by a range of anthropogenic factors. After sustaining stunning demographic losses from the plagues of 1348 and 1400, Tuscany's population expanded considerably from about 1460 onwards, in both its large urban centers and especially in its rural countryside. This trend, which grew especially pronounced during the first two decades of the sixteenth century, put increasing pressures on the landscape and its resources.[32] Deforestation accelerated, spreading further into hilly and mountainous regions as rising rural populations sought out more arable land to cultivate and as urban demand surged for timber for building and for fuel.[33] Because

[30] While the causes of the Little Ice Age remain a topic of debate, scholars have identified solar forcing and volcanic activity as likely dominant factors. It is estimated that average global temperatures fell by one to two degrees Celsius in this period. Sam White, "Climate Change in Global Environmental History," in *A Companion to Global Environmental History*, ed. J. R. McNeill and Erin Stewart Maudlin (John Wiley & Sons, Ltd, 2012), 400–402. Emmanuel le Roy Ladurie several decades ago noted the climatic instabilities of the sixteenth century in his *Histoire du climat depuis l'an mil* (Flammarion, 1967). More recent monographs that explore the relationship between climatic fluctuation and social, political, and economic history during this period include Brian Fagan, *The Little Ice Age: How Climate Made History* (New York, NY: Basic Books, 2001); Geoffrey Parker, *Global Crisis: War, Climate Change and Catastrophe in the Seventeenth Century* (New Haven: Yale University Press, 2017); and Sam White, *A Cold Welcome: The Little Ice Age and Europe's Encounter with North America* (Harvard University Press, 2018).
[31] White, "Climate Change in Global Environmental History," 400; Christian Pfister and Rudolf Brázdil, "Climatic Variability in Sixteenth-Century Europe and Its Social Dimension: A Synthesis," *Climatic Change* 43 (1999): 7.
[32] Essential reading on the population history of Tuscany during the Middle Ages and Renaissance is David Herlihy and Christiane Klapisch-Zuber, *Tuscans and Their Families: A Study of the Florentine Catasto of 1427*, Yale Series in Economic History (New Haven: Yale University Press, 1985), chap. 3, "Population Movements: 1300–1550," 60–92.
[33] Rudolf Brazdil et al., "Flood Events of Selected European Rivers in the Sixteenth Century," *Climatic*

watercourses served as convenient conduits for timber shipments—cut logs would be tied together and sent downriver as makeshift rafts—deforestation tended to spread along riparian corridors.[34] The loss of this vegetation over time had adverse effects on the stability of alluvial ecologies, aggravating bank erosion and causing sediments to flow downstream with the current. This matter, mostly sands and gravel, would settle out as rivers passed through low-lying stretches and accumulate there over time, decreasing channel capacity in the plains and making those zones—host to many of the largest urban centers—more susceptible to overflows and inundations.[35] As we will see in Chapter 2, Girolamo di Pace recognized the correlation between riparian deforestation and flooding, making recommendations to the state to reissue deforestation bans and coordinate the seeding and planting of *posticci* along watercourses.

In addition to deforestation, flood events also invariably stemmed from the cumulative impacts of direct human intervention along watercourses. From the thirteenth century, as communities industrialized and spread further along Tuscany's river basins, private individuals and communal governments used and manipulated rivers in ways that made them more prone to flooding. For example, any kind of private or public structure that jutted into a river or stream—such as the mills, bridges, and weirs, which were legion—interacted with the current in ways that were difficult to predict. As we will see

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Change 43, no. 1 (September 1999): 273–74; Caporali, Rinaldi, and Casagli, "The Arno River Floods," 180.

[34] On these rafts (called *foderi*) and the shipping of timber by river, see Francesco Salvestrini, "Navigazione e trasporti sulle acque interne della Toscana medievale e protomoderna (secoli XIII–XVI)," in *La civiltà delle acque: tra Medioevo e Rinascimento*, ed. Arturo Calzona and Daniela Lamberini, Ingenium: Centro Studi L. B. Alberti, n. 14 (Firenze: Leo S. Olschki, 2010), 197–220. On forest laws and forestry in Tuscany, see Gianluca Belli, "La legislazione forestale nella Toscana medicea," in *La legislazione medicea sull'ambiente*, ed. Giovanni Cascio Pratilli and Luigi Zangheri, vol. 4: Scritti per un commento (Florence: Leo S. Olschki, 1998), 119–48.

[35] Brazdil et al., "Flood Events of Selected European Rivers in the Sixteenth Century," 274.

in Chapter 1, from mid-century, the ducal government endeavored to more strictly regulate and police these structures than they had previously. Meanwhile, larger interventions, like the meander cuts ("*tagli*") that were executed selectively starting in the mid-fourteenth century in the area of the Pisan plain, were later assessed as having had an overall negative impact on alluvial stability.[36] This view would not become widespread until the later seventeenth century, however, and as Chapter 3 will explore in further detail, this strategy continued to proliferate throughout the early ducal period.

In this larger context, then, the 1540s stand out as a decade of heightened alluvial instability. A combination of climatic shifts coupled with a demographic surge that intensified land usage along riparian corridors in Tuscany are probably to blame for the succession of large and hazardous floods of that decade. A period when Cosimo was working intently to consolidate power in the ducal state, his government viewed these inundations as a grave problem and took decisive actions in an attempt to remedy them.

[36] Caporali, Rinaldi, and Casagli, "The Arno River Floods," 179–80; Giancarlo Severini, *Fortificazioni e controllo delle acque in Toscana fra '500 e '600: il caso di Pisa* (Pisa: ETS, 1999), 38.

CHAPTER 1

THE UFFICIALI DEI FIUMI AT WORK[1]

"It is a mighty thing that the waters have done this year, and from all parts of the world, nothing else like it is known."[2] So lamented the ducal secretary Cristiano Pagni in a letter to Pier Francesco Riccio (1501–1564), Cosimo's tutor, major-domo, and right-hand man.[3] It was October 28, 1547, two months after the terrible August deluge, and Pagni had just accompanied Charles V's advisor Nicolas Perrenot de Granvelle (1486–1550), who was visiting Florence, on a tour through the city. The imperial emissary, as Pagni relayed to Riccio, had apparently described the sight of some of its still-waterlogged neighborhoods as an "almost impossible thing."[4] While Riccio had earlier assured Pagni that the duke "would not fail to do what is appropriate" to mend the wreckage wrought by the flood,[5] the troubling optics of this unresolved situation—at a time, especially, when Cosimo had all but released his duchy from Habsburg fetters[6]—

[1] My title was inspired by the the title of Chapter 3 of Hannah Marcus, *Forbidden Knowledge: Medicine, Science, and Censorship in Early Modern Italy* (Chicago: University of Chicago Press, 2020), titled "The Censor at Work."

[2] ASF, Mediceo del Principato 1170a, fols. 475r-v, 28 October 1547, Cristiano Pagni to Piero Francesco Riccio (MAP DOC ID# 666). "È gran cosa quel che fanno questo anno l'acque, et da tutte le parti del mondo non s'intende altro."

[3] Pier Francesco Riccio was "the most influential of his secretaries ... who acted as the duke's right-hand man during his reign." Alessio Assonitis and Henk Th. van Veen, "Introduction," in *A Companion to Cosimo I de' Medici*, ed. Alessio Assonitis and Henk Th. van Veen, Renaissance Society of America Texts and Studies Series, volume 17 (Leiden: Brill, 2022), 5.

[4] ASF, Mediceo del Principato 1170a, fols. 475r-v, 28 October 1547, Pagni to Riccio (MAP DOC ID# 666). "Ha preso maraviglia di quello sforzamento del'aqua alla porta a San Miniato, et gli pareva quasi cosa impossibile."

[5] ASF, Mediceo del Principato, 1173, fol. 588r, 17 August 1547, Pagni to Riccio (MAP DOC ID# 8136). "So che V.S. no' mancherà di far' quanto convien' per questo, et pero no' mi estendero in dir' altro."

[6] On Cosimo's efforts to establish the Duchy of Florence's independence from the Holy Roman Empire, see Giorgio Spini, *Cosimo I e l'independenza del principato mediceo* (Florence: Vallecchi, 1980), and Nicholas Scott Baker, "The Emperor and the Duke: Cosimo I, Charles V, and the Negotiation of Sovereignty," in *A Companion to Cosimo I de' Medici*, ed. Alessio Assonitis and Henk Th. van Veen, Renaissance Society of America Texts and Studies Series, volume 17 (Leiden: Brill, 2022), 115–59.

could not have been lost on him. Amid the routine flurry of incoming secretaries' briefings on happenings from across the state,[7] alarmed missives of this kind reveal the volatility of territorial rivers to have been a matter of grave and ongoing concern to Florence's governing elites.

Whenever a flood hit, ducal agents like Pagni and Riccio took to writing to relay vital information to the ducal court about where and how these disasters unfolded and to transmit directives to clean up and restore order in their wake. Their harried exchanges paint a vivid picture of the differentiated local effects of alluvial destruction—fleshing out accounts like Morozzi's, which, as we have seen, privileged the testimony of Florence-based observers—while laying bare how the state had no dedicated procedure for responding to such crises. Often called upon on to aid, for example, were the Ufficiali di Torre (Officers of the Tower), a public works office formed in the fourteenth century to steward all manner of public works, from Florence's streets, bridges, and city walls, to the roads and major public waterways of its *contado* and *distretto*.[8] After the 1547 flood, Cosimo I commanded this administration to "clean and purify the streets" and remove the

[7] As Alessio Assonitis and Henk Th. van Veen have said of Cosimo's secretaries, "among their principal duties was updating the duke with recent developments, both local and distant, and suggesting solutions to problems. Aside from these tasks, they also played a pivotal role in connecting the duke with the world outside the palace." "Introduction," 5. For more on the responsibilities of secretaries in ducal Florence and Tuscany, see Giuseppe Pansini, "Le segreterie nel Principato mediceo," in *Carteggio universale di Cosimo I de'Medici*, ed. Anna Bellinazzi and Claudio Lamioni, vol. I (Florence: Giunta regionale Toscana - La Nuova Italia, 1982), ix–xlix, and Hélène Miesse and Antonio Geremicca, "All'alba della modernità, il 'nuovo' segretario, le arti e le lettere: prolegomeni," in *Essere uomini di "lettere": segretari e politica culturale nel Cinquecento*, ed. Antonio Geremicca and Hélène Miesse, Quaderni della Rassegna 124 (Florence: Franco Cesati editore, 2016), 23–28. For an orientation to secretaries in the early modern world in general, see the essays in Paul M. Dover, ed., *Secretaries and Statecraft in the Early Modern World* (Edinburgh University Press, 2016).

[8] Giuseppe Pansini, "Le piante dei popoli e strade e lo stato della viabilità nel Granducato di Toscana alla fine del secolo XVI," in *Piante di popoli e strade. Capitani di Parte Guelfa, 1580–1595*, ed. Giuseppe Pansini (Florence: Leo S. Olschki, 1989), 7. On the Ufficiali di Torre, see also Leonardo Rombai, "Il sistema delle infrastrutture di comunicazione nella Toscana fiorentina del XV secolo," in *La Toscana al tempo di Lorenzo il Magnifico: politica, economia, cultura, arte: convegno di studi promosso dalle Università di Firenze, Pisa e Siena: 5-8 novembre 1992*, ed. L. Beschi et al., vol. 3, 3 vols. (Pisa: Pacini editore, 1996), 857–68.

piles of "rubbish, mud, and filth" the river deposited within city walls.[9] At the same time, however, the duke had also tasked the Otto di Pratica (The Eight),[10] a complex magistracy that coordinated diplomacy, fortress surveillance, and territorial defense with carrying out inspections in Florence "to provide and remedy what could be done for public and private benefit."[11] He was even known on occasion to personally command artists or technicians of his court, such as Girolamo di Pace, Niccolò Tribolo, and Giovanni Camerino to inspect especially precarious sites and propose repairs.[12]

But the catastrophic 1547 deluge, due perhaps to its severity, seems to have stirred a desire for more precise and directed forms of action. In its aftermath, Cosimo and his councillors imposed a succession of orders and legislative reforms with the explicit aim of "remedy[ing] the great and infinite damages" visited upon the state by its territorial waterways, culminating, in 1549, with the formation of a specialized territorial

[9] ASF, Mediceo del Principato 1173, fol. 588r, 17 August 1547, Pagni to Riccio (MAP DOC ID# 8136). Pagni also describes the urgency of the cleanup effort in terms of its effects on the health of the air: "Prima ch'io venga alla risposta della lettere di V.S^{ria} di hiersera, dirò quel che il duca nostro signore mi ha comandato circa la palta et immonditie che restono nella città per la inundatione delle acque d'Arno. Il che è che la signoria vostra sia con li offitiali di Torre et co'l Proveditore, et che si dia il meglior' ordine, sarà possibile di nettare et mondare le strade, et che quelle terraccie palte et immonditie si portino lungo la muraglia, dove faranno dui effetti: il primo di riempiere, l'altro d'asciugare molto più presto che non fariano in altri luoghi, perché saranno exposte al sole. Et che tutto si faccia con accuratezza et buona diligentia, acciò la città resti netta et co' quei puzzi l'aere no' si venga a infettare, onde ne seguono delle infirmità."

[10] On the Otto di Pratica, see Sandra Marsini et al., eds., *Carteggi Delle Magistrature Dell'età Repubblicana: Otto Di Pratica, Legazioni e Commissarie*, Documenti Di Storia Italiana 3 (Florence: Leo S. Olschki, 1987).

[11] ASF, Mediceo del Principato, 1173, fol. 592r, 18 August 1547, Pagni to Riccio (MAP DOC ID# 2492). "La di V.S. di hier mattina dette hiersera' raguaglio al duca nro' S^{re} de danni et ruine, che hanno fatto Arno et la Sieve, et dentro et fuore et del ordine che havevon preso i consiglieri et li Otto di Pratica di fare rivedere la città, per poter' provedere et remediare quanto far' si potesse a' benefitio publico et privato."

[12] For example, ASF, Mediceo del Principato, 1171, fold. 261v, 12 October 1544, Lorenzo di Andrea Pagni to Riccio (MAP DOC ID# 6548): "La Comunità di Pietras^{ta} ha scritto al duca mio S^{re} quanto vedrà la S.V. per la aggiunta lra', sopra di che lei si è risoluta, havendosi a servir' qua del Tribolo, che vi vadi Camerino. Però m'ha comandato ch'io scriva alla S.V. che mandi per lui, et li ordini che se ne vadi a quella volta a provedere a quelle inundationi. Cosi sarà contenta di exeguire."

rivers office, the Ufficiali dei Fiumi (Officers of the Rivers).[13] Perceiving a looming flood crisis, the ducal government endeavored to streamline its responses to aquatic disorder and devise targeted ways to resolve it.

This chapter explores the duchy's initial institutional responses to alluvial flooding in the mid-sixteenth century, focusing on the formation of the Ufficiali dei Fiumi and its early work over the course of the 1550s. Formed as a branch of the Capitani di Parte Guelfa, one of approximately two dozen specialist courts or tribunals in early ducal Florence, the Ufficiali dei Fiumi carried out a diverse array of activities both technical and judicial in nature.[14] On the one hand, it juggled a variety of complex alluvial defense and engineering projects in zones concentrated around the ducal capital, primarily along the Arno, which it funded and coordinated in a direct capacity. But it also

[13] ASF, Consulta poi Regia Consulta, Serie I, 1, 35. "Volendo l'Illustrissimo et Eccellentissimo Signore il Signor Duca di Firenze, porger rimedio a' grandi et infiniti danni che fanno et farebbono e fiumi del suo felice Stato ...." Published in Giovanni Cascio Pratilli and Luigi Zangheri, eds., *La Legislazione Medicea sull'Ambiente*, vol. 1: I Bandi (1485–1619) (Florence: Leo S. Olschki, 1994), 32. The quoted language is echoed in later ducal river legislation, as well.

[14] From its beginnings in the mid-13th century, the Capitani di Parte Guelfa, established by the Republic's victorious Guelf party, functioned more or less as a civic court for prosecuting members of the adversary Ghibelline faction and other enemies of the Florentine state, as well as for confiscating and reselling their properties. It retained these powers through the 14th and early 15th centuries, growing wealthy in the process, and eventually taking on general responsibilities for resolving property conflicts and financing and directing fortress construction and maintenance in the *contado* and *distretto*. See Anna Cerchiai and Coletta Quiriconi, "Relazioni e rapporti all'Ufficio dei Capitani di Parte Guelfa - Parte I, Principato di Francesco I dei Medici," in *Architettura e politica da Cosimo I a Ferdinando I*, ed. Giorgio Spini (Florence: Leo S. Olschki, 1976), 187, and Vieri Mazzoni, "Il patrimonio fondiario e le strategie insediative della Parte Guelfa di Firenze nel primo Trecento," *Archivio Storico Italiano* 154, no. 1 (567) (1996): 3–31. For more on the Capitani di Parte Guelfa's role in land confiscations, see Vieri Mazzoni, "Note sulla confisca dei beni dei ghibellini a Firenze nel 1267 e sul ruolo della Parte Guelfa," *Archivio Storico Italiano* 158, no. 1 (583) (2000): 3–28. The Ufficiali di Torre, similarly, operated as a generalized public works magistracy from its foundation in the 14th century. In collaboration with Florence's Capitano del Popolo, the city's chief magistrate during the early Republic, this office would adjudicate and prosecute legal violations of the use of public ways and structures. Pansini, "Le piante dei popoli e strade e lo stato della viabilità nel Granducato di Toscana alla fine del secolo XVI". These judicial structures of public works administration were not particular to Florence and Tuscany, nor to the ducal period: civic magistrates called *viarii*—public works and roads masters—were also, as Guy Geltner has shown, "staple organ[s] of urban policing" in many of north-central Italy's towns and cities from at least the thirteenth century. See Guy Geltner, *Roads to Health: Infrastructure and Urban Wellbeing in Later Medieval Italy*, The Middle Ages Series (Philadelphia: University of Pennsylvania Press, 2019), quote at 1.

worked to alleviate the risks of alluvial volatility by regulating how subjects could use and interact with rivers and riverine spaces, issuing laws and orders, administering justice, and acting in an advisory capacity on various problems pertaining to public waterways. By means of these activities in the realm of legislating and policing, the office sought to extend its reach over a much wider expanse of aquatic territory than it could by planning and building projects directly. Though not typically studied as such, these judicial activities should therefore also be understood as an integral part of its overall alluvial engineering strategies.[15]

To date, most of the scholarship on Tuscany's first dedicated rivers bureaucracy has nonetheless focused exclusively on the first of the above two operational categories. On the basis of some of the largest and most ambitious hydraulic interventions it executed in the watery landscape from the reigns of Cosimo I to Ferdinando I, the Ufficiali dei Fiumi (along with the Capitani di Parte Guelfa that contained it) has been characterized as an instrument of Medicean autocracy, "a kind of modern 'ministry of public works'," even, that remade aquatic territory according to ducal will.[16] Though the office did oversee an expanding campaign of public works in the Arno River valley during this period, assertions about its essential "modernity," (aside from not being very meaningful) create an exaggerated impression of the power it initially exercised, while

[15] I am grateful to Arindam Dutta for helping me to develop this idea.
[16] Rombai, "Il sistema delle infrastrutture," 857. It is similarly characterized in Carlo Vivoli and Diana Toccafondi, "Cartografia e istituzioni nella Toscana del Seicento: gli ingegneri al servizio dello Scrittoio delle Possessioni e dei Capitani di Parte," in *Cartografia e istituzioni in età moderna. Atti del Convegno: Genova, Imperia, Albenga, Savona, La Spezia, 3–8 novembre 1986*, ed. Ministero per i Beni Culturali e Ambientali, vol. XXVII, Atti della Società Ligure di Storia Patria, Nuova serie (Rome: Pubblicazioni degli Archivi di Stato, 1987), 172; Pansini, "Le piante dei popoli e strade e lo stato della viabilità nel Granducato di Toscana alla fine del secolo XVI"; and Carlo Vivoli, "'Provisione, et ordini concernenti la iurisditione, et obligho delli Ufitiali de'fiumi, et lor ministri.' La legislazione medicea in materia di strade, ponti e fiumi," in *La legislazione medicea sull'ambiente*, ed. Giovanni Cascio Pratilli and Luigi Zangheri, vol. 4: Scritti per un commento (Florence: Leo S. Olschki, 1998), 79.

eliding the complex processes by which its functionaries sought to understand and overcome the various difficulties they faced and the technopolitical solutions they came to devise as they attempted to order and shape watery territory.

Examination of the Ufficiali dei Fiumi's lesser-known judicial activities supplies a much more comprehensive and complex picture of this office and its work in the landscape. In the following pages, I trace these varied procedures to analyze how the office wielded social control as a tool of aquatic control. By adopting conventional mechanisms of judicial administration and enforcement, Tuscany's rivers bureaucracy, much like any early modern court, worked to disseminate laws and orders across a difficult and differentiated territory, and enjoined ducal subjects and agents to monitor and transmit timely information about local problems and violations. Tuscany's rivers bureaucracy therefore approached flood prevention as a dialogical process that distributed agency, often uneasily, between the state and its subjects.

In advancing this line of argument, I draw inspiration from work in Tuscan political and legal history that revises older narratives about the absolutist nature of relations of power ushered in with the founding of the ducal state. As I began to describe in the dissertation's Introduction, absolute rule was more a theoretical and rhetorical ideal than a reflection of real conditions. Elena Fasano Guarini, for example, has called attention to problems of information deficits, compromise, and local resistance time and again in her studies of the uneven results of government attempts at centralization.[17] And in his study of the Otto di Guardia, the main judicial body and police force in ducal

[17] See Elena Fasano Guarini, *Lo stato mediceo di Cosimo I* (Florence: Sansoni, 1973); Elena Fasano Guarini, "Potere centrale e comunità soggette nel Granducato di Cosimo I," *Revista storica italiana* 89 (1977): 491–538; Elena Fasano Guarini, "Center and Periphery," in *The Origins of the State in Italy, 1300–1600*, ed. Julius Kirshner (Chicago: University of Chicago Press, 1995), 74–96.

Florence, John K. Brackett has gone as far as to conclude that "the grand duchy did not have enough centralized control over criminal justice to be considered an absolutist state."[18] The same dynamics conditioned the management of territorial waterways: indeed, to see like a rivers bureaucracy was to be "partially blind."[19] My aim in calling attention to the complex social and political processes at the heart of aquatic control in the early duchy, then, is to recover a sense, missing from present discussions of this office and its work, of just how contingent and unwieldy the task of territorial flood mitigation was in sixteenth-century Tuscany. As we shall see in the following chapters, it was this challenging on-the-ground reality—the sheer impossibility of total control against which ducal functionaries strained—that served as a powerful impetus to the development of an absolutist territorial imagination.

Emergence of a Rivers Bureaucracy[20]

Among the reforms spearheaded by Cosimo and his advisors over the course of the mid-sixteenth century to streamline Tuscany's public lands and works offices, bloated after centuries of incremental growth,[21] the formation of the Ufficiali dei Fiumi signalled

[18] John K. Brackett, *Criminal Justice and Crime in Late Renaissance Florence, 1537–1609* (Cambridge University Press, 2002), 78.
[19] James C. Scott, *Seeing Like a State: How Certain Schemes to Improve the Human Condition Have Failed* (New Haven, CT: Yale University Press, 1998), 2.
[20] I riff here on R. Burr Litchfield's *Emergence of a Bureaucracy: The Florentine Patricians, 1530–1790* (Princeton: Princeton University Press, 1987), in which he traces the emergence of new functionaries within the Florentine and Tuscan ducal state.
[21] ASF Consulta poi Regia Consulta, Serie I, 2, 98. The law opened by stating that the duke desired to "better reorder the management of the Capitani di Parte, and the Ufficiali di Torre, for more expeditious government, and structuring of public things, and for better, and more easy administration of a holy, and perfect justice ...". ("Volendo l'Illustrissimo et Eccellentissimo Signore il Signore Duca di Firenze, riordinare in meglio i maneggi de' Capitani di Parte, et degl' Ufitiali di Torre, per più espedito governo, et reggimento delle cose pubbliche, et per migliore, et più facile amministratione di una santa, et perfetta giustitia ..."). Published in Cascio Pratilli and Zangheri, *La legislazione medicea in materia di strade, ponti e fiumi*, 1: I Bandi (1485–1619):42.

a specific desire on the part of the ducal government to better position itself to address the problems of alluvial flooding. An examination of the river laws and proclamations the ducal government issued in the late 1540s after three severe and damaging inundations makes plain how waterways came to be defined as a specialist domain of government control.[22]

The first state-wide rivers legislation came on the heels of the 1547 deluge.[23] On 17 August, just four days after the terrible flood, the duchy issued a *bando* (proclamation) that prohibited throughout the state, for a period of five years, any disturbance or harm to riverbanks and beds "without a license of the worthy Ufficiali di Torre, or of their Commissary, or agents."[24] Called the *Bando sopra la conservatione de' fiumi* ("proclamation on the conservation of rivers"), it specified that no person "of any rank, status, or condition" could modify *posticci* or riparian structures such as dams, weirs, and mills "in and around any river of the Dominion," nor manipulate embankments and the floodplains that bordered them. This included a wide array of actions, from digging up and removing the stones, gravel, and sand lining alluvial shores, to permitting livestock to

[22] Luca Mannori, *Il Sovrano tutore: pluralismo istituzionale e accentramento amministrativo nel principato dei Medici (Secc. XVI-XVIII)* (Milan: Giuffrè, 1994), 386–87; See also Emanuela Ferretti, "'Imminutus crevit': Il problema della regimazione idraulica dai documenti degli ufficiali dei fiumi di Firenze (1549–1574)," in *La città e il fiume: Secoli XIII–XIX*, ed. Carlo Travaglini, Collection de l'École française de Rome 394 (Rome: École française de Rome, 2008), 105–28.

[23] It is worth noting that the duchy had also during that spring (29 April 1547) formed a specialized Pisan water office, the Ufficiali dei Fossi ("Officers of the Ditches"). This was an administration charged with draining and cultivating the Pisan plains, an area of longstanding investment interest to moneyed Florentines, and therefore responds to slightly different impulses than the need to manage excessive territorial floods. After the Ufficiali dei Fiumi was founded in Florence, however, this Pisan office aided in alluvial flood mitigation and control efforts, supporting the mandate of the office operating out of the ducal capital. On the ducal drainage office in Pisa and its republican antecedents, see Ranieri Fiaschi, *Le magistrature pisane delle acque* (Pisa: Nistri-Lischi Editore, 1938), and Elena Fasano Guarini, "Regolamentazione delle acque e sistemazione del territorio," in *Livorno e Pisa: due città e un territorio nella politica dei Medici*, ed. Mario Mirri et al. (Pisa: Nistri-Lischi, 1980), 43–47.

[24] ASF, Consulta poi Regia Consulta, Serie I, 1, 35. "… senza licentia delli spettabili Officiali di Torre o del loro Commissario, o agente." Published in Cascio Pratilli and Zangheri, *La legislazione medicea in materia di strade, ponti e fiumi*, 1: I Bandi (1485–1619):33.

wander near vulnerable embankments and wash themselves in rivers' flowing waters.[25] The law additionally forbade erecting new flood defense barriers, like levees and dams—structures we will explore in more detail shortly—along the Arno and Serchio rivers.[26] By defining the spaces of watercourses and their alluvial borderlands as protected corridors within the wider landscape, this measure represented a first attempt in law to restrict access to rivers statewide and to centralize their maintenance.[27]

A second river remediation law appeared almost two years later.[28] Rather than regulating riparian borders, this provision expanded the state's fiscal powers to raise money for river works. Dated 23 July 1549, it extended the scope of an existing tax on livestock sales, the *gabella delle bestie muline, cavalline, et asinine,* whose revenues helped to fund Arno embankment repairs carried out, still at that time, by the Ufficiali di Torre.[29] Levied on sales of mules, horses, and donkeys within Florence and its *contado,* the city's traditional tax jurisdiction, it was enlarged in the July law to apply, for a period of five years, "also in the Distretto, and in every part of the remainder of this most ample, and happy state."[30] It applied to all livestock transactions conducted by "people of the

[25] ASF, Consulta poi Regia Consulta, Serie I, 1, 35. "Che la non sia alcuna persona di qual si voglia grado, stato, o conditione, che intra 'l tempo et termine d'anni cinque prossimi futuri da hoggi, ardisca, o prosuma in alcun modo, né sotto alcun quesito colore per sé, o per altri, guastare, o altrimenti danneggiare, personalmente, o con bestie, gl'argini, ripari, o vero rosti, et posticci, fatti, o che si faranno per ordine de' commissarii di Sua Eccellenza, o de' magistrati da quella deputati, in alcuno, o intorno alcun fiume del prenarrato Dominio, né intra detti posticci, né int su detti argini, o ripari lavorare, né di lì cavar rena, sassi, o giaia, né fare per sé, o per via d'altra persona, ne' detti fiumi d'Arno, et del Serchio solamente nuovi ripari." Published in Cascio Pratilli and Zangheri, 1: I Bandi (1485–1619):33.

[26] ASF, Consulta poi Regia Consulta, Serie I, 1, 35. Cascio Pratilli and Zangheri, 1: I Bandi (1485–1619):33.

[27] Although the Ufficio dei Fossi di Pisa, founded on 29 April 1547, did similar work as the Ufficiali dei Fiumi established later, the jurisdiction of this former office was limited to the *contado* of Pisa, and was tasked primarily with land drainage. See ASF, Senato dei Quarantotto, cc. 95v-99r. Published in Cascio Pratilli and Zangheri, 1: I Bandi (1485–1619):27–32.

[28] ASF, Consulta poi Regia Consulta, Serie I, 2, 91. Published in Cascio Pratilli and Zangheri, 1: I Bandi (1485–1619):38–41.

[29] This tax "was probably of republican origin, and re-established by Cosimo I in 1538." Vivoli, "La legislazione medicea in materia di strade, ponti e fiumi," 98.

[30] ASF, Consulta poi Regia Consulta, Serie I, 2, 91. "Et non solo nella Città, et Contado di Fiorenza, ma

Dominion, or foreigners, of any state, grade, or condition" across the ducal territory, as well as to subjects who purchased or sold farm animals beyond state borders.[31]

Two months thereafter, these initial measures taken to exert greater control over state rivers culminated in a third law that aimed at more systematically reforming the management of aquatic territory.[32] Signed on 18 September 1549, this measure, called the *Legge dell'unione* ("Law of the Union"), made two principal amendments. It first absorbed the Ufficiali di Torre into the Capitani di Parte Guelfa, the Florentine Republic's old property court. While the amalgamation extinguished the Ufficiali di Torre as an entity, its responsibilities, along with several of its staff, were transferred over to the Capitani di Parte Guelfa, which merged the Ufficiali di Torre's customary duties with its own to administer public infrastructure and private property together. But to "obviate, with every opportune remedy, the infinite damages, that the rivers cause, and would cause, to this most large, and happy State," the law also established, as a branch of the Capitani di Parte Guelfa, a specialized territorial rivers sub-office: the Ufficiali dei Fiumi.[33] It granted this administration "such equal and greater authority that the Ufficiali di Torre have had up to the present day … or that any other officers, offices, and magistrates have, or have ever had, in the governance of the rivers."[34] As chief stewards

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etiam nel Distretto, et in qualunque parte del resto del suo amplissimo, et felice Stato, et nominatamente in Pistoia, et nel suo Contado, et Montagna." Published in Cascio Pratilli and Zangheri, *La legislazione medicea in materia di strade, ponti e fiumi*, 1: I Bandi (1485–1619):41.

[31] ASF, Consulta poi Regia Consulta, Serie I, 2, 91. " ... et per quelle persone, che le contratteranno dentro a' termini del suo Stato felice, o pe' patroni di esse, sieno le persone, o del Dominio, o forestiere, o di cche stato, grado, o conditione si vogli ...." Published in Cascio Pratilli and Zangheri, 1: I Bandi (1485–1619):40.

[32] ASF, Consulta poi Regia Consulta, Serie I, 2, 98. Published in Cascio Pratilli and Zangheri, 1: I Bandi (1485–1619):42–59.

[33] ASF, Consulta poi Regia Consulta, Serie I, 2, 98. " ... che si possa ovviare con ogni opportuni rimedio agli infiniti danni, che fanno, et che farebbono i fiumi del suo amplissimo, et felice Stato." Cascio Pratilli and Zangheri, 1: I Bandi (1485–1619):42.

[34] ASF, Consulta poi Regia Consulta, Serie I, 2, 98. "... il prefato Magistrato de' fiumi solo s'intenda avere, et abbi ancora quella tale, tanta, et maggiore autorità, quale et quanta nelle predette, et circa le predette

of Tuscany's unruly waterways, they were given a mandate to take "primary care of the rivers, and to support them, care for them, and govern them all, such that any damage that they cause to everything ceases."[35] This included enforcing the terms of the 1547 *Bando sopra la conservatione de' fiumi*; collecting the expanded 1549 *gabella delle bestie muline, cavalline, et asinine*; levying, when these revenue sources were not sufficient for funding works of universal benefit, the so-called *impositioni* (impositions), a direct tax over all the state;[36] and, in short, seeing to all public works matters having to do with waterways.

In a significant departure from the fragmented nature of past customs of waterway management, these Cosimian river laws delineated the dominion's rivers as protected arteries in the landscape, forming an expansive and networked legal geography I call "aquatic territory." Just as the unification of the Ufficiali di Torre and Capitani di Parte Guelfa may evince a rising conception that the task of resolving public works issues and property disputes were related exercises—both, fundamentally, matters of fixing boundaries, of drawing lines upon the earth to distinguish public rights of way from private rights to land[37]—so the creation of the Ufficiali dei Fiumi as a separate

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cose, hanno avuto infino nel presente dì gli Ufitiali di Torre, et qualunque altri ufitiali, ufitii, et magistrati, che sopra la ccura, et reggimento de' fiumi sien mai stati in alcun tempo proposti ...." Published in Cascio Pratilli and Zangheri, 1: I Bandi (1485–1619):44–45.

[35] ASF, Consulta poi Regia Consulta, Serie I, 2, 98. "... di aver cura precipua di essi fiumi, et di reggergli, curargli, et governargli tutti di sorte, che ogni danno che essi facessino al tutto cessi ...." Published in Cascio Pratilli and Zangheri, 1: I Bandi (1485–1619):43–44.

[36] Mannori, *Il Sovrano tutore*, 387. See ASF, Consulta poi Regia Consulta, Serie I, 2, 98. Published in Cascio Pratilli and Zangheri, *La legislazione medicea in materia di strade, ponti e fiumi*, 1: I Bandi (1485–1619):44.

[37] I draw inspiration in my thinking here from David Alff who, in his study of early modern roads and other public ways, asserted that these systems (unlike the ones that interlink much of the developed world today) were still far from a "solid and settled thing." While speaking of 17th- and 18th-century Britain, Alff rightly observes that early modern infrastructures had to be continually asserted and reinscribed in the face of encroachments and competing claims on the part of private interests. Laws, as he explains—codified in documents, and propagated and upheld by government functionaries—"readied the world for it [infrastructure] by carving traversable space from private land." David Alff, "Make Way for

administrative branch suggests that fixing rivers was beginning to seem like an altogether different kind of assignment. Whereas managing roads and footpaths principally meant safeguarding them from misappropriation and obstruction, stewarding waterways involved shielding them from encroachments while also preventing them, in all their violent dynamism, from encroaching.[38]

The Ufficiali dei Fiumi's status as a branch of the Capitani di Parte Guelfa, connected to but distinct from it, was reflected in its organizational structure. It was headed by two magistrates with the official title of "Ufficiali dei Fiumi," who were among the group of 10 Florentine citizens selected as magistrates to oversee the larger joint administration. Three were drawn by lot, according to conventional election procedures under the Republic, while seven, including the two Ufficiali dei Fiumi, were personally appointed by the duke. All served one-year terms, except the Ufficiali dei Fiumi, who held the role indefinitely.[39] While not justified in the office's founding law, the lifetime tenure of the rivers magistrates probably reflects the perceived importance of a longer institutional memory to the effective management of waterways in contrast to other kinds of public works. The problems of water in this moment were evidently deemed grave enough to warrant permanent, dedicated forms of oversight.

Infrastructure," *Critical Inquiry* 47, no. 4 (2021): 625–43, quotes at 626 and 628.

[38] Inundations were seen as violent incursions upon neighboring property. The legal category of the nuisance, or "*danno dato*," after all, as we will see, literally meant "damage given," while rivers, when flooding, likewise caused *danno*. It is perhaps no accident that contemporary commentators sometimes evoked invasion and siege to discuss flooding. In his sonnet on the 1589 Arno flood, for instance, the little-known pamphlet author Michele Pieri personified the river as if an treasonous enemy of Florence: see BNCF RARI.E.6.7.55.II.31. A few years later, the Aretine nobleman and scholar Baldassarre Nardi, in his *Discorsi intorno alla disseccatione delle Chiane*, wrote that floods "…[imitate] l'ingordigia de crudeli soldati i beni loro contro ogni ragione usurpano…" ("[imitate] the greediness of soldiers, who against all reason seize the property of their victims"). BR, Ricc. 2575, fol. 76v.

[39] ASF, Consulta poi Regia Consulta, Serie I, 2, 98. Published in Cascio Pratilli and Zangheri, *La legislazione medicea in materia di strade, ponti e fiumi*, 1: I Bandi (1485–1619):42.

Together, the Capitani di Parte Guelfa and Ufficiali dei Fiumi oversaw a large staff of clerical, administrative, and technical functionaries. The *provveditore* (superintendent), assisted by the *sottoprovveditore* (assistant superintendent), held general project management responsibilities.[40] Clerical and accounting tasks fell to a group comprising an *auditore* (auditor),[41] *cancelliere* (clerk), *sottocancelliere* (assistant clerk), *camarlingo* (treasurer), *ragioniere* (accountant), and *esattore* (tax collector). Its technical staff, meanwhile, counted two to three salaried architects and engineers, as well as eight *capomastri*, or "master builders," trained variously as carpenters, stonecutters, bricklayers, architects, and engineers, who formerly served the Ufficiali di Torre.[42] The founding law stipulated that they would all be based together in the "same house"—the Palagio di Parte—in which the Capitani di Parte Guelfa traditionally convened (figure 10).[43]

While the *Legge dell'unione* granted the Ufficiali dei Fiumi complete authority to execute in and around rivers "all those repairs, and expenses, and to remove obstacles, that they know to be appropriate," it did not precisely dictate how this work would be

[40] As Emanuela Ferretti has pointed out, the *provveditore* soon became the duke's main contact within the Capitani di Parte Guelfa and Ufficiali dei Fiumi. Ferretti, "'Imminitus crevit,'" 107.
[41] The office's *auditore* initially also carried out this role in other government offices, namely the Magistrato dell'Abbondanza and the Conservatori di Legge. Ferretti, 108, n. 10.
[42] For a list of this staff and a description of their duties, see ASF, Consulta poi Regia Consulta, Serie I, 2, 98. Published in Cascio Pratilli and Zangheri, *La legislazione medicea in materia di strade, ponti e fiumi*, 1: I Bandi (1485–1619):45–47. Aside from the Ufficiali dei Fiumi, the Capitani di Parte Guelfa also sat above another branch, called the Castello e Fabbriche di Firenze ("The Castle and Plants of Florence") which oversaw the Fortezza da Basso and public manufactories, probably for artillery. Functionaries serving this branch included a *camarlingo*, a *provveditore*, a *sottoprovveditore*, a "*bombardiere*" (bomber), and an "*oriolaio*" (clockmaker). The Capitani di Parte Guelfa also had *ministri sopra i segni de' pesi et misure* (ministers over weights and measures), a *scrivano delle teste* (scribe of the census), and six *donzelli* (servants). Ferretti, "'Imminitus crevit,'" 107–9.
[43] The law specified that the Palagio di Parte would continue to serve as their base "until such time as another more suitable place is provided for them."ASF, Consulta poi Regia Consulta, Serie I, 2, 98. Published in Cascio Pratilli and Zangheri, *La legislazione medicea in materia di strade, ponti e fiumi*, 1: I Bandi (1485–1619):45. On the Palagio di Parte, see Sara Benzi and Luca Bertuzzi, *Il Palagio di Parte Guelfa a Firenze* (Florence: Firenze University Press, 2006).

organized in practice.[44] To understand how Tuscany's first rivers office enacted their mandate to take "primary care of the rivers,"[45] then, we must examine their officers and technicians at work. The administration's bureaucratic papers, a vast archive of practice preserved today in Florence's state archive, make it possible to reconstruct some of the complex operations it managed across a number of fronts. After briefly summarizing what has already been said of the alluvial defense projects the Ufficiali dei Fiumi constructed along waterways, I will turn to its judicial records—its *partiti*, or summaries of its resolutions and deliberations, mainly, but also the orders, laws, incoming and outgoing communications, and expert reports to which they referred—to explore the office's distributed efforts to promulgate and enforce river laws and gather intelligence on and respond to problems in the landscape over the course of the 1550s.

Direct Interventions: Constructing Alluvial Defenses

During its first decade of operations, the Ufficiali dei Fiumi's direct interventions along waterways primarily concerned the building and maintenance of barriers and embankment reinforcement structures to shield alluvial lands from flood surges. These included routine public works projects, many inherited from the Ufficiali di Torre, that targeted volatile zones around Florence and its immediate countryside. While little in the way of a paper trail survives for these projects, scholars have been able to reconstruct a general picture of the office's interventions in this domain from analysis of summaries of

[44] ASF, Consulta poi Regia Consulta, Serie I, 2, 98. "... et abbino piena autorità di poter fare in essi fiumi, et nelle pertinenze loro, et fuora di essi fiumi, et pertinenze, tutti quei ripari, et spese, et di levarne quegli ostacoli, che essi conosceranno convenirsi al reggimento predetto, et che ricercherà alla giornata il bisogno del rimedio in sé." Published in Cascio Pratilli and Zangheri, *La legislazione medicea in materia di strade, ponti e fiumi*, 1: I Bandi (1485–1619):44.

[45] ASF, Consulta poi Regia Consulta, Serie I, 2, 98. "... di aver cura precipua di essi fiumi ...." Published in Cascio Pratilli and Zangheri, 1: I Bandi (1485–1619):43–44.

its *stanziamenti,* or expense allocations.[46] These records, which date back to the office's beginnings,[47] summarize project costs, mostly for supplies and labor, in addition to other operating expenses. These sums were paid out from the tax revenues of the *gabella dei bestie* and from universal impositions,[48] as well as from occasional loans from Florence's Monte di Pietà.[49]

As Carlo Vivoli and Emanuela Ferretti have pointed out, in spatial terms, the Ufficiali dei Fiumi's early work in this domain concentrated overwhelmingly along the Arno in proximity to the ducal capital. Clustered between the towns of San Giovanni Valdarno and the Gonfolina, the Ufficiali dei Fiumi focused especially on protecting urban settlements along the river from flood hazards.[50] In addition to the Arno, the Ufficiali dei Fiumi also completed works along the Sieve River where it empties into the Arno, at Pontassieve; the Mugnone, skirting Florence; the Bisenzio at Prato; and the Pesa.[51]

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[46] ASF, Capitani di Parte Guelfa, Numeri Neri, 190, fols. 130r–146v. Either the routine nature of interventions like embanking and damming—ancient forms of technology—meant that they were, by the sixteenth century, products of largely tacit knowledge, and possible to execute without a need for extensive working documents. Or such papers were indeed produced, but deemed unworthy of preservation. The surviving documents nonetheless reveal a great detail about the nature of the Ufficiali dei Fiumi's routine maintenance projects, specifying, in addition to their costs, their general sites, when they took place, the materials and labor involved, and the engineers from the Ufficiali dei Fiumi who coordinated them.

[47] The office began operations not on the date of its founding law (the *Legge dell'Unione*), but rather, as that law stipulated, on 1 March (near the end of the Florentine calendar year).

[48] Ferretti, "'Imminitus crevit,'" 110.

[49] ASF, Capitani di Parte Guelfa, Numeri Neri 190, c. 136r, for example, lists three debt-servicing payments to the "Camarlingo of the Monte della Pietà della ducal città di Firenze." From the 1540s, Cosimo I drew on and authorized increasingly large loans from Florence's Monte di Pietà to finance varied state initiatives and gifts, transforming this originally charitable institution into a source of cheap credit. See Carol Bresnahan Menning, "Loans and Favors, Kin and Clients: Cosimo de' Medici and the Monte Di Pieta," *The Journal of Modern History* 61, no. 3 (1989): 487–511.

[50] Vivoli, "La legislazione medicea in materia di strade, ponti e fiumi," 82; Ferretti, "'Imminitus crevit,'" 110. This zone, which Girolamo di Pace studied intently, as we have already seen, was evidently a well-known site of concern.

[51] Other rivers mentioned less frequently are the Elsa, Ombrone, Cagina, and Anconella.

The office's interventions along these alluvial corridors took many forms. Under the direction of the office's *provveditore,* and with possible assistance from its engineers or *capimastri,* corps of manual laborers conscripted through the *comandate,* a system of obligatory labor service by the peasantry, worked primarily during the dryer spring and summer months on recurring projects of alluvial maintenance and flood containment.[52] Maintenance work could involve cleaning riverbeds to keep them free of silt deposits, debris, and other damaging obstructions; servicing and repairing alluvial structures like bridges and weirs; and planting *posticci* or building retaining walls to fortify embankments against corrasion. Occasionally too, the Ufficiali dei Fiumi repaired bridges or nearby streets that had been ruined by floodwaters; a particularly frequent cost item in this area were funds for the reconstruction of the Ponte a Sieve, a bridge washed away by the 1547 deluge of the Sieve, that linked Pontassieve with San Francesco, a neighborhood of the town of Pelago.[53] But most frequently mentioned in its records were the lines of *ripari* ("shelters"), defensive structures built to shield urban settlements, farm fields, and principal roads from alluvial overflow. The morphology of these structures

[52] Ferretti, "'Imminitus crevit,'" 113. As Suzanne B. Butters has explained, "obligatory labor services by countrymen were not new, but the efficiency with which public works administrators employed by the sixteenth-century Medici dukes were able to conscript large teams of *contadini* to manage roads, and rivers, raise earthworks, and cut canals was striking." For more on the *comandate* system, see her "Pressed Labor and Pratolino. Social Imagery and Social Reality at a Medici Garden," in *Villas and Gardens in Early Modern Italy and France*, ed. Mirka Benes and Dianne Harris (Cambridge: Cambridge University Press, 2001), 62, 70–77, and Luigi Aztori and Ivo Regoli, "Due comuni rurali del dominio fiorentino nel secolo XVI: Montopoli in Val d'Arno e Castelfranco di Sotto," in *Architettura e politica da Cosimo I a Ferdinando I*, ed. Giorgio Spini (Florence: Leo S. Olschki, 1976), 79–164. The Ufficiali dei Fiumi's summarized payment records frequently list payment periods for work beginning around February or March and ending around September or October. ASF, Capitani di Parte Guelfa, Numeri Neri, 190, fols. 130–146. The summer *comandate* conscriptions, which extracted men and work animals from farms when they were most needed for agricultural work, could have a number of punishing knock-on effects in rural towns. Giorgio Spini, "Introduzione," in *Architettura e politica da Cosimo I a Ferdinando I*, ed. Giorgio Spini (Florence: Leo S. Olschki, 1976), 50.

[53] Expenses for this bridge are first recorded in the Ufficiali dei Fiumi's *stanziamenti* in February 1552. ASF, Capitani di Parte Guelfa, Numeri Neri, 190, fol. 134r.

varied widely, from retaining walls that patched up and artificially elevated sunken banks, to a host of different kinds of levees and walls erected parallel or transversal to the river to beat back rising water levels. They were built either from timber, as slatted walls or palisades, or with stones and gravel, in the form of gabions.[54] While the Ufficiali dei Fiumi's technicians seem to have only occasionally produced detailed visual records of such structures during the office's initial years of operation, these sorts of hydraulic technologies—by that time, already centuries-old—were pictured not infrequently in treatises on architecture and machines dating back to the fifteenth- and early-sixteenth centuries.[55] Illustrations by the likes of Mariano di Jacopo Taccola (1382–ca. 1453) and Francesco di Giorgio Martini (1439–1501), among others, lend insight into how various *ripari* would have looked, as do later drawings of these constructions—which continued to be built in much the same manner—from the seventeenth century (figures 11–12).[56]

In addition to maintaining and fortifying embankments, the Ufficiali dei Fiumi, in an attempt to altogether avert flood risks at especially precarious alluvial zones, occasionally undertook more radical interventions that included rectifying winding

[54] These *ripari* are described in Ferretti, "'Imminitus crevit,'" 114–15; Danilo Barsanti and Leonardo Rombai, *La "guerra delle acque" in Toscana: storia delle bonifiche dai Medici alla riforma agraria* (Florence: Edizioni Medicea, 1986), 42; Emanuela Ferretti, "Il corso del fiume e le opere idrauliche," in *Navigare in Arno: acque, uomini e marmi tra Firenze e il mare in età moderna*, by Emanuela Ferretti and Davide Turrini, Le terre del Rinascimento. Quaderni didattici 1 (Firenze: Edifir, 2010), 13–16; Emanuela Ferretti and Davide Turrini, "Regimare le acque e navigare il fiume. Il basso corso dell'Arno fra Medioevo ed Età Moderna," in *Leonardo e l'Arno*, ed. Roberta Barsanti (Ospedaletto-Pisa: Pacini Editore, 2015), 84–90.

[55] On the social and political contexts for the proliferation of technical manuscripts of these sorts, see Pamela O. Long, "Power, Patronage, and the Authorship of Ars: From Mechanical Know-How to Mechanical Knowledge in the Last Scribal Age," *Isis* 88, no. 1 (1997): 1–41, and Pamela O. Long, *Openness, Secrecy, Authorship: Technical Arts and the Culture of Knowledge from Antiquity to the Renaissance* (Baltimore: Johns Hopkins University Press, 2001).

[56] Ferretti, "Il corso del fiume e le opere idrauliche," 116; Ferretti and Turrini, "Regimare le acque e navigare il fiume," 87; Mariano Taccola, *De machinis. The engineering treatise of 1449*, ed. Gustina Scaglia and Bayerische Staatsbibliothek (Wiesbaden: Reichert Harrassowitz in Komm., 1971); Francesco di Giorgio Martini, *Trattati Di Architettura Ingegneria e Arte Militare*, ed. Corrado Maltese (Milan: Polifilo, 1967), 28; Cosimo Noferi, "La Travagliata Architettura" (Florence, 1656), Biblioteca Nazionale Centrale di Firenze, Galileiani, 124.

segments of rivers. Over the course of the 1550s, a large project of this kind was executed near the town of Limite, just upstream of Empoli, the site of a large meander in the river and a vulnerable zone where the current, forced in a hairpin turn, slowly corraded the banks. To bypass this bend, the Ufficiali dei Fiumi carved a *taglio* (literally, a "cut" or "slice") through the earth at the base of the elbow to receive the Arno's current and divert it from its meandering path (figure 13).[57] It was completed in 1556, when land recovered from the area of the *taglio*, claimed as ducal property, began to be cultivated for conversion into the Medici farm complex of Arnovecchio.[58] The draining and appropriation of formerly flood-ridden lands by the duke, a practice perpetuated by his successors, points to ways in which these sorts of reclamation projects, while carried out at least officially under the banner of flood prevention, also enlarged the Medici family's agricultural estates acreage (while additionally expediting riverine navigation).[59]

Judicial Interventions: Regulating Rivers

[57] Begun in 1548 or 1549 under the direction of hydraulic engineer and sculptor Niccolò Tribolo, who worked as an engineer for the Ufficiali di Torre and the Capitani di Parte, the project passed to the supervision of the engineer Pasqualino d'Ancona, whom the Ufficiali dei Fiumi hired first on contract, and then, from 1553, as a salaried technician. Ferretti, "'Imminitus crevit,'" 117.

[58] Ferretti, 117–18. For more on the *taglio* at Limite and the farm of Arnovecchio, see Libertario Guerrini, *Empoli dalla peste del 1523-26 a quella del 1631*, vol. II (Florence: Gonnelli, 1990), 479–95; Anna Guarducci and Leonardo Rombai, "Il territorio. Cartografia e organizzazione spaziale tra i tempi moderni e contemporanei," in *Empoli: città e territorio: vedute e mappe dal '500 al '900: Convento degli Agostiniani, 8 febbraio-13 aprile 1998*, ed. Giuseppina Carla Romby et al. (Empoli: Editori dell'acero, 1998), 35–114; and most recently, Paolo Santini, "Cosimo I de' Medici e la politica delle acque nella terra d'Empoli (1550–1583). Arno Vecchio: la storia di una grande trasformazione territoriale," *Bullettino Storico Empolese* 19, no. 63/64 (2020): 58–78.

[59] In 1560, the Ufficiali dei Fiumi began another large *taglio* at Calcinaia, near Pisa, which straightened the tract of the Arno from Montecchio to San Giovanni alla Vena. This work drastically changed the city's urban geography, changing the position of the Castello di Calcinaia with respect to the river from its left bank to its right bank, and separating the town from the Strada Regia Pisana, a main road. The project continued through the reigns of Francesco I and Ferdinando I. Ferretti, "'Imminitus crevit,'" 120–21. Giorgio Spini has speculated that the Medici sought to consolidate their landholdings by reclaiming marshy areas by means of projects like the *tagli* because this helped them to "avoid as much as possible any collisions with the families of the older Florentine governing classes, and to instead win over those of the nobles in the dominion." See his "Introduzione," 32–35, quote at 35.

In addition to coordinating and building flood containment works around Florence, however, the Ufficiali dei Fiumi also endeavored to quell alluvial disorder by regulating waterways and their borderlands. From their seat in Florence, they employed conventional judicial tools and procedures to promulgate and enforce river legislation across the ducal dominions. Their measures generated a profusion of legal and administrative proceedings, and on a handful of occasions each month, the two rivers magistrates convened together in the Palagio di Parte, with their auditor and possibly other clerks, to "properly, and faithfully, and diligently observe the established laws and statutes, and to do each and every other thing for which our obligations are bound."[60] In these meetings, they deliberated on the manifold riparian matters funnelled to their desks from across the state, from requests for dispensation from the laws and orders in force; to notices of noncompliance; to alerts of floods and other alluvial hazards, often accompanied by petitions for aid in the form of expert advice, funds, or both; and other assorted requests and repairs.[61] By analyzing the resulting records, this section reconstructs the principal mechanisms through which the ducal rivers office wielded social control as a tool of aquatic control, and explores some of its consequences in practice. To confine our discussion—for the office produced a veritable "mountain of

[60] ASF, Capitani di Parte Guelfa, Numeri Neri, 190, fol. 1r. "Prefati Magnifici Officales Fluminum ambo su dicta die presente rapresentaverunt in loco eorum residentie in scripturis corporaliter manu tactis ad dalationem Canc^{ii} ac not^{ii} interus, iuraverunt, dictum eorum officium, bene, fideliter ac diligenter exercere et statuta et leges observare et omnia et singula alia facere ad que vigere eorum officii tenentur ac dabent."
[61] Other common requests that did not come from subjects with special requests regarding interactions with rivers were mainly for exemptions from the *gabella delle bestie*. A third type of supplication that emerges from these records is a kind of early modern job application, specifically from men requesting employment with the Ufficiali dei Fiumi to assist them on projects. Early in the 1550s, for example, more than a few such supplications were sent to the Ufficiali dei Fiumi by people looking for employment in construction works for the bridge over the Sieve River at Pontassieve, a large project underway during those years. For example: ASF, Capitani di Parte Guelfa, Numeri Neri, 700, fols. 44–46. Many of these supplications emphasized their authors' parsimony and facility with keeping accounts.

paper"[62]—I will focus in particular on the *partiti* from the years 1550 to 1558, collected in one register, as a starting point, while looking also to associated legislation and incoming and outgoing communications referenced therein.[63] While the office sought to govern watery territory by dictating how subjects and communities could use and interact with the alluvial systems that both sustained and threatened their livelihoods, their agency, as we will see, was contingent upon the mutual efforts of ducal subjects and subject towns who were called upon to participate in policing these spaces.

1. Enforcing River Protection Laws

After deciding to pass a new river law or order, the Ufficiali dei Fiumi would draft the measure for dissemination as a *bando*. A well-established instrument of political communication, probably dating back to the early communal period, *bandi* were public proclamations made by *banditori* (town criers) to broadcast laws, orders, and requests on behalf of government magistracies.[64] While traditionally an ephemeral announcement, shouted out by mounted *banditori* after a trumpet trill, by the ducal period, these proclamatory texts were also frequently printed and posted in prominent positions at public sites.[65] Entries in the Ufficiali dei Fiumi's *stanziamenti* for payments to the likes of "Filippo di Giunta and his fellow booksellers … for having printed 200 *bandi* on account of the repair of rivers," for instance, or to "Tomaso Cortecci *banditore* for having

[62] Cerchiai and Quiriconi, "Relazioni e rapporti - Parte I," 188.
[63] This register is ASF, Capitani di Parte Guelfa, Numeri Neri, 190. The office first convened on 1 March 1550, as the *Legge dell'unione* specified, and their last meeting recorded in this register took place on 9 September 1558. ASF, Consulta poi Regia Consulta, Serie I, 2, 98. Published in Cascio Pratilli and Zangheri, *La legislazione medicea in materia di strade, ponti e fiumi*, 1: I Bandi (1485–1619):43.
[64] Stephen J. Milner, "'Fanno bandire, notificare, et expressamente comandare': Town Criers and the Information Economy of Renaissance Florence," *I Tatti Studies in the Italian Renaissance* 16, no. 1/2 (2013): 108.
[65] Milner, 134.

published the said *bando* in all the usual places,"[66] evoke the very material labor of disseminating early modern river laws.

As Stephen J. Milner argued in a recent study, *bandi* were crucial vectors of the "information economy of Renaissance Florence."[67] Though carriers of the voice of government, the so-called "*voce del governo*,"[68] these proclamations were unique in that they conveyed and solicited notice in equal measure, announcing laws and orders unto the masses while also appealing for their collaboration in enforcement through entreaties for information on exceptions, noncompliance, and other matters. Rather than a monological address from on high, then, *bandi* "confess[ed] to a knowledge shortfall and admitt[ed] to a vulnerability of sorts in the very act of policing," while "permitting … a voice to, and … eliciting … a response from, the general public."[69] *Bandi* should therefore be understood as catalysts of a dialogical process of information collation and consolidation that helped magistracies to enforce laws and acquire knowledge critical to governance.

It is therefore unsurprising that during its first decade of operations, the vast majority of the issues the Ufficiali dei Fiumi deliberated on proceeded from the 1547 *Bando sopra la conservatione dei fiumi*, the duchy's state-wide river conservation law. As we learned earlier in the chapter, this measure, first passed in 1547 by the Ufficiali di Torre and then transferred in 1549 to the oversight of the Ufficiali dei Fiumi, restricted

[66] ASF, Capitani di Parte Guelfa, Numeri Neri, 190, fol. 139v. "A Philippo di Giunta et compagni librai lire nove pagati per suo emolumento d'havere stampato 200 bandi per conto della reparation dei fiumi"; "A Thomaso Cortecci banditore per havere publicato decto bando in tutti ai luoghi publici et soliti delle città di Firenze."
[67] Milner, "'Fanno bandire, notificare, et expressamente comandare.'"
[68] Manuela Barducci and Francesca Gaggini, eds., *La voce del governo: leggi e bandi del 16. secolo* (Firenze: Comune di Firenze, 2010).
[69] Milner, "'Fanno bandire, notificare, et expressamente comandare,'" 132.

landlords and peasants on riverfront properties from planting or harvesting vegetation and building along or otherwise interfering in precarious alluvial zones without a license. It is worth revisiting this *Bando* to consider the ways in which it conscripted ducal subjects to partake in a distributed process of alluvial policing.

To intervene licitly along alluvial zones, subjects and subject towns were obliged to petition the magistracy for a license. The 1547 *Bando* detailed the consequences to befall those who committed infractions: 10 *scudi* on a first offense, two *tratto di fune* (the strappado) for any subsequent offense, and, for owners of livestock that roamed near riverbanks and disrupted alluvial soils, an additional fine (four *lire* for large animals and one *lira* if by small animals).[70] The *Bando* also recruited subjects and local officials to assist in policing rivers by soliciting denouncements (*denunci*) of violators.[71]

The *Bando* detailed a number of positive and negative incentives meant to deter offenders and promote the transmission of information thereof to office magistrates in Florence. A primary positive incentive, and a common feature of *bandi*, was the promise of financial reward.[72] "Open or secret notifiers" who denounced delinquent neighbors

[70] ASF, Conservatori di Legge, 1, 35. Published in "Bando deliberato, et Bandito il dì XVII d'agosto MDXXXXVII sopra la conservatione de' fiumi" (Florence, 1547), 33.

[71] Submitting denouncements was typically a two-step process. Private subjects first notified the officials of the communities where they resided of local infractions they witnessed. Denouncements could be submitted openly or in secret; in republican Florence, for example, citizens could submit unsigned letters in dedicated receptacles, called *tamburi*, positioned around the city center. Andrea Zorzi, "The Judicial System in Florence in the Fourteenth and Fifteenth Centuries," in *Crime, Society and the Law in Renaissance Italy*, ed. Trevor Dean and K. J. P. Lowe (Cambridge University Press, 1994), 44–47; Cecilia Nubola, "Supplications between Politics and Justice: The Northern and Central Italian States in the Early Modern Age," *International Review of Social History* 46, no. S9 (December 2001): 43–44; Allie Terry-Fritsch, "Networks of Urban Secrecy Tamburi, Anonymous Denunciations, and the Production of the Gaze in Fifteenth-Century Florence," in *Visual Cultures of Secrecy in Early Modern Europe* (Penn State University Press, 2013), 162–81. Under Cosimo I, a deliberation from February 1550 divided Florence (and possibly its contado) into 50 different subdivisions, each headed by a "*sindaco delle malefitti*," who was in charge of keeping records of denunciations to pass on to ducal magistracies. Brackett, *Criminal Justice and Crime in Late Renaissance Florence, 1537–1609*, 60.

[72] As Milner put it, "in trafficking information in this way and enabling citizens to make money in the process, it may appear that one of the basic categories used to identify modern information economies was met, namely, that information was already a commodity in late medieval and Renaissance Florence." See

would be paid a sum equivalent to one quarter of the offender's fine. Rectors and magistrates of subject towns who advanced denunciations to the magistrates in Florence would receive another quarter of the fine, while the remaining half would be collected by the ducal fisc "to service remedies."[73] Other incentives involved widely distributing liability for any offenses that went unreported, so as to punish not only anonymous transgressors, but also any who concealed knowledge thereof. The *Bando* held fathers accountable for violations committed by sons, for example, and entire villages and towns liable for local infractions for whom a perpetrator failed to be identified.[74] Moreover, rectors and local officials who failed to funnel denunciations from their jurisdictions onto the Ufficiali dei Torre and Fiumi "within that time, and in the mode and form, in which they are to denounce malefactors" would suffer a 25 *lire* penalty.[75] By weaving webs of social obligation, the Ufficiali dei Torre and Fiumi hoped to bolster compliance and ensnare those who dared defy ducal rivers orders.

i. Licenses

Analysis of the magistracy's proceedings issuing from this *Bando* lends some insight into its practical consequences in the landscape. Let us begin with licenses. From 1550 to 1558, the Ufficiali dei Fiumi granted a total of 133 licenses to subjects and subject towns whom requested waivers of the restrictions of the 1547 *Bando*. All such

his "'Fanno bandire, notificare, et expressamente comandare,'" 119.

[73] ASF, Conservatori di Legge, 1, 35. Published in Cascio Pratilli and Zangheri, *La legislazione medicea in materia di strade, ponti e fiumi*, 1: I Bandi (1485–1619):33.

[74] ASF, Conservatori di Legge, 1, 35. Published in Cascio Pratilli and Zangheri, 1: I Bandi (1485–1619):33.

[75] ASF, Conservatori di Legge, 1, 35. "...infra que' tempi, et nel modo et forma, et come e' son tenuti denuntiare e malefitii, che si commettano in tali loro sindicherie..." Published in Cascio Pratilli and Zangheri, 1: I Bandi (1485–1619):33. The *Bando* also outlined provisions for appealing things like fines, granting local rectors 10 days to make recourse to the Ufficiali di Torre (or Fiumi) to initiate these cases, which would then be adjudicated within the month.

licenses were granted on condition that the petitioner not "hinder the water from the direction of its course, nor cause damage to public or private lands,"[76] and also, at least in the 1550s, typically applied for a limited term of one year.[77] While these licenses, due to their conservative nature, generally precluded making major changes to the aquatic landscape, they can help shine light on how Tuscans sought, through state mediation, to modify alluvial spaces beyond those zones actively engineered by the Ufficiali dei Fiumi.

Much like the office itself, ducal subjects who sought to intervene along waterways were motivated foremost by a desire to protect their lands from the ravages of rivers. Over the course of the 1550s, license requests sent to the Ufficiali dei Fiumi most frequently concerned the building of flood defense barriers and reinforcements along waterways for the restoration ("*reparatione*") or preservation ("*conservatione*") of land and property.[78] Such requests seem generally to have been addressed to the office in reaction to (rather than in anticipation of) hazards, for during the autumn rainy seasons, and especially in the wake of floods, the Ufficiali dei Fiumi could find themselves veritably inundated by requests from riparian landowners, petitioning individually, in concert with neighbours, or on behalf of their towns and communities for permission to construct or restore defences along waterways in low-lying and precarious zones. After the severe flood of 1557, for example, requests for licenses to restore damaged embankments and riverine structures streamed into the office for several weeks after the rivers first breached their banks on September 13. To respect the chronological order of

[76] For example, ASF, Capitani di Parte Guelfa, Numeri Neri, 190, 5r: "… cum hac tamen conditione que non impediat acquam ab ipsius a directo eius cursu, nec damnat publicam ut privato inferat."
[77] An exception were fishing licenses, which were typically were granted for a period of one to four months, more on which will be discussed later.
[78] For example, ASF, Capitani di Parte Guelfa, Numeri Neri, 190, fol. 5v: "… posse impune fabricare in Flumine Terzolle pro reparatione et conservatione eorum bonorum …."

their *partiti*, clerks opted to scrawl these belated concessions—such as one license "conceded to the people of the Podesteria of Cascio to immediately restore those bridges along the Resco Torrent, as well as the mill that was torn down and destroyed by the onslaught of the flood"—in minuscule, in the margins of the page that recorded other mid-September deliberations (figure 14).[79] A rare departure from the regular bureaucratic formulism of these records, it conjures the emergency circumstances the office was still straining to handle.

Beyond constructing simple embankments to shield their lands from floodwaters, Tuscans also had recourse to the Ufficiali dei Fiumi for the right to build or repair more sophisticated alluvial structures, such as bridges, mills, or weirs. Most of the time, communities, rather than individuals, sought permission to execute projects of this kind. In a handful of these cases, the license also specified budget caps associated with varied work permits. In May 1550, for example, the magistrates granted the Capitanato of Palazzuolo a license to finish repairs to a bridge over the Senio River that passed through the town and to complete a nearby wall hemming the palace of the local governing official, "costing approximately 100 *scudi* … and no more."[80] It is unclear what these budgets referred to, though it is possible that in such cases, subject towns had included in their license requests a plea for financial assistance from the Ufficiali dei Fiumi.

Occasionally, the river magistrates granted licenses that regulated how people might extract resources from rivers and alluvial zones. Most of these pertained to fishing.

[79] ASF, Capitani di Parte Guelfa, Numeri Neri, 190, fol. 185 r: "…concesserunt licentiam et facultatem Populis Potestarie Casio posse del presenti restaurare illos pontes positum secus flumen reschi magris necesserios, et molendinum diructos et dirutum per proiectum innundationem et rependendi omnia quodam erit opportuni."
[80] ASFi, Capitani di Parte Guelfa, Numeri Neri, 190, fol. 2r.

They often included written consent to create divisions or *disecationes* (cuttings) in waterways—which may have referred to any number of fishing contraptions, from weirs, to reed fences, to nets, to buckets[81]—along with clear instructions to clean up all equipment on completion and "return the water to its usual course."[82] Fishing licenses were also typically granted for a shorter duration, often one to four months.[83] Most other resource licenses instead authorized felling trees on private property. In September 1550, for example, Lorenzo Buonacorsi dei Pitti requested a license to cut trees growing in proximity to the alluvial borderlines of his estate, a privilege he was granted "provided he does not touch the *posticci* erected by Girolamo di Pace da Prato."[84]

Taken together, the 133 licenses the Ufficiali dei Fiumi granted from 1550 to 1558 testify to the intricate social and economic demands that shaped alluvial ecologies in the early ducal state and the manner in which the office sought to mediate these interactions. For the eight-year period examined, however, the modest number of licenses recorded in the office's *partiti*, averaging about 16 per year, is but a trifling sum, even for Tuscany's relatively small population at the time. While we cannot know whether this count reflects all applications received by the office, or only a small sliver of them (these records, after all, do not list any denied requests for licenses, the existence of which remains an open question[85]), it was most certainly eclipsed by the number of violations.

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[81] On fishing practices in Tuscany in this period, see Andrea Zagli, "Pesca e ambienti 'umidi' nella Toscana del rinascimento," in *Fiumi e laghi toscani fra passato e presente. Pesca, memorie, regole*, ed. Franek Sznura (Florence: Aska Edizioni, 2010), 210–42.

[82] For example, ASF, Capitani di Parte Guelfa, Numeri Neri, 190, fol. 14v: "… remittent acquam in pristinum locum et solitum cursum, et duret presenti licentia per duos mensos et non ultra."

[83] See, for example, note 79 above.

[84] ASF, Capitani di Parte Guelfa, Numeri Neri, 190, fol. 4r: "… posse incidere ligna et arbores existentes super eius bonis in loco decto alla casa al Piano, dum modo non tangat posticcios factos per Hier^{o} da Prato et cum dicta conditione."

[85] If it is the former, then it is possible that the state introduced the possibility of licensure to simply regulate and keep tabs on how subjects made use of territorial waterways, rather than to actively arbitrate

Though we can only know of those ones that were detected and denounced to the office, they shine a revealing light on the kinds of infractions that took place and on the office's efforts to police them.

ii. Punishments

The Ufficiali dei Fiumi pursued a range of tactics to punish offenders and remedy infractions of which it was notified. All denouncements initiated proceedings of one sort or another, as malefactors caught cutting trees, digging diversion trenches, or building structures like mills without a license were summoned to appear before the rivers magistrates for a hearing. Those arraigned and subsequently found guilty would face down the penalties dictated by the *Bando*, though in some cases the Ufficiali dei Fiumi seem to have exercised discretion to modify its terms. On the lenient end of things, the office appears to have sometimes simply issued monitory orders reprimanding subjects for meddling with alluvial boundaries and directing them to remove impediments. In February 1550, for example, the rivers magistrates issued a formal warning to Berto del Zuta, Battista Landini, the Fornaciari brothers for removing rocks and gravel from exposed portions of the Arno's bed at an area near Florence, beyond the Porta San Niccolò, without a license. No fine or punishment is recorded.[86] Similarly, in August 1551, a certain Giovanni Ubertini de Oricellari was handed an order to "have removed two weirs and a log in the Bisenzio river, beside the banks of his lands." He completed

their use or ban such interactions outright.
[86] ASF, Capitani di Parte Guelfa, Numeri Neri, 190, 7r.

the task the next day, according to a note scrawled below the order, and again received no fine or other penalty.[87]

In addition to commuting fines, however, on occasion the Ufficiali dei Fiumi also issued a number of much harsher verdicts. For severe offenses, such as violent tampering with the precarious borders of rivers and streams, or felling under the cover of night, for firewood or other purposes, the trees that grew there naturally or as *posticci* planted to counteract corrasion of alluvial soils, the magistracy exacted punishing fines, and on occasion sentenced malefactors to torture or imprisonment. It is worth discussing a few examples of some of the more severe punishments issued during the 1550s to understand how seriously the state sought to deal with egregious and unlawful alterations to vulnerable riparian zones. For example, in May 1551, the Custodians of the Trees and Posticci of the Arno, a commission that kept watch over the volatile stretch of the river outside the Porta San Niccolò, denounced a certain Lorenzo Machei Giovanni of the plains of Ripoli for cutting down trees in the area. The Ufficiali dei Fiumi summoned Lorenzo to the Palagio di Parte, whence he made "spontaneous confession before them, that on ten occasions he damaged the trees outside the Porta San Niccolò, cutting and carrying them away, and selling them."[88] For this transgression, he was charged the steep sum of 100 *scudi* (to account for each of his ten transgressions).[89] Such extraordinary

[87] ASF, Capitani di Parte Guelfa, Numeri Neri, 190, 10r: "… debeat effectualiter removisse duas peschaiolas et unum ceppum existentes super flumine Bisenti secus ripas bonorum."
[88] ASF, Capitani di Parte Guelfa, Numeri Neri, 190, fol. 8r: "… per confessionem dicti Laurii coram eis sponte factam qui confessus fuit decios in dictis posticcis extra Portam Sti Nicc. damnum dedisce dictas arbores incidendo asportandoque et ipsas vendendo …." It is possible that different communities had local guardians paid to monitor *posticci*: an entry in the Ufficiali dei Fiumi's *stanziamenti*, for example, mentions a payment to a certain Stefano di Piero Fanetti for "taking care and guard of the *Posticci* of the Arno at San Giovanni" (ASF, Capitani di Parte Guelfa, Numeri Neri, 190, 143r), while Anna Cerchiai and Coletta Quiriconi note another such "guardie dei *posticci*" active at Montevarchi in 1582. Cerchiai and Quiriconi, "Relazioni e rapporti - Parte I," 200.
[89] ASF, Capitani di Parte Guelfa, Numeri Neri, 190, fol. 8r. For comparison, in 1549, both Girolamo di

fines were also not the worst of possible penalties: in March 1551, for example, Simoni Giunte del Campi, who lived near the banks of the Bisenzio river north of Florence, seemed to have been sentenced to prison for "cutting and taking away many small trees, and five old ones, from a place commonly called the Pirgione on the banks of the Bisenzio, around the bridge of Capalla."[90]

iii. Reissuing *Bandi*

In an effort to curb infractions of this sort, the Ufficiali dei Fiumi were moved to repeatedly issue rivers conservation proclamations. During the 1550s, the office appears to have promulgated either the 1547 *Bando* or more targeted orders meant to avert specific offenses on an almost annual basis, attesting to just how troublesome these spaces were to police. For example, deploring "the damage that is daily committed to embankments, weirs, and *posticci* of the Arno" by inhabitants of several towns around the ducal capital—locales likely easier to monitor than regions further field, due both to their proximity to Florence and because some of them hosted building sites managed by the Ufficiali dei Fiumi—the magistrates decided, in February 1550, to issue a *bando* reiterating the state's prohibitions on "breaking, or otherwise damaging, personally or with animals, the banks, *ripari*, piles, and *posticci* of the Arno, under the penalties contained in the *bando* last issued."[91] Damage by livestock, singled out in the original

Pace da Prato and Niccolò Tribolo were paid 48 *scudi* by the Capitani di Parte Guelfa and Ufficiali dei Fiumi as their annual salary. Ferretti, "'Imminitus crevit,'" 127.

[90] ASF, Capitani di Parte Guelfa, Numeri Neri, 190, fol. 13r: "commisserunt que quatenus simon giunte del campi [unintelligible] in carceribus [unintelligible] per fidem [unintelligible] et asportasse nonnullo arbores parvos et quinqus arbores veteris existentus in quodam ut vulgo dicitur Pirgione super ripa Bisentii citra pontem capalla que una [unintelligible] casu intelligatur liber a carceribus …."

[91] ASF, Capitani di Parte Guelfa, Numeri Neri, 190, 6v. "Li spettabili signori ufficiali del fiumi di sua Eccelentia Illustrissima fanno publicamente notificare et representamente comandare che nessuna persona di qualsivoglia stato, grado, o conditione, ardisca o prosumma in modo alcuno per sa, o per altrui, guastare

1547 *Bando* and in this subsequent one, seemed to have been an especially incessant problem. Another proclamation from April 1554, for instance, warned that "anyone who dares to pass, with any animals, through the Mugnone between the Bridge of San Gallo and the Bridge of Posse" would suffer a penalty of 10 *lire* "and the office's arbitrary punishment."[92] As was usual, denouncers were to receive one quarter of the assessed fine for reporting on offenders.[93]

Whereas most of the *bandi* promulgated by the Ufficiali dei Fiumi were meant to proscribe the range of permissible action along waterways, at least one early *bando* seemed to have been issued with the express intention of accommodating, if only in relatively circumscribed zones, subjects' customary rights to these spaces. This order, from 5 July 1550, asked "each and every person who claims rights or actions along the uncultivated lands of the Arno, and who, in so doing, impedes the river"—along a stretch upstream of Florence, between the weirs of San Niccolò and Rovezzano, and the Valdarno towns of Figline, San Giovanni, and Montevarchi, as well as downstream of the capital, until Signa—"to give notice to the Ufficiali dei Fiumi in writing, on a full sheet, of those parts to which he claims rights, stating his town, the borders, and the number of *staiora*." It gave these subjects a window of one month in which to notify the office—so they might, presumably, take note of any heavily used or worked riparian zones, and investigate or plan repairs if necessary—after which time "they will be charged as violent

o altrimenti danneggiare personalmente o con bestie gli argini, ripari, overo rosti et postici del fiume d'arno, sotto pena che ne bandi ultimamente mandati si contiene...."

[92] ASF, Capitani di Parte Guelfa, Numeri Neri, 190, 13r. "Gli spettabili signori ufficiali di sua Eccelentia Illustrissima fanno commandare a' ogni et qualunque persona di qualunque stato, grado, o conditione si sia et massime a' Beccai et Peccorai, che non sia alchuno che ardisca passare con alchune bestie indomite per il Fiume di Mugnone dal Ponte di S. Gallo insuno al Ponte alle Mosse sotto pena di y 10 et del arbitrio di loro signorie…"

[93] ASF, Capitani di Parte Guelfa, Numeri Neri, 190, 13r.

occupiers of the lands, and will be punished accordingly."[94] What is interesting about this particular proclamation is the temporary pardon it extended for actions otherwise prohibited by the 1547 *Bando*, with the intention, likely, of encouraging subjects to come forward with information on how they were using the river. (As we will see in Chapter 2, this early instance of actively soliciting information from subjects would before long become a more common feature of river legislation and policing.) In the end, the results of this measure are difficult to track, but were probably met, like so many others were, with mixed success.

By enforcing the 1547 *Bando* and other river protection laws, then, the Ufficiali dei Fiumi sought to exert control over waterways throughout ducal dominions. These orders severely limited the rights of subjects and subject towns to use and manipulate rivers without express permission in the form of a license. But the Ufficiali dei Fiumi's laws were imperfect tools for shaping alluvial spaces, for the office's agency was, after all, conditioned by and shared with subjects, on whom its magistrates relied to enforce orders and pinpoint problems.

2. Remedying flood damage to riparian property

In addition to enforcing the 1547 *Bando*, the Ufficiali dei Fiumi also administered proceedings initiated by subjects and subject towns seeking remedies, judicial and

[94] ASF, Capitani di Parte Guelfa, Numeri Neri, 190, 4v. "Illustrissimo et Eccelentissimo Signor in Duca di Firenze et per sua Ecc^{tia} li Magistrati Signori Capitani di Parte et Spettabili Officiali dei Fiumi, fanno publicamente bandire et notificare a ogni et qualunque persona che pretendasse ragioni o actioni sopra i beni et per li impedimento del fiume d'Arno, son stati inculti et copertti cominciando dalla Pescaia di sopra di Firenze insino alla pescaia di Rovezzano, et in valdarno di sopra nelle intere tre Podestaria, cioe Figline, S. Giovanni, et Montevarchi, et da Firenze in giu insino al Ponte a Signa, debba infra un mese dal publicato bando haverne dato notitia al detto Magistrato, faccendo tutto distintamente notare in scrivere in un foglio intero, quella parte de beni sopra ai quali pretenda ragione … altrimenti sarà imputato occupatore violente dei beni d'altri, et ne sara punito secondo che per le legge si despone."

technical, for property that sustained flood damage. These cases were of two main kinds. In the first, an afflicted party, imputing flood damage to the negligent or wrongful use of rivers or alluvial lands by another party, brought a dispute ("*lite*" or "*differenza*") to the Ufficiali dei Fiumi for resolution. The proceedings that ensued resembled a particular riparian form of *danno dato* (literally, "damage given" or "damage done," also sometimes called *turbata possessione* or "troubled possession"). This category, conventionally distinguished in statutory law from civil and criminal jurisdiction, was established during the communal period in Tuscany[95] and referred to "disputes between landowners, landowners and peasants, and agriculturalists and pastoralists over the use of land or its fruits."[96] (It is similar to what in early modern English law was known as a nuisance.) In the second category of case, by contrast, subjects and subject towns overwhelmed by flooding not attributable to any perceived neglect or wrongdoing, but rather originating from general alluvial disarray, petitioned the Ufficiali dei Fiumi for assistance in rectifying damages to property ("*disordini*," or "disorders," as the office's technicians termed them). Though similar in several respects to cases of riparian *danno dato*, in these latter instances, the offending party was no obstreperous neighbor, but rather the river itself.

As was mentioned earlier, investigating and resolving *danno dato* disputes and other public works and property deficiencies, alluvial and otherwise, had long been the purview of the Capitani di Parte Guelfa and Ufficiali di Torre. After the *Legge dell'unione* came into effect in 1549, the Capitani di Parte Guelfa continued to adjudicate these cases, with the exception of those pertaining to waterways, which were hence

[95] Fasano Guarini, *Lo stato mediceo di Cosimo I*, 47.
[96] Brackett, *Criminal Justice and Crime in Late Renaissance Florence, 1537–1609*, 93–94.

funnelled instead to the Ufficiali dei Fiumi.[97] And although riparian problems and disputes made up only a fraction of the total number of property damage cases (typically ranging between 150 and 250 annually over the course of the 1550s) directed to the Palagio di Parte for resolution, they permitted the state to intercede in an immediate advisory capacity in managing territorial waterways, and therefore merit a place in this broader discussion of state attempts to wield law as a tool of aquatic territorial engineering. For in contrast to licenses, which seem to have generally been granted in a summary manner to authorize temporary, conservative modifications to segments of rivers and alluvial shorelines, property damage cases gave rise to investigations that drew the Ufficiali dei Fiumi's functionaries to different locales across the territory, where they studied the landscape and its waterways while transacting with subjects to assess the situation at hand and advise on a course of action.

A multi-step process, investigations were delegated to the Ufficiali dei Fiumi's staff of *capomastri* and sometimes to their engineers.[98] For every flood-based grievance that came before their office, the magistrates first appointed a technician to travel to the site of concern.[99] Upon arriving at the afflicted property, group of properties, or town in

[97] There are some exceptions: in the Reports fondo, sometimes some river matters were shown to have on occasion been assigned to Capitani di Parte, a symptom perhaps of the imperfect early phases of bureaucratization. Drainage ditches also seemed to be an ambiguous category: sometimes they were assigned to the Ufficiali dei Fiumi, and other times to the Capitani di Parte. The *Legge dell'unione*, however, had nonetheless stipulated that "la qual'autorità, et maneggi, e' s'intenda tolta in questo capo, dei fiumi solamente, a essi Capitani di Parte, salvo quello, che di sopra si dice delle vendite, et delle consegne de' beni, et delle impositioni di denari, per detti conti da farsi." ASF, Consulta po Regia Consulta, Serie I, 2, 98. Published in Cascio Pratilli and Zangheri, *La legislazione medicea in materia di strade, ponti e fiumi*, 1: I Bandi (1485–1619):45.

[98] In most cases, this was the task of a *capomastro*, although in some instances, engineers accompanied *capomastri* or produced reports themselves. It is probable that they were called in as experts to investigate matters deemed especially precarious or to advice on works that were of a greater expense or level of difficulty than was typical.

[99] Often, one technician was appointed to each investigation, though on occasion the Ufficiali dei Fiumi elected technicians to work in pairs or, more rarely, in a small team.

question, the elected technician would acquaint himself with the facts on the ground, empirically observing the site and often speaking with the relevant parties and other locals. He would then write up his findings, *in situ*, in a report. On completing this work, he would return to Florence to file the report with the Ufficiali dei Fiumi, whose magistrates then reviewed and, in virtually all cases, approved the recommendations proffered. Thus transformed into a legally binding works order, a copy of the report was produced and sent on, finally, to the relevant parties for execution.[100]

Realizing improvements ordered by the Ufficiali dei Fiumi was in the interest not only of the local entities that sought out help and advice, but also, as the office seemed to recognize, of the lands and communities downstream. In fact, subjects and towns that failed in their obligations to collaboratively order rivers courted the scrutiny of the Ufficiali dei Fiumi: in January 1556, for example, the river magistrates wrote to the governing officials at Montevarchi to follow up on a report sent their way a month prior. Produced by Piero di Francesco di Donnino, a bricklayer by trade, it outlined procedures for repairing local ruptures in the embankments of the Arno. "We understand that you did not carry out a thing," the Ufficiali dei Fiumi scolded, "and not knowing the cause, we are very surprised." Reminding Montevarchi's rectors of their obligation to "have this report carried out," the rivers magistrates ordered them to "immediately put everything into effect, keeping us advised."[101]

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[100] Judging from the puncture holes in the middle of each report, the autograph documents were probably then placed on a spike for storage in the Palagio di Parte's offices.

[101] ASF, Capitani di Parte Guelfa, Numeri Neri, 190, 159v: "Sp^{lis} vir., insino sotto le 19 del passato ti fu scritto et mandato la copia del rapporto fatto per m^{ro} Piero del Zuca uno dei nostri capimaestri circa al modo di provedere et riparare al fiume, commettendoti che facessi esseguire detto rapporto ordinando che nessuno passassi termini assegnatogli per quello ma che dacordo ciascuno andassi riparando insino si esso et da ogni banda, et intendiamo che non hai exeguito cosa alcuna et non sapendo la causa ce ne maravigliamo assai, et pero non mancherai subbito alle ricevuta fare tt^{o} mettere ad effetto con tenerci advisati et bene vale."

Almost forensic records of the alluvial hazards afflicting the ducal dominions, the Ufficiali dei Fiumi's reports are also exceptional documents of practice. Drafted on site, these documents are perhaps the closest we can come to peering over the shoulders of early modern technicians as they attempted to problem-solve in the landscape, working to comprehend the causes of flooding and to devise appropriate remedies. To better explain the information conveyed in these documents, which carried the force of law, I will analyze a few reports completed by the *capomastro* Piero di Francesco di Donnino. One of the most active of the Ufficiali dei Fiumi's river technicians during this decade, his reports are legion and serve as exemplary records of what it meant to *see* like a rivers technician in the early ducal state: to glimpse, that is, their partial, distributed sight.

On 5 December 1551, the Ufficiali dei Fiumi elected Piero to "see to some lawsuits and disputes turning" between various parties in San Giovanni Valdarno.[102] Within the month, he visited the town to inspect the matter, and on 4 January 1551, he drafted a report with his findings.[103] Following the standard conventions for these documents, he opened his report with an address to the Ufficiali dei Fiumi and summarized its basic purposes:

> Before you, magnificent Lord Officials of the Rivers, I, Piero di Francesco di Donnino, *capomastro*, report, having been sent by your Lords to San Giovanni Valdarno to see and measure certain lands near the Ponte alla Cerva, where at present there is a dispute between Girolamo d'Agniolo, or the heirs of S. Francesco d'Agniolo and Francesco di Domenico, on one side, and the nuns of San Ghaggia and Gherardo Chafferelli and Antonio Ghottoli, on the other side.[104]

[102] ASF, Capitani di Parte Guelfa, Numeri Neri, 190, 11v-12r: "… elegerunt et deputaverunt Petrum Franc^{o} Donnini caputm^{ro} ad videndam nonnullus lites et differentias vertentes inter moniales S^{ti} Gaggi et Pro eius et Leonardum Petri del Bianchini eorum procuratorum, re una, et Gherardum Franc^{o} del Caffarelli, re alia … ex causa nonnullus continuum bonorum posit in potestaria S^{ti} Johannes …."

[103] ASF, Capitani di Parte, Numeri Neri, 957, 512r-v. Report # 207, 4 January 1551.

[104] ASF, Capitani di Parte, Numeri Neri, 957, 512r. Report # 207, 4 January 1551. "Dinanzi a voi magnifici signori ufficiali dei fiumi si rapporta per me Piero di Francesco vostro capomastro mandato da vostre signorie a San Giovanni in Valdarno per vedere e misurare certe terre appreso al ponte alle cerva, dove di presente è lite infra girolamo dagniolo overo li eredi di S. Francsco d'Agniolo et Ser Francesco di

After introducing the circumstances of the case, identifying the dispute, its location, and relevant parties, Piero established its specific facts. It was brought to the attention of the Ufficiali dei Fiumi by the latter party, represented by Antonio, Gherardo, and the nuns, who had earlier complained that "the river had thrown itself" onto their lands.[105] This watercourse, the Cerva, did so "by accident or by its nature" at a spot where, on the opposite bank, a parcel of earth—reclaimed from the river after an earlier project to confine or narrow its floodplain—had been purchased by the other party.[106] Though originally measuring 9 *staiora*, this parcel of reclaimed land had somehow in the meantime grown larger, to 10 *staiora* and 26 *panora* in total, constraining the Cerva's bed and causing it to engulf properties along the facing shore.[107]

Thus "having seen and considered everything," Piero proceeded to his resolution. "Because the bed of the river is to return to its place every time land is liberated from it," he reasoned—seeing this condition unmet—that "Girolamo d'Agniolo must relinquish the land he acquired."[108] Reiterating the lawful procedures for allocating land freed up from riparian modifications, Piero stated that no claims could be made "until the Ufficiali

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Domenico da una, e per l'altra, spedale di bonifalzio et le monache di san ghaggia e Gherardo Chafferelli e antonio ghottoli."

[105] ASF, Capitani di Parte, Numeri Neri, 957, 512r. Report # 207, 4 January 1551. "Dove la lite depende per conto che il detto fiume della Cerva s'è gittato in sulla mana delli detti antonio ghottoli et altri detti di sopra."

[106] Piero does not explain how the reclaimed land first became available, but it was probably released from an embankment or straightening project executed along a segment of the Cerva River.

[107] ASF, Capitani di Parte, Numeri Neri, 957, 512r. Report # 207, 4 January 1551. "Questo si derivato overo per accidente, overo per sua natura, dove si trova che dalla parte opposita fu comprato una presa di terra di staiora 9 cioe braccia nove, la quale oggi si trova staiora 10 e panora ventisei che sono braccia 10 e 13/18."

[108] ASF, Capitani di Parte, Numeri Neri, 957, 512r. Report # 207, 4 January 1551. "… ogni volta che quelle faranno de liberazione che letto del fiume ritorni nel suo luogho per il detto girolamo dagnioli, si debba rellasare tutto laquisto da lui fatto …."

dei Fiumi have determined that the river will remain in its bed."[109] In concluding his report, he attested to the truth of his statement and listed the 12 *lire* salary he collected from the disputing parties, each of whom paid in proportion to the extension of their riparian frontage. According to a note scrawled in its margins, the report was approved by the river magistrates at their meeting just over one week later, on 12 January.[110]

In cases of riparian *danni dati* such as this one, the *capomastro*'s essential tasks lay in assigning fault and ordering remedies. The restoration of social and aquatic order in these disputes therefore hinged on the liable party duly redressing committed infractions. But how were these cases corrected when a perpetrator could not be identified—when the river had inexplicably flooded? Over the course of the 1550s, requests for aid to rectify the resulting "*disordini*," the carnage suffered by subjects and towns in the wake of alluvial disaster, outnumbered requests to resolve riparian *danni dati*. While investigations of these cases proceeded in a similar manner, the proposed solutions were often far more complex and involved, typically requiring affected subjects to shoulder the labor and expenses of the fixes proposed.[111]

At some point early in the summer of 1550, the Ufficiali dei Fiumi elected Piero di Francesco di Donnino to "see certain disorders of the river, or channel, called Bagniolo, near Montemurlo, as well as of a stream that feeds into the Bagniolo."[112] In early June 1550, he visited the site—a two-day's journey from Florence—and,

[109] ASF, Capitani di Parte, Numeri Neri, 957, 512r. Report # 207, 4 January 1551. "… sia lectio a ciaschuno al dirimpetto delle sua terre raquistare quel tanto che fuori del leto del fiume si racquistera e questo non si aquisti ne relassi prima che vostre signorie abbino determinato che il fiume ritorni al suo leto …"
[110] ASF, Capitani di Parte, Numeri Neri, 957, 512r.
[111] As was convention in Roman law; Mannori, *Il Sovrano tutore*, 383–85.
[112] ASF, Capitani di Parte Guelfa, Numeri Neri, 957, 129r-v. Report # 41, 3 June 1550. "… per vedere certi disordini del fiume overo fosato detto il bagniolo apresso a montemurlo e cosi d'uno rio che mette in detto bagniolo."

accompanied by the owners of the flooded bordering properties, he assessed the damage and composed his report. Starting with the Bagniolo, he observed that its bed "is not capacious enough for the water, since it is narrow, and has some elbows, which impede the course of the water."[113] He proposed cutting the river to straighten its path; widening its bed; and building a *riparo* "at the site of the first disorder," by the lands of a certain Tomaso di Filichaia. Finally, he proposed enlarging the bridge that crossed over the Bagniolo immediately upstream of the damage, since "it is not capacious enough, and impedes the water."[114] The feeding stream, on the other hand, had been diverted so radically from its usual course by a recent flood such that Piero determined "it is not possible to restore it to its former bed," and instead proposed rerouting it around some of the private properties it was engulfing.[115] Meanwhile, he concluded that the expenses for these varied tasks were to be divided in common among the subjects who stood to benefit from the proposed works, with each paying a share proportionate to their riparian frontage.[116] While silent on who was to realize the proposed works, these would have been divided among subjects and the local communal government, as was customary in the Roman law tradition.[117]

To their river reports, Piero and other *capomastri* sometimes appended schematic designs, or rather map-designs, that visually described their observations of the landscape, its present state of disarray, as well as a future prescribed plan of action. In

[113] ASF, Capitani di Parte Guelfa, Numeri Neri, 957, 129r-v. Report # 41, 3 June 1550. "… trovo che quello non e' chapace allaqua per essere istretto e avere alcuni ghonbiti li quali impediscono il chorso dellaqua."
[114] ASF, Capitani di Parte Guelfa, Numeri Neri, 957, 129r-v. Report # 41, 3 June 1550. "… perche non e' chapace e impediscie laqua …."
[115] ASF, Capitani di Parte Guelfa, Numeri Neri, 957, 129r-v. Report # 41, 3 June 1550. "… e quanto a rio uscito del suo luogho non e' possible che rimesso nel suo letto anticho …."
[116] ASF, Capitani di Parte Guelfa, Numeri Neri, 957, 129r-v. Report # 41, 3 June 1550.
[117] Mannori, *Il Sovrano tutore*, 383–85.

July 1550, for example, Piero di Francesco di Donnino was sent to inspect the "disorders of a river beyond Montelupo" that had flooded the lands of a certain Mona Maddalena, a widow of the noble Frescobaldi family, and of other inhabitants of the nearby community of San Lorenzo.[118] After observing the river, Piero "found it to be so abruptly restrained in its width that it flooded, causing land around it to be so waterlogged that it could not be seeded."[119] He then measured the river's breadth at various points, and proposed a new straightened and enlarged bed to be carried out by the owners of fronting properties according to measurements he specified. Piero set down these terms in a design, depicting, in plan, his proposed riverbed (labelled "*letto nuovo*," or new bed), cutting through the meandering course that wreaked havoc on surrounding lands (figure 15).

An early payment to Piero in the Ufficiali dei Fiumi's *stanziamenti* for work he completed in the Valdarno makes mention of his "having done many designs, and putting everything down on paper," a rare particular that suggests that Piero was recognized for creating drawings, while also testifying to the perceived novelty of such images, which were coming to be appreciated by the office as useful tools.[120] In the mid-sixteenth century, topographical mapping was still a relatively new administrative technology in the central Italian states, and the eclectic visual modes of the images scattered among the reports of the Ufficiali dei Fiumi speak clearly to this experimental time.[121] Unlike the

[118] ASF, Capitani di Parte Guelfa, Numeri Neri, 957, 175r. Report #60, 29 July 1550. "…mandato da vostre signorie a vedere certo disordine dun fiume di la da montelupo…."
[119] ASF, Capitani di Parte Guelfa, Numeri Neri, 957, 175r. Report #60, 29 July 1550. "…e o veduto il detto fiume overo rio e quello o chonsiderato et trovo che per essere in lungheza direnpo ristretto e ripieno a impaludire i tireni di qualita che per molti non si puo seminare…."
[120] ASF, Capitani di Parte Guelfa, Numeri Neri, 190, 130r. Report #60, 29 July 1550. "A Piero di Franc^{o} di Donnino capomaestro per suo emolumento di piu giorni che stette occupato con decti S^{ri} Officiali in Valdarno et altri luoghi et per havere facto piu disegni et messi in carta in tutto."
[121] Administrative mapping began to proliferate in the 1550s, but it was not until the late seventeenth century when it became a standardized technique. For an introduction to early Tuscan and central Italian cartography, see Leonardo Rombai, "Cartography in the Central Italian States from 1480 to 1680," in *The*

formulaic structure and language of the river reports, these water map-designs, aside from labelling the names of rivers, towns, and property owners, and listing relevant information about dimensions, adhere to no recognizable conventions. Instead, the master builders and engineers who produced theses glimpses of aquatic territory used a variety of different methods to depict water features and their surrounding lands. Across the office's reports can be seen plan projections, bird's-eye views, and elevations; gestural ink drawings and colorful watercolor paintings; abstract, schematic sketches, as well as more carefully modelled evocations of form and volume (figures 16–17). Moreover, for the 1550s, such maps seem far more preponderant in reports for the Ufficiali dei Fiumi than in those produced for the Capitani di Parte Guelfa on non-alluvial property matters. The proliferation in this archive of visual technologies of *river* mapping, specifically, is likely a sign of the sheer complexity of aquatic territory, its unruly, running waters constituting an expansive and dynamic system that river technicians struggled to comprehend, depict, and control.

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By shining a light on the context of the Ufficiali dei Fiumi's emergence and exploring their work over the course of the 1550s, I hope to have shown just how complex, contingent, and often unwieldy the work of territorial flood mitigation was in

History of Cartography, Volume 3: Cartography in the European Renaissance, ed. John B. Harley, The History of Cartography (Chicago: University of Chicago Press, 1987), 909–39 and; Leonardo Rombai, ed., *Imago et descriptio Tusciae. La Toscana nella geocartografia dal XV al XIX secolo* (Venice: Marsilio Editori, 1993). For more on mapping, territorial management, and statecraft, see for example: Richard L. Kagan and Benjamin Schmidt, "Maps and the Early Modern State: Official Cartography," in *The History of Cartography, Volume 3: Cartography in the European Renaissance*, ed. John B. Harley, The History of Cartography (Chicago: University of Chicago Press, 1987), 661–79; Roger J. P. Kain, "Maps and Rural Land Management in Early Modern Europe," in *The History of Cartography, Volume 3: Cartography in the European Renaissance*, History of Cartography (Chicago: University of Chicago Press, 1987), 705–18; Michael Biggs, "Putting the State on the Map: Cartography, Territory, and European State Formation," *Comparative Studies in Society and History* 41, no. 2 (1999): 374–405.

sixteenth-century Tuscany. While the Ufficiali dei Fiumi could direct alluvial works along the Arno around Florence and in areas immediately upstream and downstream of the ducal capital, it made use of a set of standard early modern legislative and judicial techniques to order a much wider aquatic territory, relinquishing some degree of control to rural subjects and subject towns who were obligated to collaborate in ordering this space. These were people who may or may not have obeyed river laws; who may or may not have reported flood damage; and who may or may not have denounced malign neighbors. The state's reliance on these distributed systems of enforcement and correction constrained it to approach the problem of flood control in a largely reactive manner: by the time it set about coordinating repairs, or dispatching technicians to site, it was often too late; disaster had already struck, and now they had to remedy it.

Over time, however, a new way of thinking about the problems of flooding and about the best ways to combat them seems to have emerged. And this is where Girolamo di Pace, with whom this dissertation opened, comes in once again. An engineer for the Ufficiali dei Fiumi from 1550 until his death in 1562, Girolamo, dissatisfied with the office's technical and bureaucratic limitations, sought to devise a means of engineering waterways in a more systematic and proactive manner on the larger scale of the territory. His ideas and recommendations shall occupy our focus in the next chapter.

CHAPTER 2

THINKING WITH FLOODS

On 12 October 1558, Girolamo di Pace da Prato, then nearing 80 years of age, began a lengthy missive to Cosimo I about the flood hazards afflicting the ducal dominions. "Given the love and affection I hold for you, and for the world," he explained, "it seemed fitting to me to compose a little account, before I die, on the topic of rivers."[1] An ongoing problem, the engineer deemed a full account of its scope worthy of the prince's attention. For in spite of the institutional reforms the ducal government had spearheaded in the prior decade to order unruly waters, Tuscany's rivers continued to wreak their seasonal havoc upon the landscape, often overwhelming the capacities of the Ufficiali dei Fiumi, for whom Girolamo still worked as an engineer. The urgency of the matter was cast into especially sharp relief in September 1557, when another especially severe inundation, far more devastating than those of the 1540s (indeed, worse than any to follow until November 1966) battered Tuscany and other parts of central Italy, leaving a vast toll of destruction in its wake.[2] Apprehensive about the unyielding violence of the region's rivers and wistful, in his advanced old age, about his growing incapacity to do much about it, Girolamo put pen to paper, believing he could at the very least usefully weigh in on the crisis at hand. Drawing on everything he had learned over a long career as a hydraulic engineer, he went beyond his call of duty to write a synthesis of the watery

[1] BNCF, Manoscritti Palatini 788, fol. 2r. "…per l'amore, & affettione, che io porto à quella, et ancora alla universita; mi è parso fare à V. Ecc[a] un poco di memoriale īnanzi, che io muoia, circa à fiumi …"
[2] Ugo Losacco, *Notizie e considerazioni sulle inondazioni d'Arno in Firenze*, 1967, 33; Enrica Caporali, Massimo Rinaldi, and Nicola Casagli, "The Arno River Floods," *Giornale Di Geologia Applicata*, no. 1 (2005): 177–92. On the Tiber floods, see Pamela O. Long, *Engineering the Eternal City: Infrastructure, Topography, and the Culture of Knowledge in Late Sixteenth-Century Rome* (Chicago: University of Chicago Press, 2018), chap. 1.

landscape, describing its workings and enumerating a raft of methods for combating its destructive forces. While confessing that "writing is not my profession," he begged his reader's forbearance: by the time he brought his account to a close five months later, he had filled several dozen pages, leaving a veritable handbook as his final legacy.[3]

Though it remains unclear whether Girolamo's missive ever made it into ducal hands, what followed from his efforts is, for all intents and purposes, the first comprehensive written survey of Tuscany's aquatic territory and an instruction manual for mitigating its flood hazards. At once a letter, treatise, and technical text, Girolamo produced three copies of the text, including, for presentation to the duke, a nearly-200-page-long octavo volume in an elegant scribal hand (figures 18–20). While the engineer left his account untitled, the writer and archivist Cesare Guasti (1822–1889) later catalogued Girolamo's autograph draft under the heading, *Memoriale sopra la natura, il corso, ed i ripari di quasi tutti i fiumi e fossi dello Stato Vecchio, e sopra i regolamenti, che vi erano stato fatti fino all'anno 1558, e che si sarebbero dovuti fare nell'avvenire* ("*Record of the nature, course, and repairs of almost all the rivers of the Stato Vecchio, and on the methods for regulating them, imposed until the year 1558, and that ought to be done in the future*"), lending it the title that has stuck ever since.[4] (As this title

[3] BRP, Carteggi di Cesare Guasti 194, fol. 49v: "Comincatto in Firenze adi 12 di ottobre 1558 e finitto adi 22 febraio 1558."

[4] The Roncioniana Library in Prato holds the engineer's autograph draft (BRP, Carteggi di Cesare Guasti, 194), his densely packed handwriting heavily annotated, crossed out, reworked. Two other copies are in the Biblioteca Nazionale Centrale di Firenze: the presentation text (BNCF, Manoscritti Palatini, 788) and possibly an intermediate copy, in yet another hand (BNCF, Landau Finaly, 97). Though scholars recognize BRP, Carteggi di Cesare Guasti, 194 and BNCF, Manoscritti Palatini, 788 as original and copy, BNCF, Landau Finaly, 97—catalogued in Giovanna Lazzi and Maura Rolih Scarlino, *I manoscritti Landau Finaly della Biblioteca Nazionale Centrale di Firenze: catalogo* (Firenze: Giunta regionale toscana Bibliografica, 1994), 197 rather nondescriptly as "Progetti di opere idrauliche"—has so far escaped scholarly notice as a copy. For Cesare Guasti's entry, see Cesare Guasti, *Bibliografia Pratese compilato per un da Prato* (Prato: Per Giuseppe Pontecchi, 1844), 112.

indicates, the work concerned the "Stato Vecchio" only, referring to Medici dominions excepting the state of Siena. Annexed by Florence in 1555 at the conclusion of war between these states, the region would become legally enfeoffed to the Florentine duchy by 1559.)[5]

The purpose of this chapter is to examine the nature of Girolamo's remarkable project and speculate on its possible legacies. Though chock full of information and practical advice on alluvial engineering, this ponderous technical manuscript, far from a riveting read, has attracted only glancing attention from historians.[6] Forgoing any extended engagement with its text, scholars have discussed the *Memoriale* in general terms as an artifact of self-promotion, a bid by the wizened engineer to seal Cosimo's esteem through a dazzling display of his hydraulic knowledge.[7] By analyzing the contents and contexts of the engineer's writing, my intention is to more precisely clarify the nature and significance of this knowledge and discuss Girolamo's plausible motivations for committing it to writing.

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[5] Michael Mallett and Christine Shaw, *The Italian Wars, 1494–1559: War, State and Society in Early Modern Europe*, Modern Wars in Perspective (New York: Pearson, 2012), 257–64.

[6] The only two modern studies of Girolamo di Pace di Prato are Aldo Petri, "Il Memoriale sui fiumi di Girolamo di Pace da Prato," *Archivio Storico Pratese* XIX, no. II (1941): 63–76, and Veronica Vestri, "Girolamo di Pace da Prato, ingegnere del duca Cosimo I de' Medici: Un contributo documentario," *Prato storia e arte*, no. 111 (2012): 57–65, from where I draw details about his life and career. The engineer and his *Memoriale* were also discussed briefly in Marco Piccardi, *Tra Arno e Bisenzio: cartografia storica, fonti documentarie e trasformazione del territorio* (Signa: Comune di Signa, 2001), 118; Emanuela Ferretti, "'Imminutus crevit': Il problema della regimazione idraulica dai documenti degli ufficiali dei fiumi di Firenze (1549–1574)," in *La città e il fiume: Secoli XIII–XIX*, ed. Carlo Travaglini, Collection de l'École française de Rome 394 (Rome: École française de Rome, 2008), 105–28; Saida Grifoni and Leonardo Rombai, "Del dirizzare i corsi a'grandissimi fiumi: gli ingegneri dei fiumi e gli interventi idraulici nel bacino dell'Arno da Cosimo I a Ferdinando I," in *Fiumi e laghi toscani fra passato e presente. Pesca, memorie, regole*, ed. Franek Sznura (Florence: Aska Edizioni, 2010), 197; and in the exhibition catalogue, Loredana Maccabruni and Carla Zarrilli, eds., *Arno: fonte di prosperità, fonte di distruzione: storia del fiume e del territorio nelle carte d'archivio: mostra per il 500 anniversario dell'alluvione di Firenze (1966–2016)* (Firenze: Edizioni Polistampa, 2016), 23, 58–60. Before the twentieth century, Girolamo's Memoriale was mentioned and partly transcribed in Giovanni Targioni Tozzetti, *Relazioni d'alcuni viaggi fatti in diverse parti della Toscana per osservare le produzioni naturali e gli antichi monumenti di essa.*, 2nd ed., vol. 8 (Florence: Stamperia Granducale per Gaetano Cambiagi, 1775), 31–44.

[7] Petri, "Il Memoriale sui fiumi"; Maccabruni and Zarrilli, *Arno*.

The following pages make the argument that Girolamo desired to reform how aquatic territory was managed and governed. For beyond merely codifying a set of inherited alluvial regimentation techniques, the engineer believed he had new insights to share on administering the state's many watery spaces as well as the people who lived by them: "it is better," he advised, "to follow other modes, that were not followed in the past."[8] Through his practical work in the landscape, he had come to understand waterways as a vast and interconnected material system whose improvement demanded mechanisms of spatial intervention, labor coordination, and social control more far-reaching and proactive than those then in force in the state, as well as the oversight of specialist experts in possession of not only technical, environmental, and geographical knowledge, but also acute social and political acumen. As the ducal dominions continued to suffer the depredations of their untamed rivers, Girolamo took to writing in his advanced old age to preserve his learnings in the landscape and outline his vision for improving this space, elevating both his status and his art.[9] For more than a mere mechanical endeavor, alluvial engineering, as he seemed to have realized, was integral to territorial governance, and therefore constituted a vital matter of state.

Girolamo di Pace, from Prato to the Palagio di Parte

Like so many other practical technicians of his day and age, both within and without the hydraulic and mechanical arts, Girolamo honed his *métier* through a life of

[8] BNCF, Manoscritti Palatini 788, fol. 3v. "… per bene che si seguire altri modi che non si faceva per il passato …"

[9] In this sense, I see the *Memoriale* to fit within the fifteenth-century tradition of "*ars*" manuscripts of the fifteenth century. Girolamo's contribution to the hydraulic genre, I contend, was anchoring technical knowledge in an understanding of geography and territory. For more on this genre, see Pamela O. Long, "Power, Patronage, and the Authorship of Ars: From Mechanical Know-How to Mechanical Knowledge in the Last Scribal Age," *Isis* 88, no. 1 (1997): 1–41.

work in the field.[10] Though the circumstances of his early life and training are murky, he probably came from a family of technicians, learning the rudiments of practical mechanics and hydraulics from his father or an uncle after, possibly, an early training in basic mathematics and geometry.[11] He may have worked in or around Prato, from where he hailed, and possibly also in Florence. He was certainly in the ducal capital by 1534, however, when his name first appears in a list of artists and technicians in the Medici Court, perhaps brought into this orbit by Piero Francesco Riccio, then a tutor in Alessandro I's court, who also hailed from Prato.[12] From this time through the 1540s, he directly served Alessandro and Cosimo I as a hydraulic engineer, busying himself with aquatic projects of various kinds. The construction campaigns underway at the ducal residences in this period created work for several men like himself, and during this decade he collaborated with Niccolò Tribolo and others on the design and construction of water conduits and fountain systems at the gardens of the Medici villas at Poggio a Caiano and Castello.[13]

During these years, Girolamo also applied himself to problems of river maintenance and design.[14] His gargantuan proposal to canalize a segment of the Arno between Pontassieve-Rosano and the confluence of the Greve, explored in this

[10] For an introduction to practical technicians, what Pamela O. Long has in some places called the "artisan/practitioner," see her *Artisan/Practitioners and the Rise of the New Sciences, 1400–1600*, The OSU Press Horning Visiting Scholars Publication Series (Corvallis, OR: Oregon State University Press, 2011), 4.
[11] Ferretti, "'Imminitus crevit,'" 116; Paul F. Grendler, *Schooling in Renaissance Italy: Literacy and Learning, 1300-1600*, 1991, 306–29.
[12] Vestri, "Girolamo di Pace da Prato," 58. The archival refrence is ASF, Carte Strozziane, Prima serie, XII, 12v.
[13] Daniela Lamberini, "Il Tribolo ingegnere e lavori al Poggio a Caiano," in *Niccolò detto il Tribolo tra arte, architettura e paesaggio*, ed. Elisabetta Pieri and Luigi Zangheri (Poggio a Caiano: Comune, 2001), 189, n. 34; Vestri, "Girolamo di Pace da Prato," 59.
[14] In the closing pages of the *Memoriale*, he writes that he began working on the Arno and in other places in 1533: "Con l'aiuto et nome di Dio io cominciai à lavorare in sul fiume d'Arno in piu luoghi, et in piu paesi, l'Anno 1533." BNCF, Manoscritti Palatini 788, 82r.

dissertation's Introduction, is one artifact of his early work in this domain (figure 1). An ongoing preoccupation of his from 1534 to 1558, he would have almost certainly used these plans, among other cartographic referents, as a geospatial tool while drafting the *Memoriale*.[15] Yet Girolamo's work on waterways also took him much further afield. In a brief note from May 1545 he described a series of inspections and works he carried out over the past few years along some of Tuscany's major rivers, probably on commission for the Capitani di Parte Guelfa or Ufficiali di Torre.[16] It reveals a second collaboration with Tribolo from 1542–1545 to straighten a section of the Arno at San Giovanni Valdarno as well as, shortly thereafter, a journey to Tuscany's northwest coast where he examined the Serchio and other streams around Pietrasanta, a region that supplied the ducal capital with precious cargoes of marble.[17] The engineer commented extensively on the need for certain alluvial repairs, from enlargements of the Serchio's bed to reinforcement of collapsed segments of embankments along the Arno, and also remarked on the need to address the disrepair of streets in parts of the ducal dominion. These were concerns he would address again, and in a more comprehensive manner, in the *Memoriale*.[18]

By 1550, we find Girolamo in the service of the Capitani di Parte Guelfa and Ufficiali dei Fiumi, for whom he worked as an engineer until his death in 1562.[19]

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[15] For this suggestion, see Maccabruni and Zarrilli, *Arno*, 59. Notes on the back of the third and fourth sheets of Girolamo's map list these start and end dates, revealing its diachronic process of creation.
[16] For more on this, including a transcription, see Vestri, "Girolamo di Pace da Prato." The archival reference for this note, or *relazione*, is ASF, Miscellanea Medicea, 715/2.
[17] Vestri, 62.
[18] Vestri, 62–65.
[19] Vestri, 59. Girolamo's name first appears in a bureaucratic list of salaries on 6 May 1550. ASF, Capitani di Parte Guelfa, Numeri Neri, 8, fol. 147v. It is unclear whether he was still doing private projects for the duke at this time. He was one of the regularly salaried engineers in the office, and had the title of Ingegnere della Parte. In 1549 and 1559 (and likely in the intervening period), his annual payment was 48 scudi. For a

Whereas the magistracies' *capomastri*, as we have seen, were deployed on a regular basis to conduct visitations every time there was a property dispute or alluvial disaster to investigate, and also regularly authored judicial records and reports for the office, Girolamo and other engineers, who enjoyed a more elevated status within the office's hierarchy of technical experts, appear more sporadically: they were called upon on a more occasional basis to inspect cases deemed especially delicate or challenging for one reason or another, or to offer a second opinion (for example, figure 21).[20] Payment records from the office's building and engineering activities reveal a similar case-by-case pattern, with Girolamo credited for directing or aiding at worksites along the Arno and select other rivers for protracted stretches, often several months at a time, over the course of the 1550s.[21] Yet as he continued in his advanced age to assess cases and study localized alluvial problems for the duchy's rivers magistracy, Girolamo also departed from this workaday bureaucratic labor to attempt a much more comprehensive picture of the territory in its entirety, analyzing its myriad complications and potentials for improvement. Summoning his immense geographical, environmental, and technical knowledge, acquired over several years of work in the watery landscape, he presented an omniscient vision of Tuscany's hydrology, issuing specific recommendations and abstracting a set of planning principles for the benefit of the duke and the state.

The *Memoriale*: A Report on Aquatic Territory

summary of the stipends of engineers in the Capitani di Parte Guelfa, see Ferretti, "'Imminitus crevit,'" 127.

[20] Some examples of Girolamo's reports from ASF, Capitani di Parte Guelfa, Numeri Neri: 958, fols. 33r–34r (unnumbered); 959, fol. 246r, Report #115; 959, fols. 345r-v, Report #169 (collaborator of Pasqualino d'Ancona); 960, Report #78 (unnumbered, collaborator of Battista di Raffaello Battaglioni).

[21] For example, ASF, Capitani di Parte Guelfa, Numeri Neri, 190, fols. 131r, 141v.

In taking to writing, however, Girolamo did not, in the end, stray too far from his administrative roots. For notwithstanding its much more ambitious geographical scope, in its structure, style, and language, the *Memoriale* closely resembles an archival river report. Opening as these documents did with mention of a given site of concern, in his first lines Girolamo identifies this vast area as more or less the whole state, anchoring his survey across its principal hydrographic basins extending out from the ducal capital (figure 22). He trains his focus on

> … the rivers, streams, and ditches from Florence to Prato, which damage the plains of Florence and Sesto and Campi, and likewise the *contado* of Prato, and the *contado* of Pistoia; and the rivers, streams, and ditches, and of the fens of Arezzo, and of Castiglioni; and of Lucignano, and Foiano; and those toward the bridge of Granaiuolo toward Orvieto, that is, toward the east; and those that come toward the west; and … the lakes of Fucecchio and Bientina, and of the marshes of the *contado* of Pisa, and of the Serchio River; and of the lake of Massaciuccoli, and of the rivers and marshes of the *contado* of Pietrasanta, and of the new outlets to the sea, that run from Livorno until the Lake of Montignoso, and of many other things in the dominions of your Excellency.[22]

In encompassing the state's water features in this manner, Girolamo reified aquatic territory as a unitary entity. By including the wetlands of the state's southeast and western plains, he defines the category even more comprehensively than had the authors of the rivers legislation we analyzed in Chapter 1, which mentioned only public watercourses, thereby designating these water bodies as integral components of a connected riverine network. As the previous chapter also explored, this expansive territory, in spite of the office's ambitions, was difficult to uniformly govern in practice,

[22] BNCF, Manoscritti Palatini 788, fol. 2r. " … fiumi, et fosse, et fossati, che sono da Firenze à Prato, e quali danneggiono el piano di Firenze, et di Sexto, et di Campi, et cosi el Contado di Prato, et parte del contado di Pistoia, et cosi di quegli fiumi, e fosse, et fossati, et delle Chiane d'Arezo, e di quelle di Castiglioni: et di quelle di Lucignano et Foiano: et di quelle, che sono inverso el ponte à Granaiuolo diverso Orvieto, cioe diverso levante: et di quelle che vengono diverso Ponente: et ancora diro del lago di Fuciecchio: et del lago di Bientina, et de Paduli del Contado di Pisa, et del fiume del Serchio: et del lago di Massacuccoli, et de fiumi et paduli del Contado di Pietra santa et delle nove foci di mare, che sono da Livorno insino à lago di Montignoso, et di qualch' altra cosa, che in sul diminio di V. Ecc^{za} …."

with the ducal government often delegating the administration of zones in the Pisan countryside west of Castelfiorentino and Fucecchio to the city's Ufficio dei Fossi instead.[23] Still other sites Girolamo explores in his text were ducal enclaves, inherited from the Florentine republic, that were territorially non-contiguous to the rest of the state. Pietrasanta, above the Republic of Lucca on the peninsula's northwest coast, for example, scarcely interacted with the ducal rivers office over the course of the 1550s.[24] Despite the geographical and environmental challenges appertaining to these marginal regions, distant as they were from the ducal capital, Girolamo nonetheless sought territorial omniscience, believing comprehensive knowledge of the state's aquatic dominions vital to effectively governing these zones in practice.

The engineer's survey of this space reads as a chorographical ramble along Tuscany's watercourses. Beginning with the Arno through Florence, then moving to the Mugnone and Terzolla rivers and onward, he discusses in turn each river and stream, torrent and ditch, marsh and fen he encountered. Descriptive, discursive, and diffuse, Girolamo turns an attentive eye to all the duchy's waterways, from its largest and most vital arteries to its slightest effluents, lending them all an equivalent sense of importance. He discusses not only water features, moreover, but also aquatic infrastructures such as bridges, mills, weirs, locks, and dams; topographical landmarks, such as mountains, valleys, hills; and elements of the local built fabric, including churches, towns and villages, inns, and roads. His knowledge of proper names even seems a point of pride: on the one occasion he chose to elide these details, he conceded, "I know that there are quite

[23] Ferretti, "'Imminitus crevit,'" 106, n. 3.
[24] Giorgio Spini, "Introduzione," in *Architettura e politica da Cosimo I a Ferdinando I*, ed. Giorgio Spini (Florence: Leo S. Olschki, 1976), 29–30.

a lot of bridges, and channels, but I do not say the names for brevity, even if I know the greater part of them."[25]

For each waterway he profiled, the engineer conveyed an intimate familiarity with the landscape and its ecologies. Indicating in *passi*, *braccie*, and miles the dimensions of water features, their relative elevations, and distances from one to the other, he very directly evoked the challenging labor of surveying and traversing Tuscany's difficult aquatic topography. When describing one of the ditches built in 1555 to help drain water from parts of the swamps around Arezzo, he conceded, "I couldn't measure it in that place, because there was so much cut-up wood along the said ditch, so that I approached its banks with difficulty."[26] Later, he recalled a visit he conducted to inspect drainage ditches in the Valdichiana "a year ago in October, with my mule," whereupon the animal, on wading into the channel, "had trouble getting out of the said water."[27] On occasion, Girolamo also recounted specific projects and inspections he directed personally or with collaborators from the Ufficiali dei Fiumi.[28] Across the *Memoriale*, the engineer's thick descriptions of three-dimensional space and allusions to his work in the landscape attest to his "*sperienza della cosa,*" his experience of things, which cumulatively informed his rich understanding of the Tuscan territory.[29]

[25] BNCF, Manoscritti Palatini 788, fol. 68r: " … Io so che sono parecchi ponti, e fossi, ma non diro e nomi per brevita, benche io so el nome della maggior parte …."
[26] BNCF, Manoscritti Palatini 788, fols. 29r-v: "Non lo potetti misurare in quell luogo, per che vi era tanti legnami tagliati lungo detto fosso, che con difficulta mi vi accostai, cui assai frassini diritto lunghi, che vi e da fare una quantita di picche …."
[27] BNCF, Manoscritti Palatini 788, fol. 47v: "Io vi passai Anno d'ottobre con la mula mia, che hebbi fatica di uscire di detta acqua."
[28] BNCF, Manoscritti Palatini 788, fols. 8r-v: "Noi habbiamo principiato una fossa tra campi, et largine, la qual sara per confine tra l'argine, e campi: in modo non sara piu guasti gli argini dal ponte di San Gallo insino al ponte di Santo Donato, da ogni lato degli argini iddio Laudato."
[29] BNCF, Manoscritti Palatini 788, fol. 3v, for example, "… ma la sperienza della cosa, mostra la verita …."

Girolamo's chief priority lay in describing the dynamic behavior of water, in tracing its movement as it issued forth and made its treacherous way across the landscape. There is even a certain torrential quality to the writing itself; lacking sections or marked structural divisions of any sort, his pronouncements and proposals unfold in an endless stream as he moved verbally through the territory. The following passage, from his description of the Marinella di Travalle, a small tributary of the Bisenzio river, lends a sense of his typical style, along with the general explanatory structure deployed throughout the text:

> From the bridge of Marina, one mile and ¼ toward Prato, there is a bridge above the street of Prato, under which passes the water of the Marinella di Travale, which starts at the mountains of Valbuona, from which three small streams come down suddenly, and make the same cause, and again, when the Marina pours down with fury from the bridge of Calenzano above, that water enters in the river of the Marinella di Travale, and results in great disorder, and from the bridge of the street of Prato until where it enters in the river of Bisenzio there is a stretch, downstream of the bridge of Capale, of around 100 *braccia*, with so many disorders, such as in an elbow, where timbers have enclosed the course of water such that it cannot be contained there, and it damages the countryside, and it would be necessary to have it reordered and cleared of the wood and other things.[30]

Here and throughout, after locating his reader in space, Girolamo assessed the state of the river or stream in question, identified its salient problems, and proposed apposite solutions, all with breathless knowledge and detail.

The nature of the issues he perceived across the landscape and the remedies he proposed to fix them varied somewhat regionally. The densely-populated alluvial

[30] BNCF, Manoscritti Palatini 788, fol. 9r: "Dal ponte della Marina inverso Prato un miglio ¼ vi è un ponte in su detta strada di Prato che vi passa sotto l'acqua della marinella di travale; la quale principia à monti di Valbuona cui tre fossati che vengano da monti repenti, et fanno le medesime cause dette, et ancora quando la Marina traboccha dal ponte di Calenzano in su quell'acqua entra in detoo fiume della marinella di travale, et fa gran disordine, et da detto ponte della strada di Prato insino à dove l'entra nel fiume di Bisenzo vi è circa che entra indetto fiume di sotto al ponte di Capale br 100 cuui assai disordini cioe di gombito di legnami che hanno serrato el corso dell'acqua di sorte che la non vi cape, et danneggia il paese bisognerebbe farla rasettare et rimondarla de legnami e altre cose."

stretches of inland Tuscany, for example—the focus of much of the first part of his text—was a space, one he knew well, to be chronically besieged by flooding. This part of his narrative reads more or less as a catalog of aquatic failure. Encompassing the Arno and its feeding tributaries, from its source until Fucecchio, as well as areas in the Bisenzio Valley and Chiane lowlands near Arezzo, this zone had suffered particularly extensive damage during the autumn floods of 1557. As he moved through this wrecked region, he remarked at how unbridled waters had "carried away" farm fields and vineyards; "spoiled" or caused "great suffering" to all the plains the eye could see; and brought "utter ruin" to streets and buildings of all sorts, from homes, to churches, to the inns and taverns lining the highways. Sometimes, as he told it, all it took was a particularly heavy rain to cause watercourses to brim over and render entire streets impassable,[31] or to make sheltering indoors futile in the face of rising currents. For example, "toward Volterra," as he explained forebodingly, "there is neither house nor roof under which to seek cover when the river grows large."[32]

He identified as the causes for this widespread disarray a number of persistent material deficiencies in the alluvial network. Constrained channel capacity was a significant problem he diagnosed time and again: gradual accumulations of stone, gravel, and sand in riverbeds had raised their levels and gradients, while their embankments, sunken or in disrepair due to corrasion, neglect, or damage by humans and animals, failed to accommodate even subtle increases to the volume of the current. Impediments were

[31] For example, BNCF, Manoscritti Palatini 788, 23r: "… quando il fiume è grosso non vi si puo passare, & I viandanti et mulattieri patischono assai, oltre al pericolo ch'è portono da detto luogho insino all'Ancisa …." See also 19r-v.
[32] BNCF, Manoscritti Palatini 788, 19r: "… per che diverso Volterra non vi è ne casa ne tetto che si possa stare al coperto quando il fiume è grosso diverso Fir^{ze} …."

also legion, from weirs that modulated the flow of water in unexpected and detrimental ways, to bridge piers and support structures that agitated or stifled the current, to the masses of stone, earth, timber, and other detritus that, discharged from broken and decaying alluvial structures, floated downstream and clustered in the elbows and shallower stretches of rivers. Girolamo, like many of the technicians with whom he worked, also viewed alluvial meanders themselves as troublesome flood hazards.[33] He suggested a number of targeted procedures to rectify these various problems, from deepening and enlarging riverbeds, to raising embankments, to straightening out major elbows, cleaning detritus from watercourses, and, where multiple tributaries entered a larger river from both sides, rerouting their final tracts so as to symmetrically align their confluences.

As did his colleagues in their reports for the Ufficiali dei Fiumi, Girolamo also referred to all of these varied problems as *disordini* ("disorders"). While a technical and judicial designation, as we saw in the prior chapter, the engineer's heavy lacing of this term and its cognates throughout his writing—they appear over 40 times in just the first half of the *Memoriale*, for example—warrants brief comment. Extracted from their bureaucratic context, these words echo as a strident and incriminating refrain; denoting floods and wandering rivers, torrential currents and shattered embankments, flattened buildings and more, their repetition in the account sharpened Girolamo's grave and urgent critique into a kind of lamentation for the territory's fallen state. In early modern Italy, *disordine* and *disordini* were, of course, polyvalent political terms that encompassed the subversion of laws and orders, violence, and social disarray of all

[33] On this, see Giancarlo Severini, *Fortificazioni e controllo delle acque in Toscana fra '500 e '600: il caso di Pisa* (Pisa: ETS, 1999), 38.

kinds.[34] Used with great frequency in normative sources and to especially great effect in the hands of political writers such as Niccolò Machiavelli (1469–1527) and Francesco Guicciardini (1483–1540), these terms, mobilized to describe the territory itself, probably inspired these ambient associations.[35] Disorder telegraphed a serious and fundamental aberrance, after all, a localized condition that threatened the coherence and stability of the whole. In deploying "disorder" to characterize Tuscany's hydraulic interior, Girolamo could convey to his reader both the gravity of its problems and justify and implore state intervention into this space.

His characterization of much of the aquatic territory as "disordered" also squared with many of the observations he made about how this environment had changed over time. A sensitive student of the watery landscape, he seemed to read in its fluctuations and deficiencies alarming signs of decline in a stable and carefully-calibrated hydraulic equilibrium. While Girolamo often remarked on how aquatic features and infrastructures diverged from their vaguely "ancient state," he could also recall a more specific and not-so-distant time when things were better.[36] Most noticeably, water levels in many places

[34] In attestations from the period compiled in the GDLI, for example, *disordine* and *disordini* could refer to violations in the structure of natural bodies or in the proper course of natural phenomena, but more commonly, it signified confusion or subversion of norms and regulations in political, social, or military contexts. Quashing disorder was a veritable leitmotif of political thought in the period. Salvatore Battaglia, ed., "Disordine," in *Grande dizionario della lingua italiana* (Turin: UTET, 2002 1966), 708–9.

[35] While the dialectic of "*ordine*" (order) and "*disordine*" (disorder) can be traced back to ancient philosophy, the terms acquired a notable resonance in the Florentine political tradition during the late Middle Ages and into the Renaissance, coming into especial prominence in the work of Niccolò Machiavelli. Although present in *Il principe*, it comes into even greater use in *Discorsi sopra la prima deca di Tito Livio*, wherein historian John Humphreys Whitfield, over fifty years ago, noted several instances of one or the other of these word forms on almost every page. Here, *ordini* especially took on a specific and pointed meaning: it referred to the laws and constitutional arrangements that secured the state and promoted the common good. *Disordini*, on the other hand, were all those forces that actively undermined the *ordini* and flourished in their absence. Machiavelli's concerns lay in preventing those endogenous disorders that subverted the security and peace of the state (and therefore threatened the state itself), such as corruption, sedition, and rebellion. John Humphreys Whitfield, *Discourses on Machiavelli* (Cambridge: W. Heffer & Sons Limited, 1969), 141–62.

[36] For example, BNCF, Manoscritti Palatini 788, fols. 17r-v ("… secondo l'ordine antico …"), 70r (" … come anticamente egli era …").

had grown uncontrollably. Between Vernio and Prato, he noted a striking variation in the water levels of a set of tributaries—eight of them in total—which fed into the large river Bisenzio. "In my time," he began, "I would have passed them with one step, but many of them today, where I passed, are over 30 *braccia* wide by 40 *braccia* deep, such that they have brought ruin to houses, vineyards, and olive groves."[37] The engineer also observed drastic changes to the Arno, "which from the year 1550, until this year 1558, has a greater incline … and this I believe to be the cause of the great abundance of water that we have had."[38] In other places, though, old rivers had dried to a trickle, their waters diverted elsewhere seemingly of their own volition. North of Pistoia, for example, he described a river "called the Bargena, which has been dry for around 20 years," whose water "escapes partly through a ditch, and partly at nature's will, damaging the countryside and neighboring rivers."[39] Speaking later of the nearby Dogaia, Ficharello, and Bagnuolo, he explained that "it has been 40 years or more since these three rivers have been in their beds, instead abandoning them and breaking their shores and banks, and taking another way."[40] As he surveyed the territory, Girolamo glimpsed countless physical signs of a deteriorating ecological order.

[37] BNCF, Manoscritti Palatini 788, fol. 11r: "… entra di detto luogo otto grossi fossati, quattro per banda, che vi è di quegli che à mio tempo gli ho passati con un' passo et la maggior parte hoggi … dove io lo passai è largo br. 30 et fondo piu di 40: in modo, che gli ha fatto rovinar' case, vigne, uliveti."
[38] BNCF, Manoscritti Palatini 788, fols. 4v-5r: "Et prima diro un motto del fiume d'Arno, che mi pare, che da l'anno 1550 per infino à questo anno 1558 che sia in piu declinatione che non era in detto anno 50 et questo credo che sia stato buona causa la grande abbundanza dell'acqua, che habbiamo havuto."
[39] BNCF, Manoscritti Palatini 788, fols. 13r-v: "Poco dila da detto fosso diverso Pistoia vi principia uno altro fiume che si chiama la Bargena, el qual fiume hoggi è stato seccho circa à 20 anni, et l'acqua sene va una parte per detto fosso, laltra sene va a benefitio di natura, danneggiando il paese et del letto suo e convicini …."
[40] BNCF, Manoscritti Palatini 788, fol. 14v: "et da quaranta anni o piu fa, che e detti tre fiumi non sono iti per il letto loro solito, anzi lo abbandonorono e roppano le ripe, et l'argine nel luogo detto, et presono un'altra via dove hoggi sono …."

On several occasions, the engineer attributed these disorders to human error and neglect. While surveying the Mugnone, for example, Girolamo explained that its damages resulted "partly from the great abundance of water from the last flood, as well as partly from the actions of the peasants and landowners, who have lowered the banks to plant and seed in many places."[41] Sometimes, entire towns were to blame. Commenting on flood disruptions stemming from a faulty weir in the community of Foiano that he had advised on in 1555, alongside Piero di Francesco di Donnino and one of the Ufficiali dei Fiumi's *provveditori*, Alamanno de' Medici, Girolamo complained that "they did not complete it according to our orders."[42] In fact, he spoke often with nostalgia of an earlier time when he believed subjects to have been more dutiful. In the Arno west of the Golfolina, for example, he noticed that several feeder ditches had deposited, "of great detriment to the river," many piles of stone and gravel in its bed, "which all derived from traversals of these ditches, which are not done as they used to be, with great care and diligence."[43] Elsewhere, he more forcefully reproached the state's rural populations for failing to properly steward the waterways contiguous to their properties. "In other times," he stated,

> People used to employ great diligence, that those who had lands bordering canals and ditches would make enclosures across their banks, either with wood or with mud or with stones, and one neighbor would help the other, such that the channel would not sink, nor collapse, and very few stones, or other grievous materials,

[41] BNCF, Manoscritti Palatini 788, 5r: "… et questa n'è stata la causa della grande abbondanza dell'acqua della piena passata et anchora ne è stata la causa de contadini, et padroni, che hanno à fare lungo detto fiume, che havevano abbassati gli argini per seminare in piu luoghi …"
[42] BNCF, Manoscritti Palatini 788, 39r: "… e fa grandissimo danno la detta peschaia di Foiano, non l'hanno fatta in quell modo, che noi ordinamo."
[43] BNCF, Manoscritti Palatini 788, 18r-v: " … et ha menato tanti sassi, et ghiaia gross ache gli ha ripieno el letto del fiume di mala sorte et e gran danno del fiume, & del paese, tutto deriva dalla prima causa detta delle traverse de fossati, che non si fa come si soleva fare, con gran sollecitudine et diligentia …."

> would fall down; rather, only pure water would descend, and it would not make so great a force, as it does in our times.[44]

Contrasting the dereliction of duty he observed across the landscape with the collaborative labors of yesteryear, Girolamo yoked alluvial disarray to a decline in a delicately calibrated socioecological order.

Though rivers were his principal focus, Girolamo also proclaimed his "opinion" of Tuscany's many *zone umide*, ("humid zones"), the stagnant pools, lakes, and wetlands that submerged the low-lying plains of the Valdichiana, Valdinievole, Pisan countryside, and coastal areas stretching from Livorno up the coastline to Versilia.[45] He discussed the reasons for the swamping of many of these regions, noting their connections to the river network via their inflowing and outflowing tributaries as well as the embankment, drainage, and channel works underway to alternately drain or confine them.[46] In contrast to the torrential outpourings of so many rivers, Girolamo deemed these waters, "which can hardly be seen to move," to be disorderly in their own ways.[47] He accordingly voiced his support for the reclamation projects in progress, while trumpeting the "great benefit" they would bring to Tuscany in the form of acquisitions of land for arable, forests, and

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[44] BNCF, Manoscritti Palatini 788, fol. 2v: "Per altri temi si soleva usare gran diligentia, che chi haveva beni confini à tali fosse, et fossati, detti facevano delle serrate à traverso à dette fosse, et fossati, ò di legnami ò murate, ò con sassi, et l'uno vicino aiutava à l'altro, in modo, che detti fossati, non potevano affondare, ne tirar giu le grotte, et non veniva giu tanti sassi, ne altra materia grave: veniva giu solo lacqua pura, et non faceva tanto grande impeto d'acqua, che a tempi nostri."

[45] BNCF, Manoscritti Palatini 788, fol. 28r, "Diro ancora la mia opinione…." His mention of ports at certain towns in the region, as at Cortona in the Valdichiana, testifies to just how wet some of these inland areas were.

[46] Danilo Barsanti and Leonardo Rombai, *La "guerra delle acque" in Toscana: storia delle bonifiche dai Medici alla riforma agraria* (Florence: Edizioni Medicea, 1986), and Danilo Barsanti, "Le bonifiche nell'Italia Centrale in età moderna e contemporanea: profilo storico e prospettive di ricerca," *Rivista di Storia dell'Agricoltura* XXVII, no. 2 (1987): 67–104 survey the drainage and infill activities undertaken in these regions during the early modern period.

[47] For example, BNCF, Manoscritti Palatini 788, fol. 28v: "Al porto di Castiglione si vede che detta acqua ne va inverso Arezo che à fatica si vede muovere, et cosi al porto di Cortona, si vede, che detta acqua sene va inverso el ponte à Valiano lentamente, che à fatica si vede muovere …."

pasture, and improvements to the health of the air.[48] But these works too could be optimized, and the engineer issued a number of specific suggestions for expediting and improving them: from proposing locations for new channels to encourage outflow, to methods for erecting locks and dams along them to better control and redirect this outflow and keep them free from sediments, to bridges that might be built to enable channel crossing, to sites where milling operations could be constructed to take advantage of the motive force impelled by drainage effluent.

Repairing Aquatic Territory

Yet as he described the watery territory, Girolamo digressed occasionally from its afflictions and possible corrections to reflect more abstractly on a set of principles, "other modes" to follow as a guide to intervention in this space.[49] Seeded intermittently in the text, his axioms, oblique at first, echoed cumulatively over the course of the text, crystallizing gradually as an unmistakable philosophy of practice. Technical, social, and political in nature, his recipe for quelling water's violent and destructive flow arose from his gradual apprehension that aquatic territory had to be governed as a unified geographical and physical entity, a space requiring coordinated action on the state scale. By appreciating the interconnectedness of all parts of the alluvial network, discrete tweaks and fixes could be understood instead as orchestrated gestures that ramified across

[48] BNCF, Manoscritti Palatini 788, 36v: "… che si fa le dette cose tutti è detti paese, che si acquisterebbe el benefitio della sanita dell'aria, et degli habitanti, de paesi, et anchora degli acquisti delle buone pasture per I bestiami, et della gran quantita di legnami che sono in quelli paesi, et d'ogni sorta legnami."
[49] BNCF, Manoscritti Palatini 788, fol. 3v. " … per bene che si seguire altri modi che non si faceva per il passato …."

the entire system (an approach even manifested in the mere form of the *Memoriale*, it should be noted, in all its territorial comprehensiveness).

The engineer first made mention of his methods quite early on the text, in fact, nesting them in a discussion of the Arno in its urban stretch and immediate upstream and downstream zones around Florence. Their contours grew clearer and their significance more apparent as he repeated them over and again across the rest of the survey. "The experience of things," he began, "shows the truth":

> This river Arno is a great torrent and one cannot fix it with force, but one needs to make use of its own force of water, and to force its own force, and not to set oneself up to combat it where the water causes damage, but rather to place oneself where one sees the cause of the water that causes damage, and to know this cause, and in that place to start to remove such cause with small beginnings, and to not want to force the water all at once, but instead going along it bit by bit, making use of plants, and seeds from plants, where they are intended: and to commence the banks in one place and another from these plants on each side of the river, and to make the banks along each side, standing opposite from one another across each side of the river, where they will be more to the purpose with little expense, and to have patience, and diligence, and to work the whole year, for these things, that require time, and to accommodate the said river in a reasonable breadth, and as straight, as you can; and the said width of the bed, always keep it clean from any impediments that may be there.[50]

Two of his principal strategies are encapsulated here. The first pertains to the strategic location of reparative action, and rests on an understanding of water's causal, downstream effects in space. Solving hydraulic disorder required acting not at the site of

[50] BNCF, Manoscritti Palatini 788, fol. 3v: "Ma la sperienza della cosa, mostra la verita, et questo fiume d'Arno è un gran torrente et non si puo correggiere con la forza: ma bisogna valersi con la sua forza dell'acqua sua, et forzare la sua forza, et non si porre à combattere dove l'acqua fa el danno, anzi porsi a donde si vede la causa dell'acqua che fa fare el danno, et conosciere tal causa, et quivi cominciare à levar tal causa con piccoli principii, et non volere sforzare l'acqua à un tratto, ma andandola seguitando à poco à poco et valersi delle piante, et semi di piante dove sono à proposito: et principiare gli argini per luno luogo et per l'altro di dette piante da ogni lato del fiume, et fare delli argini a traverso da ogni banda dallo stante al fiume dirimpetto l'uno, à l'altro dove sieno piu a proposito con manco spesa si puo, et havere patientia, et sollecitudine, et lavorare tutto l'anno, à quelle cose, che richiede tempo, per tempo et comodare el detto fiume in una largheza ragionevole et piu diritto, che si puo; et detta largheza, sempre tenerla netta di tutto gli impedimenti vi fusse."

physical disruption—where water thrashes, overruns, or ruins its banks—but by following water's motion backward and upstream to identify the source of its deviation. As his narrative progressed through the landscape, Girolamo issued this advice repeatedly, insisting on the importance of acting "at the first cause" ("*alla prima causa*"), rather than at the "place where the damage arises," drawing analogy, not entirely correctly but nonetheless to great didactic effect, with still-prevailing theories of causation in Aristotelian natural philosophy.[51] He elaborated periodically on his reasoning, insisting over and again on the method's large-scale, remedial effects. While later discussing repairs to weirs along the Arno upstream of Florence, he declared, for instance, that "by organizing the river, the entire countryside can be organized: and organizing the countryside would organize the river, because it follows that helping one thing, helps the other."[52] The engineer's understanding of the causal effects of moving water, evident here and in countless other places in the *Memoriale*, reflects an effort to envision the Tuscan territory as a materially coherent and interconnected space, one eminently redeemable through selective and strategic action.

A second recommendation Girolamo issued in the passage cited above pertained to how best to physically manipulate watercourses to realize intended effects. Rather than militating against water's force, Girolamo advised collaborating with nature, making use of its continuous motion to slowly coax its course along an intended path. While the idea that nature could be a co-creative agent was fast becoming a trope across the visual and

[51] Istvan Bodnar, "Aristotle's Natural Philosophy," in *The Stanford Encyclopedia of Philosophy*, ed. Edward N. Zalta, Spring 2018 (Metaphysics Research Lab, Stanford University, 2018), https://plato.stanford.edu/archives/spr2018/entries/aristotle-natphil/.
[52] BNCF, Manoscritti Palatini 788, fol 54v: "… et assetando el detto fiume tutto el paese si potrebbe assettare: et assettando el paese, s'ascetterebbe detto fiume, perche bisogna che una cosa aiuti l'altra …."

mechanical arts at the time[53]—in his own earlier investigations of Tuscan rivers, Leonardo da Vinci, for one, had often recommended working with nature's forces or "desires," rather than trying to combat them[54]—Girolamo extended this logic as a generalized method. To him, "laudable, and grand, and marvellous works of great importance"[55] need not require recasting the territory in its entirety, but rather merely making "small beginnings" to stabilize its foundations. While speaking of the Bisenzio, for example, for which he recommended "cleaning logs out from the bed, and removing its meanders, and straightening the river as much as possible," he advised "great diligence, and consideration, because it is not necessary to clean and mend it all at once, but rather to make a cut where the water most offends, and leave it be where it does not offend."[56] Manipulating and cajoling nature's violent forces in this manner also demanded patient and deliberate work. "One cannot do it if not with the space of time," he explained, "and if one wants to complete it in one year, or in two by force of ducats, it would not be possible to drive it to a perfect end."[57] Girolamo's striking predilection for

[53] Suzanne B. Butters, "From Skills to Wisdom: Making, Knowing, and the Arts," in *Ways of Making and Knowing: The Material Culture of Empirical Knowledge*, ed. Pamela H. Smith, Amy R. W. Meyers, and Harold J. Cook, First paperback edition, Cultural Histories of the Material World (New York City: Bard Graduate Center, 2017), 53. The idea that art could complete or perfect nature also had Aristotelian roots; see Long, *Artisan/Practitioners*, 30–33.

[54] Martin Kemp, *Leonardo Da Vinci: Experience, Experiment and Design* (London: V&A Publications, 2006), 39; Leslie A. Geddes, *Watermarks: Leonardo Da Vinci and the Mastery of Nature* (Princeton: Princeton University Press, 2020).

[55] BNCF, Manoscritti Palatini 788, fol. 69r: "… perche a volere fare una impresa laudabile et grande et maravigliosa et di grande importanza, la quale è impossibile poterla fare senza l'aiuto della natura e forza dell'acqua, et con la sollecitudine manualmente come ho detto più volte, e questa più che tutte l'altre, bisogna servirsi di detta natura è forza dell'acqua di mare, e di terra."

[56] BNCF, Manoscritti Palatini 788, fol. 10v: "…che bisognerebbe tagliare et rimondare detti legnami, et levare e detti gomiti, et dirizare el fiume piu che si potesse: ma à tagliare e legnami et rimondare le ripe bisogna gran diligenza et grande advertenza, per che non bisogna nettare, et rimondare le riper per tutto à un modo: anzi bisogna tagliare dove l'offendono el corso dell'accqua, et lasciare stare dove le non offendono, et dove le riparano le ripe, et gli argini …."

[57] BNCF, Manoscritti Palatini 788, fol. 46v-47r: "… non si puo fare se non con spatio di tempo et se uno volesse farla in uno anno, ò in dua per forza di ducati non sarebbe possible di condurla à Perfetto fine in si breve …."

laboring slowly with nature is perhaps best encapsulated in his digressions on the alluvial planting of trees and other vegetation, whose roots, as they grew and spread, helped to structurally secure natural embankments against corrasion. Acknowledging the considerable time it took to realize these effects when planting from seed, he insisted on their benefits: "this mode of repairing is founded upon nature, in which everything, in its beginning, is small, and the second it is urged, the more it increases, and the sooner things come to an end."[58] Girolamo intuited the potentials of applying this method in a systematic and regularized way across territory, and repeatedly and enthusiastically articulated its benefits.

Underlying these two approaches was a third, expressed elsewhere, which involved planning hydraulic interventions of all kinds in a coordinated and uniform manner across territory. When discussing the importance of planting and seeding along rivers, for example, Girolamo had added that "it would be necessary to do this to all of the rivers, whose beds have been ruined by expanding more than what is necessary."[59] And later, in proposing to carve a *taglio* to cut a meander in the Arno near Calcinaia (a project undertaken shortly thereafter, from 1560–1564), he concluded by endorsing this kind of intervention "in any place, where one has to straighten the river for some cause,

[58] BNCF, Manoscritti Palatini 788, fol. 27r, extended passage: "… ma la fine loro, non si puo dare loro, se non con spatio di tempo, et con patientia, et sollecitudine et valersi della forza, et natura dell'acqua, et della natura delle piante, di quelle, che si piantano con il palo di ferro, et di quelle, che si piantano con le fosse: et di quelle che si seminano, benche difficile al venire el seme massime el seme dell'albero, et della vetrice et del salcio, quello dell'ontano è facile, et cosi di certe herbe che sono à proposito seminare lungo le ripe de fiumi, è in su gli argini questo modo di questa reparatione è fondato in su la natura è ogni cosa el suo principio, è piccolo; et secondo si va sollecitando, tanto pui si va aumentando, et piu presto si viene al fine."

[59] BNCF, Manoscritti Palatini 788, fol. 25v: "… et questi segui et termini bisognerebbe fare à tutti e fiumi dove havessino guasto el letto loro per essersi allargati pui che loro bisogno …."

along the Arno, from the bridge of Ariglione [by Florence] until Pisa."[60] Near the end of his *Memoriale*, the engineer endorsed yet again his vision for universal action across space:

> It would be good to work at the same time in many places, and across the countryside, and all the beginnings taken across the countryside, and in these places, would lead from the start, to the middle, and to the end of the said enterprises, place by place, and across the countryside, and thing by thing, as I have said at all points, always with the help of the good, and omnipotent God.[61]

Sanguine about the ducal state's potential to control territory, Girolamo's expansive vision, involving coordinated design, planning, and labor across space and time, rested on enhancing its bureaucratic capacities to manage and govern its dominions.

As should by now be abundantly clear, implicit in the engineer's protracted criticism of the lamentable state of the aquatic landscape and the dereliction of ducal subjects in its stewardship was an underlying dissatisfaction with the capabilities of the government and its alluvial management offices, the Ufficiali dei Fiumi and Ufficio dei Fossi, to remedy the problems of hydraulic disorder. Deeming the laws and orders in force at the time to be insufficient, he issued, in addition to the foregoing planning guidelines, a number of legislative recommendations to press for greater collaboration among office magistrates, technicians, and ducal subjects, and to encourage compliance in the distributed tasks of alluvial maintenance and control. One of his recommendations involved renewing the 1547 *Bando* that had penalized the alteration of alluvial lands and

[60] BNCF, Manoscritti Palatini 788, fols. 62r-v: "E questo modo, e questo ordine si potrebbe tenere in ogni luogo, che si havessi a tagliare el fiume per dirizarlo o per altra cagione, diro di di detto fiume d'Arno da ponti d'Ariglione per insino a Pisa." For more on this river straightening project, see Paolo Morelli and Paolo Pardini, "Taglio di Calcinaia," in *Livorno e Pisa*, ed. Mario Mirri et al. (Pisa: Nistri-Lischi, 1980), 48.

[61] BNCF, Manoscritti Palatini 788, fol. 81v: "… si potrebbe bene lavorare in un tempo medesimo in piu luoghi, et in piu paesi, e tutti e principii de paesi et de paesi, et de luoghi fussino per condurre dal princip^{o} al mezzo, et alla fine le dette imprese, et paese, per paese e luogo per luogo et cosa per cosa come di tutto ho detto sempre con l'aiuto di Dio omnipotente."

embankments.[62] In addition to advising that the order should apply for longer than the five-year period initially specified, he proposed "only adding the said things: that whoever had changed the water, or closed streets or paths without permission of the Ufficiali di Torre, or the Capitani di Parte, to have them replaced and reorganized in their former state."[63] While his proposed amendment reflected practice on the ground—*capomastri*, in their visitations and reports, often issued this very order to people who manipulated watercourses in detrimental ways without permission[64]—Girolamo wished to codify this rule and more proactively enforce it.

While his foregoing recommendation built on existing legislation, a second legal proposition was new. It consisted in enlisting communities upstream of Florence to help fund, build, and maintain alluvial dike structures and to fortify embankment walls with timber. "I believe," he offered,

> It would be well to order the communities and men of the towns of the mountains, who for this first time ought to help to make the dikes across the said rivers, and streams, and channels, by those who are close to, and have lands along the said rivers. The landowners have to help with the expenses, and from this time on, the workers of lands beside the said places, from each shore, should be obligated to maintain such dikes: and to place timbers along the banks of the said places, and this order should be able to hold for the entire countryside: and this would be of very great benefit to all the country and to your Excellency.[65]

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[62] For this law, see again ASF, Consulta poi Regia Consulta, Serie I, 1, 35, published in Giovanni Cascio Pratilli and Luigi Zangheri, eds., *La Legislazione Medicea sull'Ambiente*, vol. 1: I Bandi (1485–1619) (Florence: Leo S. Olschki, 1994), 33.

[63] BNCF, Manoscritti Palatini 788, fols. 86v-87r: Et si rinnovasi detta prohibitione et detto bando in quel modo e forma è capitoli che gli fu ordinato e bandito, solo agiugnendovi le dette cose, che chi havessi mutato esiti d'acqua, ò serrato vie ò viottole senza licentia de S.ri Uficiali di Torre, o de S.ri Capitani di Parte, l'habessi rimesse e rassettate ne loro luoghi antichi." The extension beyond five years is mentioned on fol. 87v.

[64] For example: ASF, Capitani di Parte, Numeri Neri, 957, fol. 512r. Report # 207, 4 January 1551.

[65] BNCF, Manoscritti Palatini 788, fol. 3v: "Secondo il mio parere, à voler rimediare à questa prima cã, credo sarebbe bene à ordinare à comuni et huomini delle ville de monti, che per questa prima volta dovessino aiutare, fare dele serrate atraverso à detti fiumi ò fosse, ò fossati à quelli che fussino piu vicini a detti fiumi, et à padroni che havessino beni lungo detti fiumi, cioe gli veri padroni havessino aiutare con la borsa, et da questa prima volta in la e lavoratori de beni convicini à detti luoghi da ogni banda fussino ubrigati à manterere tale serrate: et porre de legnami lungo le ripe di detti luoghi. et questo ordine si potrebbe tenere per tutti e paesi: et sarebbe grandissimo benefitio à tutto el paese di V. Ecc^{za}."

In a seeming inversion of the logic of longstanding Roman legal precedent, which had specified that the responsibility for funding and building *ripari* to protect private lands from flood damage lay with the landowners themselves rather than with the state (a rule for which an exception was made in practice, as we have seen, in the case of the Arno, whose embankment was presumed to confer more general benefits), Girolamo here proposed enlisting private subjects and subject towns to underwrite and actively assist in constructing works along upstream stretches of the Arno to mitigate the disorders suffered by the ducal capital and other downstream communities.[66] Sensitive to the complex challenges of aquatic design on the territorial scale, Girolamo believed it necessary to enjoin ducal subjects to collaborate in actively protecting state interests, recommending novel and aggressive legislation to order nature and bring people onside to realize its ambitions.

Territorial Expertise and Technical Authorship

To manage these varied endeavors, finally, Girolamo advised that the government required specific kinds of people to see them through. Since dedicated institutional officials already existed—the Ufficiali dei Fiumi was staffed with them—the engineer seemed instead to be making a call for recruiting people with a specific kind of aquatic and territorial knowledge, whose experience, skills, and talents endowed them with the authority and ability to effectively oversee works and enforce the collaboration of government technicians, local rectors, and subjects from around the state. “Of the men

[66] Luca Mannori, *Il Sovrano tutore: pluralismo istituzionale e accentramento amministrativo nel principato dei Medici (Secc. XVI-XVIII)* (Milan: Giuffrè, 1994), 383–84.

who ought to put these things into effect," he stated at one point, "it would be necessary that they be men of authority, affable people," who "have little other business: such that they do this as their work, because it is a thing of great importance."[67] They should, moreover, be "people who have intelligence,"[68] men of "good quality" that even "take delight in such endeavors."[69] *Pace* scholars who have criticized the notion of "early modern expertise" as anachronistic, it is plain from these passages that what Girolamo was calling for were what would soon be termed "experts" specializing in aquatic territorial planning.[70] As he envisioned it, such men ought to:

> Direct with their engineers and *capomastri*, and citizens, and peasants of the countryside, whatsoever has to be done in those places; and to listen to the

[67] BNCF, Manoscritti Palatini 788, fol. 25v: "… delli huomini che havessino a mettere à effetto tal cose, bisognerebbe anchor che fusse qualche persona, et huomini d'autorita, persone amorevole, et havessino poche altre faccende: et che pigliassino questa per loro faccenda, per che è cosa di grande importanza …."
[68] BNCF, Manoscritti Palatini 788, fol. 25v: "… et tali letti di detti fiumi gli havesse à fare et ordinare persone che havessino intelligentia, et chiamare huomini de' paesi, et comandare tali cose à benefitio universal, et non particulare …."
[69] BNCF, Manoscritti Palatini 788, fol. 26r: "qualche persona di buona qualità…." and 46v: "… detta impresa a volerla condurre è darli la sua buona et perfetta fine, bisognerebbe …. havere buoni ministri, che pigliassino dilettatione di tale impresa."
[70] Although the concept of early modern expertise had gained considerable currency by the late aughts, a fact heralded by the publication of Eric H. Ash, ed., *Expertise: Practical Knowledge and the Early Modern State*, Osiris, 2nd ser. v. 25 (Chicago: University of Chicago Press, 2010), it came under subsequent fire by scholars such as Andre Wakefield, William J. Ashworth, and others who argued that it involved a projection of modern values onto unwitting actors. See Andre Wakefield, "Butterfield's Nightmare: The History of Science as Disney History," *History and Technology* 30, no. 3 (July 3, 2014): 232–51, and William J. Ashworth, "Expertise and Authority in the Royal Navy, 1800–1945," *Journal for Maritime Research* 16, no. 1 (January 2, 2014): 103–16. But as Sophus Reinert remarked, "This recent scholarship would have been enriched by considering also the Italian context at the time, as Italian varieties of "peritia' were discussed explicitly during the Renaissance in relation to other words such as "arte" "scienzia", 'esperienza', and ' disciplina' to define not merely artisanal skills but the politics of economic administration and reason of state.' Sophus A. Reinert, "Authority and Expertise at the Origins of Macro-Economics," in *Antonio Serra and the Economics of Good Government*, ed. Rosario Patalano and Sophus A. Reinert, 2016, 117. Indeed, discussion of electing or sending a "perito" or many "periti" come up often, interchangeably with capomastri, in the partiti of the Ufficiali dei Fiumi, for example: ASF, Capitani di Parte Guelfa, Numeri Neri, 190, fol. 20r (" 'elegentur duo periti"); and idem, fol. 32r (in Latin, "electio peritorum"); Nevertheless, Eric H. Ash, who built much of his career on elegant studies of early modern expertise, subsequently came close to renouncing the framework himself (if in a thoughtful reflection on the concept's virtues and vices): Eric H. Ash, "By Any Other Name: Early Modern Expertise and the Problem of Anachronism," *History and Technology* 35, no. 1 (2019): 3–30.

> opinions of everyone together, and separately, and then to decide on the best course of action."[71]

No such figure who could supervise and direct this coordinated labor yet existed: the practical technicians to which the governments of Tuscany and other growing Italian principalities turned to manage their aquatic landscapes were what Pamela O. Long has called "architect/engineers," that is, "bricolage practitioners" who exhibited a certain "fluidity of occupation and self-identification."[72] Indeed, the *capomastri* who worked for the Ufficiali dei Fiumi were, as we have seen, simultaneously preoccupied with a host of other public works matters—roads, walls, property disputes, and more—on assignment for the Capitani di Parte Guelfa.[73] Many of these technicians moreover worked for the Scrittoio delle Regie Possessioni (Desk of the Royal Possessions), rotating as well through this office to aid with property matters for the sprawling ducal properties.[74] Girolamo's counterparts in the Rivers Office—the other engineers, Tribolo and

[71] BNCF, Manoscritti Palatini 788, fol. 25v: "E detti uomini di autorità menassino con loro ingegneri e capomastri, et cittadini, che havessino a fare in detti luoghi, et contadini del paese et intendere el parere di ognuno insieme; et disperse, et di poi pigliare quella deliberazione che fosse il meglio…."
[72] Pamela O. Long, "Multi-Tasking 'Pre-Professional' Architect/Engineers and Other Bricolage Practitioners as Key Figures in the Elision of Boundaries Between Practice and Learning in Sixteenth-Century Europe: Some Roman Examples," in *The Structures of Practical Knowledge*, ed. Matteo Valleriani (Cham: Springer International Publishing, 2017), 223–46 Though in this article, she used this term to denote professionals who occupied a "trading zone" in which university-educated people interacted with practically-trained ones, the concept captures the diverse character of the work of early modern technicians. On "trading zones, see also her "Trading Zones in Early Modern Europe," *Isis* 106, no. 4 (2015): 840–47. For more on mechanical technicians, see Jim Bennett, "The Mechanical Arts," in *The Cambridge History of Science: Volume 3: Early Modern Science*, ed. Katharine Park and Lorraine Daston, vol. 3, The Cambridge History of Science (Cambridge: Cambridge University Press, 2006), 677–79, and Long, *Artisan/Practitioners*, 1–29.
[73] On this, see also Diana Toccafondi, "Nascita di una professione: gli ingegneri in Toscana in Età Moderna," in *La politica della scienza: Toscana e stati italiani nel tardo Settecento: atti del convegno di Firenze, 27-29 gennaio 1994*, ed. Giulio Barsanti, Vieri Becagli, and Renato Pasta, Biblioteca di Nuncius 20 (Firenze: L.S. Olschki, 1996), 147–50.
[74] Carlo Vivoli and Diana Toccafondi, "Cartografia e istituzioni nella Toscana del Seicento: gli ingegneri al servizio dello Scrittoio delle Possessioni e dei Capitani di Parte," in *Cartografia e istituzioni in età moderna. Atti del Convegno: Genova, Imperia, Albenga, Savona, La Spezia, 3–8 novembre 1986*, ed. Ministero per i Beni Culturali e Ambientali, vol. XXVII, Atti della Società Ligure di Storia Patria, Nuova serie (Rome: Pubblicazioni degli Archivi di Stato, 1987), 167–202.

Pasqualino d'Ancona—were at the same time practicing artists and were, like Girolamo, called "architect" and "engineer" interchangeably in the administration's records. And in architectural theory, the sole discursive context in which aquatic engineering had been treated with any regularity by this time (and even then, it was mostly limited to the neo-Vitruvian texts of the fifteenth century), the topic was often, as we have already seen, lumped together with other varieties and typologies of building and land planning, giving to the nascent profession of "architecture" an indeterminate and multi-hyphenate character that persisted through the early modern period.[75] In a departure from the prevailing social, institutional, and discursive structures that had shaped work in hydraulics at the time, then, Girolamo deemed alluvial management and engineering to be an urgent state problem in need of specific attention and the oversight of dedicated, specialized experts.

He seemed, in the end, to offer himself up as a worthy candidate. Like other would-be experts in this period, Girolamo grounded his authority in his experience, highlighting at every turn his intimate knowledge of the landscape formed from decades of work in the watery territory.[76] At the same time, he also deployed this knowledge as a basis for distilling higher-order insights about how water systems and social ecologies functioned and how they should collectively be governed, setting himself apart in this

[75] Vitruvius Pollio, *Vitruvius: Ten Books on Architecture*, trans. Ingrid D. Rowland (New York, NY: Cambridge University Press, 1999); Leon Battista Alberti, *On the Art of Building in Ten Books*, trans. Joseph Rykwert, Neil Leach, and Robert Tavernor (Cambridge, MA: MIT Press, 1988); Tomaso Garzoni, *La piazza universale de tutte le professioni del mondo* (Venice, 1605), 758–64. For more on this, see also Long, "Multi-Tasking 'Pre-Professional' Architect/Engineers", and Long, "Trading Zones," 62–93.
[76] As Peter Dear argued, experience and knowledge gained from the senses *were* understood in 16th-century Europe as important features of Aristotelian natural philosophy, however much Francis Bacon and his followers would subsequently downplay this fact. Peter Dear, "The Meanings of Experience," in *The Cambridge History of Science*, ed. Katharine Park and Lorraine Daston, 1st ed. (Cambridge University Press, 2006), 106–31.

way from "mere" technicians.[77] "I speak with certainty," he insisted, in closing his survey, "with reason founded in experience, which is the mother and mistress of truth":

> I have had the great opportunity to have experimented in many ways, and in many places, and in many rivers and ditches, and I have had great consolation, and great pleasure in doing such experiments, and as well as great displeasure. And the great length of time and opportunity that I have had to do such experiments has shown me a certain light and clarity: that for all the aforementioned works, I would know it better to put them into effect today, than to write or talk about them. But time does not agree with me: because I am so far advanced in years, close to 80, and any day may be my end.[78]

By translating the results of his alluvial "experiments" into a kind of synthesis—a set of principles for governing an unruly and intractable landscape—Girolamo partook of a much wider shift underway in fifteenth- and sixteenth-century Europe, which saw skilled practitioners of all stripes putting pen to paper to explicate their empirical practice and tacit knowledge as set of rationalized methods.[79] Though in addition to merely elevating the status of the mechanical and technical arts, as authorship so often did,[80] Girolamo

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[77] This claim to higher-order theoretical knowledge was common among would-be experts in early modern European cultures: see Eric H. Ash, "Introduction: Expertise and the Early Modern State," *Osiris* 25, no. 1 (2010): 1–24.

[78] BNCF, Manoscritti Palatini 788, fol. 83v: "… et questo dico per certo con la ragione fondata in su la sperientia ch'è la madre e padrona della verita, la quale io l'ho osservata piu tempo, et piu modo, et in piu luoghi et piu fiumi e piu fossati, e ancora ho hauto grande consolation, e gran piacere in fare tale sperientie, et anchora ho havuto di gran dispiaceri, et per la gran lungheza di tempo che io ho hauuto à fare tale sperientia, e la gran comodita come ho detto mi ha mostro un certo lume e chiareza che di tutta l'opera predette io le saprei hoggi meglio metterle a effetto che scriverle o dirle: ma el tempo non melo comporta: perche io sono tanto innanzi con gli anni che io mi avicino à gli 80, in modo che io sono tanto innanzi cō gli anni, che ogni di puo essere el mio …."

[79] This is a voluminous literature, but for some starting points, see: Long, "Power, Patronage, and the Authorship of Ars"; Pamela O. Long, "Engineering, Patronage and the Authorship of Practice in Early Counter-Reformation Rome," in *Conflicting Duties: Science, Medicine, and Religion in Rome, 1550–1750*, ed. Maria Pia Donato and Jill Kraye, Warburg Institute Colloquia 15 (London, UK: The Warburg Institute, 2009), 9–34; Pamela O. Long, "Manuals," in *Information: A Historical Companion*, ed. Ann Blair et al. (Princeton: Princeton University Press, 2021), 589–93; and Paolo Rossi, *I filosofi e le macchine 1400-1700* (Milan: Feltrinelli, 2009). This phenomenon is also the focus of Pamela H. Smith's forthcoming book, *From Lived Experience to the Written Word: Reconstructing Practical Knowledge in the Early Modern World* (Chicago, IL: University of Chicago Press, 2022).

[80] This mere act of authorship was often socially or politically motivated by a desire for status and recognition on the part of artisans and technicians, living as they were in a society ruled by bookish courtiers, councillors, and clerics. But it also had the effect of popularizing empirical values, such as observation and experimentation, which went on to shape the development of mechanical philosophy, and the institutionalization of the so-called "new sciences" of the 17th century.

revealed the imbrication of his specific subject, aquatic territorial design, with social, political, and economic concerns.

Ranging the gamut from technical prescriptions to political and social precepts, Girolamo's *Memoriale* offered Cosimo a blueprint of sorts on the muddy work of aquatic and territorial governance. Though confined in its focus to controlling internal waters, Girolamo believed that resolving the disorders of the Tuscan aquatic territory demanded the implementation of further bureaucratic, administrative, and legal reforms on the part of the ducal government, ones that would shape relations between state actors, subjects, and nature—what Michel Foucault has memorably called "imbrication[s] of men and things"—in stewarding watery territory.[81] In addressing these problems in writing, and outlining their plausible solutions for the duke, Girolamo framed aquatic territory as an urgent affair of state.[82] The *Memoriale,* with its detailed guidance on managing and stewarding the territory, should not merely be considered a hydraulics manual, but rather more accurately as a kind of aquatic mirror for princes.

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Though we know little, in the end, about the reception of the *Memoriale*, in the years after Girolamo wrote, the ducal rivers bureaucracy continued to consolidate, issuing prescriptions and directing practices in ways that slowly grew more responsive to the problems of territorial flood control and alluvial management. In November 1559, for example, the office issued a law banning the felling of trees and saplings in the mountains of the Florentine dominions. The importance of trees in securing river banks was

[81] Michel Foucault, "Governmentality," in *The Foucault Effect*, ed. Graham Burchell, Colin Gordon, and Peter Miller (Chicago, IL: University of Chicago Press, 1991), 93.
[82] Foucault, "Governmentality."

something Girolamo had discussed at length. “Having learned from experience” how damaging such actions were, so the law opened, the measure applied to alpine regions across the state, appertaining specifically to their “summits … and for a space of one half mile from where the water falls.”[83] Once a month, moreover, the rectors of the towns where the law applied were held to “visit the alps and mountains of their jurisdictions, and carry out diligent research” to enforce the law and punish offenders.[84] In 1561, the Ufficiali dei Fiumi reissued the 1547 *Bando* not once but twice. The first time, in August, saw the order promulgated largely along the lines of the initial measure, but the second time, in November, involved soliciting information about damaged embankments, while also mandating that subjects notify the office of any “disorders” that should emerge in the future.[85] This later order also required landowners once a year, in August, to clean any detritus and obstacles from rivers and streams fronting their property, threatening that subjects would be regularly surveilled and punished if found in breach of the rules.[86] In the aggressive obligations it placed on subjects, and in its more proactive approach to policing the landscape, this measure almost ventriloquizes Girolamo’s prescriptions. Further laws followed in the coming years, through the 1560s and 1570s, reiterating bans on tree-cutting, impeding rivers, and seeking to punish deviant subjects and wayward

[83] ASF, Conservatori di Legge, 3, 328. "L’Illustrissimo et Eccellentissimo Signore il Signor Duca di Fiorenza et di Siena, havendo per isperientia conosciuto quanto sia dannoso che nell’alpi et luoghi montuosi si taglino li arbori … dichiarando espressamente che la soprascritta prohibitione del non tagliare, sterpare, o disodare come disopra s’intenda solamente quanto alla cima et sommità dell’alpi et monti predetti, et per ispatio d’un mezzo miglio di là et di qua come acqua pende ….” Published in Cascio Pratilli and Zangheri, *La legislazione medicea in materia di strade, ponti e fiumi*, 1: I Bandi (1485–1619):96–97.
[84] ASF, Conservatori di Legge, 3, 328. “Et all’effetto predetto li vicarii, capitani, et rettori delle sopradette giurisditioni rispettivamnete sieno tenuti, almeno una volta nel tempo del loro uffitio, mandare a visitare l’alpi et monti di sua giurisditione, et fare diligente ricerca, et condennare li transgressori….” Published in Cascio Pratilli and Zangheri, 1: I Bandi (1485–1619):97.
[85] ASF, Leggi e bandi - Appendice, 45, 7, published in Cascio Pratilli and Zangheri, 1: I Bandi (1485–1619):121–22.
[86] ASF, Leggi e bandi - Appendice, 45, 7, published in Cascio Pratilli and Zangheri, 1: I Bandi (1485–1619):121–22.

technicians (some had taken to pocketing tax collections themselves) as the state sought ever more aggressively to bring order to watery territory. Although the repetitive iteration and progressive tightening of such legislation reveals its ongoing failure in bringing about the Pollyannaish order so desired by men like Girolamo—a utopian world in which peasants, landowners, and state officials all worked together in harmony—they stand as efforts to more systematically collect information of the landscape and its shortcomings. Together, these legal texts, like Girolamo's remarkable writing, testify to the dynamic role that bureaucracy—the realm of quotidian practice—played in the production and codification of early modern territorial knowledge.[87]

[87] On this theme, see Sebastian Felten and Christine von Oertzen, "Bureaucracy as Knowledge," *Journal for the History of Knowledge* 1, no. 1 (2020).

CHAPTER 3

AQUATIC PROJECTS AND CIRCULATORY PROMISES

> My thoughts on this passage have not brought it into being, but if there was no one to make proposals, many things would not be done, which the discourses of the wise put into effect.[1]
>
> —Lorenzo Albizi, *Ragionamento sopra il bonificare il Paese di Pisa* (ca. 1568)

In Girolamo's wake, aquatic territory grew into a burgeoning subject of discourse in Tuscany. From the late 1560s onwards, and especially toward the end of the century, the problems of rivers and streams, channels and embankments, marshes and lakes emerged as a kind of "trading zone" that exercised ambitious men of varied occupational and social backgrounds, many of whom took to writing to devise solutions for rectifying the disorders they perceived in the landscapes that surrounded them.[2] Some of these authors, like our Pratese engineer, were practically-trained technicians with alluvial engineering experience who looked to offer advice for remedying the ongoing hazards of

[1] "Il mio pensiere per questo non ha fatto il detto passaggio, ma se non vi fosse, chi proponesse non si farebbe molte cose, che discorse da savi si mettono in effetto." Lorenzo Albizi, "Ragionamento sopra il bonificare il Paese di Pisa fra Messer Gio. Caccini, Maestro Davitte Fortini, e Lorenzo Albizi, al Serenissimo Cardinale, e Gran Duca Unico mio Signore [1568]," in *Raccolta d'autori che trattano del moto dell'acque, divisa in tre tomi. Tomo primo* (Florence: Stamperia di S. A. R., 1723), 32.

[2] I borrow this concept from Pamela O. Long, who in her "Trading Zones in Early Modern Europe," *Isis* 106, no. 4 (2015): 840–47, and *Artisan/Practitioners and the Rise of the New Sciences, 1400–1600*, The OSU Press Horning Visiting Scholars Publication Series (Corvallis, OR: Oregon State University Press, 2011), chap. 4, defined it as any endeavor or working context, increasingly common over the course of the 16th century, in which practically-trained people interacted and collaborated with university-educated people. She in turn adapted the term from Peter Galison, "Trading with the Enemy," in *Trading Zones and Interactional Expertise: Creating New Kinds of Collaboration*, ed. Michael E. Gorman, Inside Technology (Cambridge, MA, USA: MIT Press, 2010), 25–52. In *Engineering the Eternal City: Infrastructure, Topography, and the Culture of Knowledge in Late Sixteenth-Century Rome* (Chicago: University of Chicago Press, 2018), Long discussed the flooding of the Tiber in Rome in the second half of the sixteenth century, and identified "a kind of public arena in which flooding was seen as a legitimate topic of discussion by both practitioners and university-educated men." See chapter 1, quote at 41. This chapter will later briefly discuss such discourses in other parts of Italy.

flooding. Motivated by a sense of mission, a desire for ducal honor and patronage, or both, these men put pen to paper to explicate their empirical knowledge of aquatic territory and propose methods for containing disaster and conserving property. As just two well-known examples, in 1586 and 1591, the hydraulic and military engineer Antonio Lupicini (ca. 1530–1607) published two brief tracts on alluvial defense tactics for the benefit of "Princes, and Lords, who possess states subjected to flooding."[3] But as the problems of water came to engross a much wider social orbit, a variety of other people began to weigh in on the matter as well: scholars, noblemen, and high-ranking government officials, as well as foreign artisans and engineers. Though they shared a concern for flood prevention, their interests also went beyond this strict imperative to encompass a range of ideas, much broader in outlook, about how Tuscany's alluvial systems could be engineered to realize a host of auxiliary benefits for the duke, the state, and its subjects. In their writings, watery territory was presented as a *tabula rasa*, a space of future possibility to be deliberated on, debated, and sometimes radically recast.

To be sure, it was not the first time such ambitious ideas for reshaping the region's hydrology had been aired. The most famous of all such earlier proposals was probably Leonardo da Vinci's (1452–1519) daring, ultimately unrealized design from ca. 1503 to divert the Arno River into a long, parabolic canal to connect Florence to the Mediterranean Sea by way of the northern plains of Tuscany (figure 23).[4] And even

[3] "A' Principi, e a' Signori, che posseggono Stati sottoposti alle inondationi." Antonio Lupicini, *Discorso d'Antonio Lupicini, sopra i ripari del Po, et d'altri fiumi, che hanno gl'argini di terra posticcia* (Florence: Giorgio Marescotti, 1586), 3; Antonio Lupicini, *Discorso d'Antonio Lupicini sopra i ripari delle inondazioni di Fiorenza. Al Sereness. Don Ferdinando Medici Gran Duca di Toscana* (Florence: Giorgio Marescotti, 1591). Perhaps in reward for his demonstrated expertise, Ferdinando I appointed Lupicini as an engineer of the Ufficio dei Fossi in March 1597.

[4] For a recent overview of Leonardo da Vinci's project for the Florence canal, see Filippo Camerota, "Leonardo and the Florence Canal. Sheets 126–127 of the Codex Atlanticus," *Substantia* 4, no. 1 (2020): 37–50, as well as Sara Taglialagamba, "Il canale di Firenze. Foglio 126v," in *Leonardo e Firenze. Fogli*

Girolamo di Pace, in his *Memoriale*, briefly described the possibility of building a canal to connect Florence to Pistoia.[5] But what differed in the ducal period from such earlier, isolated attempts at reimagining aquatic territory was their growing prevalence and their emergence within a discursive field in which utopian feats of aquatic terraforming—wholesale wetland drainage, river cutting and straightening, canal building—were yoked explicitly to promises of public advantage of all kinds, from settling the countryside, to expanding agriculture, to supporting industrial sectors, to enhancing commercial exchange within the state and internationally. A distinctly textual enterprise, aquatic territorial planning in the latter part of the sixteenth century came to be theorized as a means of state enrichment.

If the two foregoing chapters offered an extended analysis of practices and ideas oriented toward disaster mitigation, the present one will instead chart the gradual rise and contours of aquatic territorial projecting—the devising of aquatic projects—in Tuscany during the last three decades of the sixteenth century. As a historical and analytical category, the English term "project" has been the focus of sustained critical attention as

scelti dal Codice Atlantico, ed. Cristina Acidini Luchinat (Florence: Giunti, 2019), 52–53, and Alessandro Vezzosi, "Il canale di Firenze. Scienza, utopia, e land art," in *Leonardo e Firenze. Fogli scelti dal Codice Atlantico*, ed. Cristina Acidini Luchinat (Florence: Giunti, 2019), 55–63. As Camerota points out, Giorgio Vasari (*Lives*, 1568) called Leonardo "the first who, as a young man, talked about the Arno River to put it in a canal from Pisa to Florence." Giorgio Vasari, *Le vite de' più eccellenti pittori scultori ed architettori nelle redazioni del 1550 e 1568*, ed. Paola Barocchi and Rosanna Bettarini, vol. 4 (Firenze: Sansoni, 1967), 17, quoted in "Leonardo and the Florence Canal," 37, n. 1. One notable, if more modest example of an Arno proposal preceding Leonardo's was the architect Luca Fancelli's (1430–ca. 1495) proposal, from 1487, to canalize the Arno between the Mulini d'Ognissanti and the town of Signa to improve navigability along that tract. Leonardo Rombai, "Il sistema delle infrastrutture di comunicazione nella Toscana fiorentina del XV secolo," in *La Toscana al tempo di Lorenzo il Magnifico: politica, economia, cultura, arte: convegno di studi promosso dalle Università di Firenze, Pisa e Siena: 5-8 novembre 1992*, ed. L. Beschi et al., vol. 3 (Pisa: Pacini editore, 1996), 866–867; Saida Grifoni and Leonardo Rombai, "Del dirizzare i corsi a'grandissimi fiumi: gli ingegneri dei fiumi e gli interventi idraulici nel bacino dell'Arno da Cosimo I a Ferdinando I," in *Fiumi e laghi toscani fra passato e presente. Pesca, memorie, regole*, ed. Franek Sznura (Florence: Aska Edizioni, 2010), 198–199.

[5] BNCF, Manoscritti Palatini 788, mentioned on fol. 2r.

of late.[6] While this now-commonplace word refers colloquially to an undertaking or coordinated plan of action of almost any kind, its meaning in early modernity, when it first emerged, was far more pointed. Deriving etymologically from the Latin noun *proiectum* (a protruding or jutting object) and verb *proiecere* (to throw or cast forth), in addition to the Middle French verb *projetter* (to plan), over the course of the sixteenth and seventeenth centuries, the word "project" in English came to signify a discrete plan of action for achieving a desired future outcome.[7] What Vera Keller and Ted McCormick call "visions of wholesale (re)creation," projects figured the future as a blank page.[8] Indeed, many aimed at nothing less than comprehensive social reform.[9] In fact, in their prospective, imperative orientations, early modern projects testify to the existence of what Reinhart Koselleck has called a plannable "open future," while also predating the very origins he posited for this concept by some two centuries.[10]

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[6] For useful recent discussions of the concept of the "project," see Vera Keller and Ted McCormick, "Towards a History of Projects," *Early Science and Medicine* 21, no. 5 (2016): 423–44, and David Alff, *The Wreckage of Intentions: Projects in British Culture, 1660–1730*, Alembics: Penn Studies in Literature and Science (Philadelphia: University of Pennsylvania Press, 2017). As they explain, projects were not only spoken of in early modernity, but theorized and debated as an analytical category as well, especially in the eighteenth century. The German cameralist Paul Jacob Marperger, for example, defined the project as "an either verbal or written, well-intended, brief proposal showing how in some portion or other of human society and of the body of the *res publica*, one thing or another could be improved in practice far beyond the current method to the benefit of the commonweal, in the sciences, household management, mechanics, business, and cameral affairs (*Physicis, Oeconomicis, Mechanicis, Commercalibus* [sic] & *Cameralibus* &c.)." Paul Jacob Marperger, *Auserlesene kleine Schriften* (Lepizig, 1733), 370, quoted in Keller and McCormick, "Towards a History of Projects," 438.

[7] Alff, *The Wreckage of Intentions*, 3.

[8] Keller and McCormick, "Towards a History of Projects," 427.

[9] Alff, *The Wreckage of Intentions*, 13–17 and passim.

[10] Reinhart Koselleck, *Futures Past: On the Semantics of Historical Time* (New York: Columbia University Press, 2004), located the emergence of the concept of an open, unknowable future, unbound by providential or Biblical teleologies, to ca. 1750, seeing this development as a particular cultural response to the experience of time and progress in the Enlightenment and Industrial Revolution. Recently, Philipp Robinson Rössner critiqued the historical timing of Koselleck's "open future" thesis through a study of seventeenth-century German cameralist writings. See his "Capitalism, Cameralism, and the Discovery of the Future, 1300s–2000s: Europe's Road to Wealth," *History of Political Economy* 53, no. 3 (June 1, 2021): 443–60. I maintain that the concept also existed the century prior in Italy. Nicholas Scott Baker agrees; as he writes in his elegant *In Fortune's Theater: Financial Risk and the Future in Renaissance Italy* (Cambridge: Cambridge University Press, 2021), 3, "around 1500 ... Renaissance Italians instead began to

But despite (or perhaps precisely because of) all the pent-up ambition they released into the world, projects have in most cases left behind an archive of failure. To achieve their utopian fulfillment, after all, projects had to ignore the particularities of local context, shunning on-the-ground realities in ways that either inhibited their effective realization or indefinitely postponed it.[11] It is for this reason that David Alff has emphasized the documentary and the discursive nature of projects; as future-oriented fictions, they may exist merely as "*written* plans of action … proposing that certain people do certain things."[12] Yet even if they never came to fruition, projects are nonetheless valuable precisely because they offer testimony of specific societal hopes and aspirations, often taking inspiration from and channeling inchoate policy discussions, technological dreams, economic experiments, and other state-directed energies into vividly posited futures.[13]

Project scholarship has so far tended to focus on all those places more familiar to historians today as cradles of political, economic, and technological modernity: in addition to England, also Scotland, Germany (where one spoke of the *projekt*), and France (the *projet*).[14] Italy, as we have already seen, has so far played but a bit a part in

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conceive of the future as unknowable, to consider that tomorrow might in fact be completely different from today and operate by different rules, values, and principles."

[11] Samuel Johnson, for instance, stated that "Whatever is attempted without previous certainty of success, may be considered as a project." See his *The Works of Samuel Johnson*, vol. 3 (London: T. Tegg, 1823), 225, quoted in Keller and McCormick, "Towards a History of Projects," 437.

[12] Alff, *The Wreckage of Intentions*, 5–6, emphasis mine.

[13] Keller and McCormick, "Towards a History of Projects," 444.

[14] Joan Thirsk, *Economic Policy and Projects: The Development of a Consumer Society in Early Modern England* (Oxford: Clarendon Press, 1978); Chandra Mukerji, *Impossible Engineering: Technology and Territoriality on the Canal Du Midi*. (Princeton University Press, 2009); Eric H. Ash, "Reclaiming a New World: Fen Drainage, Improvement, and Projectors in Seventeenth-Century England," *Early Science and Medicine* 21, no. 5 (2016): 445–69; Eric H. Ash, *The Draining of the Fens: Projectors, Popular Politics, and State Building in Early Modern England* (Baltimore: Johns Hopkins University Press, 2017); Alff, *The Wreckage of Intentions*; Tina Asmussen, "Affective Projecting: Mining and Inland Navigation in Braunschweig-Lüneburg," in *Early Modern Knowledge Societies as Affective Economies*, ed. Inger Leemans and Anne Goldgar (Routledge, 2020), 87–110.

this tale.[15] Here, to be sure, the term *progetto/proietto* in the sixteenth century still retained its literal Latin gerundive meaning as an act of "throwing forward" or "casting out,"[16] a usage that may explain its relative neglect in conceptual histories of projects. But Italian "projectors" availed themselves of an altogether different lexicon, one which, once grasped, permits us to probe a much older legacy of future statist and territorial imaginaries. Drawing perhaps on their culture's rich and precocious legacies in politics, the arts, and business, ambitious architects, engineers, bureaucrats, and statesmen instead proposed *imprese* (enterprises or undertakings),[17] *disegni* (designs),[18] and *lavori* (works) in their efforts to channel creative energies and bring about the kinds of utopian futures dreamt of by technocrats elsewhere on the Continent and in the British Isles.

In Tuscany, aquatic projects (as I shall, following the scholarship, refer to them for the purposes of this chapter) reflected a keen sense of optimism about the shifting circumstances and possibilities of their time, proliferating at a moment when the ducal government began to take on a more active role in physically reshaping its territory.

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[15] Baker, *In Fortune's Theater* studies cultural conceptions of unknowable futures in Renaissance Italy in the 16th century, but does not meditate on the category of the project.

[16] John Florio, for example, defined "Progetto" as "a proiect, a casting out, a prostrating, a iutting out. Also thrown out a farre, cast forth, prostrate, forsaken and laid aside. Also contemned or of a little account." John Florio, *A World of Wordes, Or Most Copious, and Exact Dictionarie in Italian and English, Collected by Iohn Florio* (London: Edw. Blount, 1598), 297.

[17] John Florio defines "Impresa" in this sense as "an enterprise, an action, an undertaking, an attempt." Florio, 170. The term "*impresa*" was used by assorted actors with diverse stakes and interests in the work of alluvial planning, from *capomastri* like Piero di Francesco di Donnino to political theorists like Botero.

[18] *Disegno* was becoming a loaded theoretical term in Florentine culture at the time that denoted the primacy of intellection at the heart of the arts of painting, sculpture, and architecture. Its use in the context of territorial planning evinces how contemporaries also deemed the territory as something that could be "designed." On the Florentine theory of *disegno* in the fine arts, see Karen-edis Barzman, *The Florentine Academy and the Early Modern State: The Discipline of Disegno* (Cambridge: Cambridge University Press, 2000), 145–51; Karen-Edis Barzman, "Perception, Knowledge, and the Theory of *Disegno* in Sixteenth-Century Florence," in *From Studio to Studiolo: Florentine Draftsmanship under the First Medici Grand Dukes*, by Larry J. Feinberg (Oberlin: University of Washington Press, 1991), 37–48; James Hutson, *Early Modern Art Theory. Visual Culture and Ideology, 1400–1700* (Hamburg: Anchor Academic Publishing, 2016), 56–64. Conceptually, both "projects" and "designs," before acquiring their figurative meanings, referred to graphic projections or plans. See Keller and McCormick, "Towards a History of Projects," 426.

Whereas foreign policy early in Cosimo's rule was characterized by an overwhelming preoccupation with security,[19] a succession of events in the late 1550s—the duchy's 1555 victory in the war of Siena, the republic's subsequent feoffment, in 1557, to Florence, and a general mellowing of tensions with the onset of the *pax hispanica* in 1559, at the conclusion of the Italian Wars—permitted the ducal government to redirect further attention and resources to tasks of internal development.[20] By the 1560s, for example, Cosimo's government began to enlarge its territorial and economic pursuits in ways that actively supported existing productive sectors and established new ones in diverse regions of Tuscany, developing commercial incentives and infrastructures in Pisa and, later in the decade, around the new port of Livorno, an area that would see especial impetus under Francesco from the mid-1570s.[21] These years also saw much greater

[19] During the first part of his rule especially, Cosimo I prioritized the security needs of his state and built a number of fortresses around the peripheries of his dominions and at strategic locations within its interior. Giorgio Spini, "Introduzione," in *Architettura e politica da Cosimo I a Ferdinando I*, ed. Giorgio Spini (Florence: Leo S. Olschki, 1976), 29–32.

[20] For brief accounts of the war of Siena, see Elena Fasano Guarini, "La fondazione del principato: da Cosimo I a Ferdinando I (1530–1609)," in *Storia della Civiltà Toscana*, ed. Elena Fasano Guarini, vol. 3: Il Principato Mediceo (Florence: Le Monnier per Cassa di Risparmio di Firenze, 2003), 18–24, and Lorenzo Tanzini, "Tuscan States: Florence and Siena," in *The Italian Renaissance State*, ed. Andrea Gamberini and Isabella Lazzarini (Cambridge, UK: Cambridge University Press, 2012), 104–9. The war between France and Habsburg Spain for control of the Italian peninsula ended with the Treaty of Cateau-Cambrésis of 1559. On the idea of the *pax hispanica*, see Thomas James Dandelet and John A. Marino, *Spain in Italy: Politics, Society, and Religion 1500–1700* (Leiden: Brill, 2007), and Eric Cochrane, *Italy 1530–1630* (Routledge, 1988). Although Judith C. Brown emphasizes economic policy as a constant feature of Cosimo's rule, Corey Tazzara sees Tuscan political economy grow most pronounced after the conquest of Siena and end of the Italian Wars. Judith C. Brown, "Concepts of Political Economy: Cosimo I de' Medici in a Comparative European Context," in *Firenze e la Toscana dei Medici nell'Europa del '500*, vol. 1: Strumenti e veicoli della cultura; Relazioni politiche ed economiche (Florence: Leo S. Olschki, 1983), 279–93. In distinguishing the 1560s and 1570s as an era of especially pronounced economic growth, I follow Corey Tazzara, *The Free Port of Livorno and the Transformation of the Mediterranean World* (New York and Oxford: Oxford University Press, 2017), chap. 1.

[21] For an orientation to Tuscan economic policy in the second half of the sixteenth century, see Furio Diaz, *Il Granducato di Toscana: I Medici* (Milan: UTET, 1976), 127–47; Brown, "Concepts of Political Economy"; Paolo Malanima, *Politica ed economia nella formazione dello stato regionale: il caso toscano* (Giardini, 1987); Stefano Calonaci, "Taking Over the Economy: Cosimo I de' Medici and the Management of the Wealth of the State," in *A Companion to Cosimo I de' Medici*, ed. Alessio Assonitis and Henk Th. van Veen (Brill, 2021), 304–41. For an introduction to the hydraulic projects of the countrysides of Pisa and Livorno, see Elena Fasano Guarini, "Regolamentazione delle acque e sistemazione del territorio," in *Livorno e Pisa: due città e un territorio nella politica dei Medici*, ed. Mario Mirri et al. (Pisa: Nistri-Lischi,

expenditure by the dukes in acquiring landed property, mainly in the frontier regions around Pisa and the Val di Chiana, as well as near Grosseto, Siena, and the Mugello.[22] In these zones—sparsely populated, often waterlogged—the government worked to drain marshes and establish ducal farm estates for growing cereals to ensure a steady and affordable supply of grain for public distribution, in addition to mulberry plantations to support the domestic silk industry.[23] Alluvial regimentation also continued along the Arno and other state rivers through this period, and with an ever-growing degree of administrative and political coordination. As the state endeavored to ever more intensively exploit and improve the landscape and its arrayed resources, it called upon its functionaries in the Ufficiali dei Fiumi and Ufficio dei Fossi to plan and execute reclamation works and lay the requisite physical infrastructures, involving these consolidating bureaucracies and their experts in large-scale interventions that came gradually to stretch their operations beyond the ordinary tasks of maintenance and flood control that had, at least initially, absorbed the majority of their energies.

Historians have typically seen behind these developments the quickening of a coherent political economy under the Medici dukes, oriented around policies to stimulate

1980), 43–47. On the development of Livorno, see Tazzara, *The Free Port of Livorno and the Transformation of the Mediterranean World*.

[22] On trends in ducal property acquisitions, see Calonaci, "Taking Over the Economy," 326–31; Giuseppe Vittorio Parigino, *Il tesoro del principe: funzione pubblica e privata del patrimonio della famiglia Medici nel Cinquecento*, Accademia toscana di scienze e lettere "La Colombaria" 180 (Firenze: L.S. Olschki, 1999) offers an in-depth study of ducal landed patrimony under Cosimo I and his sons. On the geography of land reclamation and drainage in Tuscany, see Danilo Barsanti and Leonardo Rombai, *La "guerra delle acque" in Toscana: storia delle bonifiche dai Medici alla riforma agraria* (Florence: Edizioni Medicea, 1986); Danilo Barsanti, "Le bonifiche nell'Italia Centrale in età moderna e contemporanea: profilo storico e prospettive di ricerca," *Rivista di Storia dell'Agricoltura* XXVII, no. 2 (1987): 67–104; Annamaria Gabellini, "La 'Cartografia delle bonifiche' nella Toscana granducale," *Rivista di Storia dell'Agricoltura* XXVII, no. 2 (1987): 153–64.

[23] Cosimo and his wife Eleonora de Toledo were Tuscany's largest grain producers and had a monopoly on its sale in order to ensure affordable and steady supplies. Calonaci, "Taking Over the Economy," 325. On mulberry cultivation for silk production, see Brown, "Concepts of Political Economy," 285.

demographic growth and promote industrial and commercial expansion.[24] Yet in seeking to account for the princes' precocious activism in orchestrating state populations and resources in this manner, scholars have traditionally puzzled over a long-supposed paucity of a corresponding theoretical discourse—of a corpus of written reflection on the underlying mechanisms of economic development—until the final decades of the sixteenth century, when such matters were integrated explicitly into reason of state theory in the hands of scholars such as Giovanni Botero (ca. 1544–1617).[25] While we shall turn to him in the next chapter, my aim for now is to take up recent calls to uncover some of the nascent origins of such theories by showing how projectors—the authors of aquatic projects—began to promote territorial redesign, aquatic planning, and infrastructure building in the years before reason of state and cameralist thinkers did, often figuring these activities as necessary preconditions of economic development.[26] In their written proposals, they responded to practical problems in the landscape and proffered imaginative, often implausible solutions for overcoming them. But if these projectors so often failed to deliver on their lofty promises, their ideas nonetheless foreshadowed and

[24] Brown, "Concepts of Political Economy"; Sophus A. Reinert, "Introduction," in *A Short Treatise on the Wealth and Poverty of Nations (1613)*, by Antonio Serra, ed. Sophus A. Reinert, trans. Jonathan Hunt, Economic Ideas That Built Europe (New York: Anthem Press, 2011), 1–86; Tazzara, *The Free Port of Livorno and the Transformation of the Mediterranean World*, 22 (from whom I borrow the term "quickening" as an especially fitting metaphor); Sophus A. Reinert and Robert Fredona, "Political Economy and the Medici," *Business History Review* 94, no. 1 (2020): 125–77.

[25] Sophus A. Reinert and Robert Fredona, who rightly put the lie to this older view, observed recently that "the silence of Italian Renaissance thinkers on matters of commerce has long been a *locus communis* in the history of ideas." See their "Political Economy and the Medici," 126–27, as well as Reinert, "Introduction," 35–36, and Tazzara, *The Free Port of Livorno and the Transformation of the Mediterranean World*, 21–22, for further discussion of this pernicious historiographical idea and its omissions. Surprisingly, even Richard A. Goldthwaite, with all he has done to uncover the rich practices at the heart of Renaissance capitalist society, maintained of his protagonists that "none of these men ever crossed the intellectual barrier to analysis." Richard A. Goldthwaite, *The Economy of Renaissance Florence* (Baltimore: Johns Hopkins University Press, 2009), 590–94, quote at 591.

[26] See Reinert, "Introduction", Reinert and Fredona, "Political Economy and the Medici", and Tazzara, *The Free Port of Livorno and the Transformation of the Mediterranean World*, as in previous footnote.

inspired early political economic theory and its concepts of absolutist territorial management.

The following pages will make this case by studying three different aquatic projects (texts, that is, in the sense defined above) for the Pisan plains, the Arno River basin, and the Val di Chiana, key regions of strategic territorial development in the Tuscan state during the period under consideration. Moving chronologically, the first project, a brief but complex text that will occupy most of our attentions, is a dialogue by the patrician and bureaucrat Lorenzo Albizi (1522–1599) titled *Ragionamento sopra il bonificare il piano di Pisa* (*Reasoning on the reclamation of the Pisan plains*).[27] Though fundamentally a work of fiction, it blurs the line between the real and the fabulous by staging a plausible conversation among the dialogue's author, Albizi, the ducal architect and *capomastro* Davide Fortini (ca. 1515/20–1594), and Giovanni di Alessandro Caccini (1522–1592), then *provveditore* of the Ufficio dei Fossi in Pisa, on methods for mitigating floods in Pisa and draining the low-lying marshes that stretched along the western littorals of the Tuscan state. Composed in or shortly after 1568, Albizi dedicated the dialogue first to Francesco I and again, some years later, to Ferdinando I, possibly on the heels of yet another severe flood in 1589.[28] The second project is a proposal for

[27] The text was not published until the eighteenth century, when it was included in the anonymous *Raccolta d'autori che trattano del moto dell'acque, divisa in tre tomi. Tomo primo* (Florence: Stamperia di S. A. R., 1723), 25–34. Emanuela Ferretti dates it to 1568. Emanuela Ferretti, "Maestro David Fortini: dal Tribolo al Buontalenti: una carriera all'ombra dei grandi," in *Niccolò detto il Tribolo tra arte, architettura e paesaggio*, ed. Elisabetta Pieri and Luigi Zangheri (Poggio a Caiano: Comune, 2001), 77.

[28] Albizi explains this in the epistle dedicatory to the later published edition (the earliest surviving version of which I am aware), which reflects the later version he ostensibly presented to Ferdinando I. Because the dialogue does not make mention of new projects in the intervening period, while commenting extensively on interventions from the 1560s, it is plausible that he did not update his script between 1568 and the later version, of undetermined date, that is reflected in the 1723 publication. Albizi, "Ragionamento sopra il bonificare il Paese di Pisa," 25. On the 1589 floods, see Ugo Losacco, *Notizie e considerazioni sulle inondazioni d'Arno in Firenze*, 1967, 36–38.

improving navigability along the Arno River by the little-known Flemish engineer, Wilhelm (or, as he was known in Italy, Guglielmo) de Raet (1537–1583). Esteemed as a designer of artillery, fortifications, and hydraulic devices, he travelled at some point in the summer of 1577 from Wolfenbüttel, where he was employed in fortification works for Duke Julius of Brunswick-Lüneburg (r. 1568–1589), to assist the Republic of Lucca with a challenging drainage endeavor in their coastal marshlands. Soon after arriving, he not only composed a comprehensive drainage scheme for Lucca's governing ministers, but also looked to gain the favor of the Medicean Court by devising a project for Francesco I to organize Tuscany's principal watercourse.[29] The final project I shall examine is a brief discourse from 1591 on the drainage of the Val di Chiana, a vast marsh stretching across southern Tuscany and the northern Papal States, by the scholar and academician Giovanni Rondinelli (fl. 1535–1592).[30] Addressed as an epistolary missive to Ferdinando I's wife, Duchess Maria Cristina di Lorena (1565–1637), Rondinelli appears to have first written it as an addendum to his *Descrizione di Cortona*, a brief manuscript history he composed on the city when he was stationed there as its local governor.

On the surface, these projects, each very different from the other, form an eclectic set. Addressing disparate aquatic geographies and problems, they engage a variety of different textual formats and rhetorical structures to enjoin the princes to implement the

[29] ASF, Miscellanea Medicea, 28/7.
[30] Rondinelli's discourse is titled "Discorso di Giovanni Rondinelli del diseccare la Chiana." I have found two manuscript copies of the text: one, plausibly the author's original, is in the BNCF: Magliabechiana XXV 312, fols. 12r–14v. The other one is in a manuscript compilation in the Biblioteca Marciana in Venice, Codice Marciano It. VI, 93 (=5897), Part IV, fols. 11r–13v. Both form addenda to Rondinelli's *Descrizione di Cortona*. Giovanni Targioni Tozzetti also later published it, again within the larger *Descrizione*, in his *Relazioni d'alcuni viaggi fatti in diverse parti della Toscana per osservare le produzioni naturali e gli antichi monumenti di essa.*, 2nd ed., vol. 8 (Florence: Stamperia Granducale per Gaetano Cambiagi, 1775), 525–528.

visions they articulate for the territory. I bring them together not as any exhaustive overview of the genre—far from it—but rather to merely begin exploring, by means of a few exemplary case studies never before discussed in previous scholarship, some of the ways in which early modern observers began to posit alternative visions for the aquatic landscape and its economic organization. By closely reading aquatic project texts and reconstructing their contexts—their authors' biographies, the environments and geographies they addressed, and the shifting regional and even global dynamics that inflected them—my research reveals the advancement of internal navigation to have been an exceptionally fervent interest among ducal technocrats. As a utilitarian circulatory imagination began to take root in the minds of projectors and princes in Tuscany and other Italian states in the late sixteenth century, it accompanied and at times eclipsed flood mitigation as a key animating concern of territorial design and planning. Underpinning these projected visions, as we will also see, was an impassioned call for a kind of absolutist, centralizing politics,[31] one that, while emerging from and responsive to the rhetorical exigencies of the patronage system at Court, also likely reflected dawning anxieties about the very real challenges bureaucratic institutions faced in attempting to carry out the grueling, muddy, Sisyphean work of statecraft.

Lorenzo Albizi's Project for the Maremma Pisana

[31] For an illuminating theoretical discussion of Court patronage in the context of the early sciences, see Mario Biagioli, *Galileo, Courtier: The Practice of Science in the Culture of Absolutism*, Science and Its Conceptual Foundations Series (Chicago, IL: University of Chicago Press, 1994), chap. 1, and select challenges to his framework by Pamela O. Long, "Power, Patronage, and the Authorship of Ars: From Mechanical Know-How to Mechanical Knowledge in the Last Scribal Age," *Isis* 88, no. 1 (1997): 1–41.

Remembered principally for his *Ragionamento*, Lorenzo Albizi has been variously described by historians as an architect, a technician, and (perhaps because he wrote on alluvial matters but was not known to have worked in the Ufficiali dei Fiumi or Ufficio dei Fossi) a hydraulic consultant.[32] But these descriptors are not quite adequate (and not only because the occupational categories they denote, still incredibly fluid in the sixteenth century, tell us precious little of his professional pursuits and aptitudes).[33] From an old patrician family, elites and prominent officeholders in the Florentine Republic, Albizi served for much of his career in high-ranking administrative positions in the ducal state, cycling through various military, territorial governance, and Court roles. A trajectory not atypical for members of the older fifteenth-century houses that managed to transform themselves into a new noble class at the Medici Court, these posts had him stationed for long stretches of time at far-flung towns and fortresses along the state's remote frontiers.[34]

After an initial period of military service immediately before and during the war of Siena, possibly as a commander in the ducal militia, Albizi took up administrative positions along Tuscany's western frontier, spending formative years in the region that

[32] For example, Fasano Guarini, "Regolamentazione delle acque," 45, and Spini, "Introduzione," 45.
[33] See, again on occupational fluidity in the building arts still in the sixteenth century, Pamela O. Long, "Multi-Tasking 'Pre-Professional' Architect/Engineers and Other Bricolage Practitioners as Key Figures in the Elision of Boundaries Between Practice and Learning in Sixteenth-Century Europe: Some Roman Examples," in *The Structures of Practical Knowledge*, ed. Matteo Valleriani (Cham: Springer International Publishing, 2017), 223–46. For a slightly different view, see Elizabeth Merrill, "The *Professione Di Architetto* in Renaissance Italy," *Journal of the Society of Architectural Historians* 76, no. 1 (2017): 13–35.
[34] For a chronicle of this process, see R. Burr Litchfield, *Emergence of a Bureaucracy: The Florentine Patricians, 1530–1790* (Princeton: Princeton University Press, 1987), chap. 2. As Litchfield describes, the status of "nobility," as conceived and constructed by the older officeholding families over the course of the latter part of the sixteenth century, also underwent a transformation in meaning to refer to a kind of individual virtue and elite lineage in Florentine politics rather than to denote dominion over land; see 30–31. Spini, "Introduzione," 31.

would come to preoccupy him as a projector.[35] In 1557, for example, he was sent temporarily to govern Barga, a distant but strategically located town of the Garfagnana, one of Florence's non-contiguous ducal enclaves northwest of Lucca.[36] Nestled in the wooded Romeccio hills on the left bank of the Serchio, Barga and its possessions formed, along with the Tuscan vicariate of Fivizzano, a kind of geographical corridor that threaded between the lands of the Este Dukes and of the Republic of Lucca, and was developed during these years as a commercial and defensive outpost and timber harvesting region.[37] A few years later, he moved to Pisa as treasurer to Cosimo's second son Giovanni di Cosimo de' Medici (1543–1562), who had been elevated to the cardinalate in 1560 at barely 16 years old and, by early 1561, appointed the city's archbishop.[38] A position of great fiduciary duty, this new role put Albizi in charge of Giovanni's household accounts, testifying to his abilities as a trusted bookkeeper, bureaucrat, and courtier.[39]

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[35] In a letter to Cosimo I from 17 March 1553, for example, Girolamo di Luca degli Albizi stated that Lorenzo Albizi "is overseeing the *guastatori*," soldiers in charge of destroying fortifications. ASF, Mediceo del Principato, 423a, 906r. MAP DOC ID# 16788. On appointments to the Medicean *Bande*, see Litchfield, *Emergence of a Bureaucracy*, chap. 2, *passim*. On the *Bande* in general, see Franco Angiolini, "Le Bande medicee tra 'ordine' e 'disordine,'" in *Corpi armati e orine pubblico in Italia (XVI–XIX sec.)*, ed. Livio Antonielli and Claudio Donati (Soveria Manelli: Rubbettino Editore, 2003), 9–47.

[36] Pompeo Litta and Luigi Passerini, *Famiglie celebri di Italia. Alessandri già Albizzi di Firenze* (Milan: P.E. Giusti, 1819) Tav. XIII.

[37] Carla Sodini, "Architettura e politica a Barga: 1527–1569," in *Architettura e politica da Cosimo I a Ferdinando I*, ed. Giorgio Spini (Florence: Leo S. Olschki, 1976), 164–83.

[38] For Giovanni de' Medici's biography, see Paola Volpini, "Giovanni de' Medici," in *Dizionario Biografico Degli Italiani* (Rome: Istituto della Enciclopedia Italiana, 2009), https://www.treccani.it/enciclopedia/giovanni-de-medici_res-f226976e-dcde-11df-9ef0-d5ce3506d72e_(Dizionario-Biografico)/. For examples of documents that list Albizi as Giovanni de' Medici's treasurer, see ASF, Mediceo del Principato, 616, fol. 315r, 1 May 1560 (MAP DOC ID# 26840), and ASF, Mediceo del Principato 616, fol. 326r, 4 June 1560 (MAP DOC ID# 27056).

[39] In contrast to scholarship on ducal and state secretaries, work on treasurers seems wanting. For some general comments on the role of treasurers, see Massimo Carlo Giannini, "Note sui tesorieri generali della Camera apostolica e sulle loro carriere tra XVI e XVII secolo," in *Offices et papauté (XIVe-XVIIe siècle): Charges, hommes, destins*, ed. Armand Jamme and Olivier Poncet, Collection de l'École française de Rome (Rome: Publications de l'École française de Rome, 2013), 859–83.

When Albizi took up residence with Giovanni's court in Pisa, its aquatic landscape was entering a renewed era of intensive transformation. The drainage of its low-lying malarial marshlands, an age-old concern of the Pisan and Florentine governments that alternately controlled this countryside, became an especially strategic priority early in Cosimo's reign.[40] In fact, it formed an integral component of his government's fiscal and economic policies of repopulating and cultivating the region, still in considerable disarray decades after the violent Florentine conquest.[41] Though chronic flooding of the Arno and Serchio continued to threaten towns and rural property, under the reformed Ufficio dei Fossi di Pisa, sizable new drainage and flood defense works began to appear by the late 1550s and 1560s. For example, the magistracy dug new diversion channels branching from the Arno, such as the Fosso delle Bocchette di Putignano (completed in 1558) and Trabocco di Fornacetta (completed in 1568), which discharged the river's excess waters before they reached the city, sending them south to fill in and deposit their sediments in the marshes of Stagno and Coltano.[42] These years also saw the Ufficio dei Fossi straighten large meanders of the Arno at the towns of Castel del Bosco and Calcinaia to reclaim land from the river's waterlogged flood plain, operations that simultaneously eased navigation along its course.[43]

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[40] On these developments, see Ranieri Fiaschi, *Le magistrature pisane delle acque* (Pisa: Nistri-Lischi Editore, 1938); Marco Della Pina, "Andamento e distribuzione della popolazione," in *Livorno e Pisa: due città e un territorio nella politica dei Medici*, ed. Mario Mirri et al. (Pisa: Nistri-Lischi, 1980), 25–30; Fasano Guarini, "Regolamentazione delle acque"; Elena Fasano Guarini, "Città soggette e contadini nel dominio Fiorentino tra Quattro e Cinquecento: Il Caso Pisano," in *Ricerche di Storia Moderna*, vol. I (Pisa: Pacini Editore, 1984), 47–51.

[41] As dramatically recounted in Fiaschi, *Le magistrature pisane delle acque*, 20–21.

[42] Fasano Guarini, "Regolamentazione delle acque," 48; Pietro Ferroni and Leonardo Rombai, "Introduzione," in *Relazione sulla pianura pisana (1774): acque e territorio, analisi e progetto per Pietro Leopoldo di Lorena*, ed. Leonardo Rombai, Edizioni dell'Assemblea 189 (Florence: Regione Toscana, Consiglio Regionale, 2019), 42.

[43] The *taglio* of Castel del Bosco was executed in 1561, and the one at Calcinaia from 1563-64. Fasano Guarini, "Regolamentazione delle acque," 48; Ferroni and Rombai, "Introduzione," 43.

The magistracy additionally took an interest in excavating new channels to improve commercial transit in the region. Between 1564 and 1566, a long branching canal was dug out of the Serchio at Ripafratta to direct some of the river's water south to the Arno in order to facilitate navigation between Pisa and the Apuan foothill towns of northern Tuscany, the sites of new and long-established marble quarries and silver mines, as well as to the Republic of Lucca, renowned for its silk production.[44] As we will see, the duchy's interests in linking this northern coastal frontier with the more populous Arno corridor was front of mind for Albizi. But when he arrived in Pisa, the region was also on the cusp of a much larger economic reorientation, one he however seems to have only hazily perceived. The duchy's commercial and maritime center of gravity was beginning to shift from the Porto Pisano (whose long-silting harbor had, by the mid-sixteenth century, become all but impassable for large ships), to Livorno, which would before long become Tuscany's premier Mediterranean port.[45] Though it would not take off in earnest until the mid-1570s, when Francesco I began to build up the city and settle Florentine commercial houses around its central piazza, by 1563, the Ufficio dei Fossi had broken ground on a new 26-kilometer-long channel, the Canale dei Navicelli, which diverted the Arno into a newly excavated branch to link Pisa to this burgeoning southern harbor.[46]

[44] It was called the Canale di Ripafratta. In his *Ragionamento*, Albizi discusses his ideas for improving the Canale di Ripafratta, which he observed to be low in its water levels. Albizi, "Ragionamento sopra il bonificare il Paese di Pisa," 27. Going solely on his mention of this canal, scholars have taken, incorrectly in my opinion, to crediting him as its architect: see for example Spini, "Introduzione," 45, and Fasano Guarini, "Regolamentazione delle acque," 63. Using epistolary evidence, Eliana Carrara more recently credited Giovanni Caccini with coordinating this project; see her "Alcune lettere inedite di Vasari," *L'Ellisse. Studi storici di letteratura italiana* 5 (2010): 66 n.55.

[45] This shift is the subject of Corey Tazzara's excellent book, *The Free Port of Livorno and the Transformation of the Mediterranean World*.

[46] Fasano Guarini, "Regolamentazione delle acque," 59; Paolo Pardini, "Canale dei Navicelli," in *Livorno e Pisa*, ed. Mario Mirri et al. (Pisa: Nistri-Lischi, 1980), 59; Tazzara, *The Free Port of Livorno and the Transformation of the Mediterranean World*, 22–24.

It would take many more decades to make the vast Maremma Pisana more widely habitable, since the region, despite these initial starts, remained a miasmal hotbed. In the autumn of 1562, in fact, Giovanni de' Medici, along with his brother Garzia de' Medici (1547–1562) and mother Duchess Eleonora di Toledo (1522–1562), fell victim to a malarial fever they contracted on a journey with the ducal family through its marshy countryside.[47] The untimely passing of Albizi's patron seems to have brought his brief period in Pisa to a close, for by 1565, he was back in Siena with a new appointment as the region's *provveditore delle fortezze*, a position within the Capitani di Parte Guelfa.[48]

It was during this time, in the few years after he left Pisa, that Albizi composed his *Ragionamento*. Acknowledging how far its watery landscape still had to come, while also sensing the possibilities unleashed by rising ducal interests in the region and novel opportunities to build upon the works already underway, our projector began to formulate his ideas for improving this space. To convince his readers—about whom we alas know little, but whom almost certainly formed a closed audience that counted the duke and his closest advisors—of the merits of his proposal, he composed neither a treatise, technical manual, nor letter, the standard early modern genres of imperative undertaking. He opted rather for a dialogue, a format that, in dramatizing the act of persuasion itself, served as the Renaissance's hortatory genre *par excellence*.[49] While dialogues were essentially fictional exchanges, Albizi, in adhering to the Ciceronean conventions of historical

[47] Volpini, "Giovanni de' Medici."
[48] ASF, Mediceo del Principato, 516a, fol. 686r, (MAP DOC ID# 20665), for example, is an undated copy of a supplication attached to a letter from Lorenzo Albizi to Francesco I dated 24 July 1565, in which Albizi is introduced as "proveditore delle fortezze di Siena e altri luoghi per V. Ecc.a Ill.ma." To this role, he would have brought his skills and experience as a treasurer, aptitudes suited to overseeing the accounts for the construction and management of new fortresses in the conquered state of Siena.
[49] Virginia Cox, *The Renaissance Dialogue: Literary Dialogue in Its Social and Political Contexts, Castiglione to Galileo*, Cambridge Studies in Renaissance Literature and Culture (Cambridge: Cambridge University Press, 1992), 5–6.

consistency that characterized the form in *cinquecento* Italy, could speak about the flood-ridden landscape with documentary verisimilitude as a space that posed real, pressing problems beyond the confines of the text.[50] Drawing on his personal experience, he discussed many of the issues he observed during his time in the region, referencing real projects recently completed or then underway while also suggesting ways to build upon and improve them.

But within the economy of the dialogue, Albizi's authority on matters of aquatic terraforming flowed above all from his fictional exchange with his interlocutors, Fortini and Caccini. Among dukes Cosimo and Francesco's most favored technicians and administrators, they were both recognized experts on alluvial matters with respectable positions in the ducal bureaucracies, and thereby functioned for Albizi—as fictional projector and flesh-and-blood author—as guarantors of the basic validity of his proposal.[51] By the time Albizi composed the *Ragionamento*, for example, Fortini had already worked for several years as a *capomastro* in the Capitani di Parte and Ufficiali dei Fiumi, supervised the construction of buildings and gardens at some of the largest Medicean villa complexes in the Valdarno, and began collaborating with Giorgio Vasari in Pisa on building projects for the Ordine dei Cavalieri di Santo Stefano, the duchy's new noble religious and knightly order, and the new Medicean arsenal.[52] He would later

[50] On the "criterion of historical consistency that distinguishes the dialogue production of *Cinquecento* Italy from that of the rest of Europe," see Cox, chap. 2, at 10.
[51] On the construction of authority in the Renaissance dialogue, see Cox, chap. 2, especially 12–15.
[52] On Fortini's life and work, see Ferretti, "Maestro David Fortini", and Emanuela Ferretti, "Davitte di Raffaello Fortini da Castelfiorentino, architetto e ingegnere di Sua Altezza," *Miscellanea storica della Valdelsa* 53, no. 1–3 (1997): 81–100. On the Cavalieri di Santo Stefano, see Cesare Ciano, *I primi Medici e il mare. Note sulla politica marinara toscana da Cosimo I a Ferdinando I*, Biblioteca del Bollettino Storico Pisano 22 (Pisa: Pacini Editore, 1980), 36–43, and Gino Guarnieri, *I cavalieri di Santo Stefano*, 2nd ed. (Pisa: Nistri-Lischi, 1960). On the Arsenale Medicea in Pisa, see Ciuti, *Pisa medicea: itinerario storico artistico tra Cinque e Seicento* (Ospedaletto, Pisa: Felici, 2003), 57–60.

in life become a chief engineer for the city's Ufficio dei Fossi.[53] Meanwhile, Caccini served during this period as the office's *provveditore*, spending his days overseeing the administration's drainage and alluvial maintenance works while also coordinating the construction of the many new channels that broke ground during the 1560s.[54] From his correspondence with Vasari, moreover, it appears that Caccini attended not only to matters of alluvial maintenance and construction but also to transport, having had a hand in the shipment of marble from Apuan quarries by river to worksites in Pisa and Florence.[55] Indeed, although Albizi's dialogue could only purport to be a real conversation, it is entirely plausible that our author had occasion to meet his fictional interlocutors personally in Pisa (perhaps even carrying on a conversation like the one staged in his *Ragionamento*) since all of them were in the city in the early 1560s to perform their various duties for the duchy.

The *Ragionamento* reads as a utopian project for defending Pisa from floods and draining its countryside. In the text, Albizi proposes a series of interventions to resolve these disorders that involve redirecting major rivers and building new drainage channels in ways that would dramatically recast the aquatic landscape. Numerous and iterative, his propositions culminate in the following principal gestures (figure 24): first, cutting the Serchio River near the town of Avane; second, filling the marshes of Nodica and Vecchiano and the Lago di Massaciuccoli with its sediments, while also cutting a diversion outlet to feed into and augment the Canale di Ripafratta; then, in dramatic

[53] He took on this role in 1587. Emanuela Ferretti, "'Imminutus crevit': Il problema della regimazione idraulica dai documenti degli ufficiali dei fiumi di Firenze (1549–1574)," in *La città e il fiume: Secoli XIII–XIX*, ed. Carlo Travaglini, Collection de l'École française de Rome 394 (Rome: École française de Rome, 2008), 112, n. 22; Ferretti, "Maestro David Fortini," 81, n. 9.
[54] Carrara, "Alcune lettere inedite di Vasari," 66 n.15. See also note 33 above.
[55] Carrara, 66.

fashion, removing the Arno from Pisa by turning its course south at Pontedera to fill in the marshes of Stagno before turning it northwards to join with the Serchio at San Piero a Grado; then finally, once Nodica, Vecchiano, and Massaciuccoli are reclaimed, turning the Serchio again to direct it toward Bientina and down through Canal of Usciana to fill the Arno's former bed.[56] These specific operations, coalescing around the Serchio River and its surrounding plains and mountains, evince Albizi's prevailing interests in developing regions of upper Tuscany, the site of quarries and mines, and bringing them into more reliable communication with the rest of the state.

Within the dialogue, Caccini and Fortini often challenge Albizi as he unfolds his vision for this space. Peppering him with questions about the possible risks and ramifications of the interventions he proposed, the engineers often express skepticism about the feasibility of his scheme. They press him to explicate and sharpen his reasoning, and occasionally proffer their own ideas for consideration. In an effort to persuade his interlocutors to see his way, Albizi insistently justifies his territorial vision in light of its widespread economic benefits, highlighting the advantages his proposed modifications would bring not only to flood mitigation and land drainage, but also to industry and especially to processes of commercial exchange.

This dynamic is in evidence throughout the dialogue, beginning with Albizi's first suggestion to cut a *taglio* to straighten the Serchio at Avane, a small foothill town 10 kilometers north of Pisa. Beyond obviating flood damages so often suffered in the town, where the river is forced to twist and bend in its treacherous journey southward, Albizi

[56] These gestures are outlined in brief in the epistle dedicatory, but it is difficult to understand them without reading the entire dialogue. Albizi, "Ragionamento sopra il bonificare il Paese di Pisa," 25. They are also summarized in Barsanti and Rombai, *La "Guerra delle acque" in Toscana*, 46.

reasons that by redirecting the river's turbid waters into the marshes of Vecchiano and Nodica and the lake of Massaciuccoli, he could fill in these wetlands, bringing about "the greatest of benefits, and the acquisition of land suited to agriculture, and the amelioration of the air."[57] He proposes straightening the river by stringing it along the base of the mountain: "It is not many *braccia* to cut," he reasons, "and for being by a stony and strong mountain, the water would never break out … and there is no need for the defensive walls or cataracts that you would have to build were you to plan this cut in any other place."[58] Albizi's interlocutors support his suggestion, elaborating in turn on the utility of his proposal beyond drainage, and especially for industrial production. "I consider in this large cut another benefit," says Caccini, "beyond the above-mentioned: one could create a mill, which would be of great use and commodity to Vecchiano, and Nodica, and others nearby."[59]

Soon thereafter, Fortini counters with his more daring suggestion to redirect the Serchio, drawing it in a straight southerly course to empty into the Arno upstream of its Mediterranean outlet. This *taglio* would pass through the marshes of San Bartolomeo and San Rossore. He justifies this proposal—what he calls, with some bluster, the "*true taglio*"—not only by insisting on its efficacy at slowly filling in these fenlands with sediment carried by the Serchio, but also by "opening the mouth of the Arno, and making such an even riverbed, so that large boats and galleys will be able to come up to Pisa, as

[57] "...dove aerebbe fatto grandissimo benefizio, ed acquisto, così di terreno atto a coltura, come di miglioramento d'aria...." Albizi, "Ragionamento sopra il bonificare il Paese di Pisa," 26.
[58] "...il quale non credo sia molte braccia da tagliare, e per essere monte sassoso, e forte, l'acqua non potrebbe mai romperlo, nè sforzare la bocca, e si risparmerebbe la muraglia, e cateratta, che s'averebbe a fare in ogni altro luogo, ove si facesse tal trabocco." Albizi, 26.
[59] "Io considero in questa tagliata un altro benefizio, oltre i sopradetti, si potrebbe fare un mulino, il quale sarebbe di grand'utile, e comodità di Vecchiano, e di Nodica, ed altri vicini." Albizi, 26.

they did 20 or 25 years ago."[60] While Caccini initially challenges Fortini's euphoric commercial vision, citing the elevated flood risk to which Pisa would be subject, with the Arno and Serchio converging around it, he too comes to concede the circulatory benefits of this alluvial redirection. "With this danger set behind us," he states, "I hold it as certain, that it would be a most helpful thing for the navigation of the Arno River."[61]

In addition to cutting and straightening rivers, Albizi in the dialogue thinks carefully about ways to repair existing channels. When he wrote, the water levels of the Canale di Ripafratta, excavated only recently, along with older drainage ditches were becoming dangerously shallow from evaporation and sand and silt accumulation in their beds, making trafficking them difficult and inhibiting the reliable discharge of floodwaters.[62] Albizi also complains of the stench that emanated from them and the health risks this posed: in the summer especially, "the waters, boiling off, usually make bad vapors."[63] To refurbish these channels and clear them of sedimentation, he proposes diverting into them more water from the Serchio, "which is by nature limpid and clear."[64] This intervention would bring countless benefits: beyond "remov[ing] the stink," it would furnish water for connected irrigation channels, support industrial milling, and restore easy navigation among Lucca, Ripafratta, and Pisa, such that merchants could "retrieve grain and other merchandise from that city."[65] The industrial and commercial affordances of aquatic improvements were never far from Albizi's mind.

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[60] "... e di più unitosi con Arno averebbero tenuto la foce aperta, e fatto tanto buon fondo, che le barche grosse, e le galere sariano potute venire fino a Pisa, come facevano 20, o 25 anni sono." Albizi, 26.
[61] "Ma posposto questo pericolo, io tengo per fermo, che sarebbe cosa utilissima per la navigazione del fiume Arno." Albizi, 27.
[62] Albizi, 27.
[63] "a tale che l'acque ribollendo, sogliono farsi cattivi vapori." Albizi, 27.
[64] "...onde con detta acqua del Serchio, che è per natura limpida, e chiara..." Albizi, 27.
[65] "Il primo sarebbe di levare il fetore ..." / "... che levano di Pisa i grani, ed altre mercanzie." Albizi, 27.

After a brief, unresolved discussion of defects of the Fornacetta, a ditch built only recently but already raising fears of siltation at the beach of Livorno, the engineers enter into the most disputatious part of their interchange. It centers on Albizi's radical idea to replace the Arno with the Serchio as Pisa's principal urban river. Caccini and Fortini raise a host of very serious objections (as we will see), many of which hinge on the risks that recasting the region's aquatic geography might pose to its alluvial stability and commercial viability.

Albizi opens this section with the salvo that to liberate Pisa from floods, "it is necessary to remove the Arno such that it does not pass by Pisa, not even within a few miles."[66] Fortini instantly challenges this suggestion, implausible on so many counts, as an economic liability: "the customs and the businesses would all come to nothing, and would make of Pisa a miserable fortress."[67] Albizi dismisses Fortini's criticism, assuring him that this would not be an issue, since he would instead direct the Serchio's waters to Pisa. He would accomplish this feat by moving the Serchio's course to flow east of Lucca, diverting it into the Lago di Bientina to then empty into the Arno's former bed, where it would course onward to Pisa. After all, "it went there formerly," as he states correctly, recalling what he learned by "asking the elderly people of Pisa and its countryside, and in particular, Giovan Vaglienti, who was one of the oldest men of the city, and well read."[68] To emphasize his sincerity, he invokes as a foil the paradigmatic

[66] "Dico dunque, che a volere liberare Pisa dall'inondazioni, bisogna levare Arno che non passi presso Pisa, ne anco appreso a qualche miglio." Albizi, 29.
[67] "Oh Pisa resterebbe una bella cosa, e come si dice sulle Secche di Barberia, e dove ha talvolta troppo bere, si morrerebbe di fame, perchè la dogana, ed i negozi al tutto farebbero nulla, e si farebbe un castellaccio." Albizi, 29.
[68] "G: E che strada faceva questo fiume per unire con Arno? / L: Pigliava il suo cammino sopra Lucca, e veniva nel lago oggi detto di Bientina, e sotto il castello di Bientina s'abboccava con Arno. / D: E donde avete sapute queste cose? / L: Nel domandare a i vecchi di Pisa, e del paese, ed in particolare a un Giovan Vaglienti, che era de più vecchi di Pisa, aveva letto assai, e tenuto a mento fino a' suoi ultimi anni, che

example Vitruvius made in his *De architectura* of the Macedonian architect Dinocrates of Rhodes, who, caught up in his quixotic project to build a city on the side of Mount Athos for Alexander the Great, neglected to consider basic practicalities such as access to farm fields.[69] "I wish not to say it like that Architect," Albizi insists scornfully,

> Who proposed to Alexander the Great to make a city atop a mountain, because it would be most secure. And Alexander, while finding the design to be pleasing, said, but the people who have to live there, whence will they get their food? The Architect responded that he had not considered it, and that the inhabitants would imagine a solution.[70]

Albizi would not repeat Diocrates's grave error. Instead, he makes it known that he had "thought about whence to get sufficient water to enable navigation," asserting that the Serchio "would be much better than the Arno on every count."[71]

Yet still at this point in their dialogue, Albizi's interlocutors remain unconvinced about his plans for substituting the Serchio for the Arno. After engaging in some playful mockery at his expense, Fortini raises a number of doubts.[72] For one, the people of Lucca, vitally dependent on the Serchio, would never agree to such a plan. Beyond this impediment, directing the river toward Pisa via Lake Bientina meant drawing it away

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passò gli attanta, sebbene mi ricordo, avanti morisse." Albizi, 30. A branch of the Serchio emptied into the Arno via the Lake of Bientina at various points in antiquity and the early Middle Ages, although it was only one of the river's branches. On the historic routes and deviations of the Serchio, see R Salvini et al., "Ricostruzione del paleoalveo del fiume serchio (Lucca, Italia) tramite rilievi lidar, foto aeree ed immagini quick bird," *Il Quaternario* 19, no. 2 (2006): 301.

[69] For this story, see Marcus Vitruvius Pollio, *Vitruvius: ten books on architecture*, trans. Ingrid D. Rowland (Cambridge, UK: Cambridge University Press, 1999), 33.

[70] "Io no voglio dire come quell'Architetto, che proponendo di fare a Alessandro Magno una Città sopra un monte, perchè ella fusse più forte, e piacendo a Alessandro il disegno, disse, ma i popoli, che avessero ad abitarvi donde averebbono il vitto? Ripose l'Architetto a questo io non ho pensato, e ci penseranno loro ...." Albizi, "Ragionamento sopra il bonificare il Paese di Pisa," 29.

[71] "...imperocchè io ho pensato di donde abbia a aver l'acqua a sufficienza, perchè si possa navigare, e sia molto migliore di quella d'Arno a ogni cosa, e dico fin per bere, e far buone faie, e rene, e ottimo Paese." Albizi, 29.

[72] For example, Fortini and Caccini asked him if he planned to have Moses resurrected to have water pour forth from the mountains, and also insinuated that Albizi must have been following in the example of some other, unnamed architect, who apparently tried to persuade Cosimo to carry out another utopian river cut near Florence. As Fortini exclaimed, "O che cosa da ridere!" ("What a thing to laugh about!"). Albizi, 29–30, quote at 30.

from the town of Ripafratta, compromising its silk mills. Finally, it would not solve the problem of navigation, since "the Serchio has little water, such that Pisa would remain dry, and boats would be unable to operate."[73] Fending off these criticisms, Albizi insists, somewhat incredulously, that the Lucchese on the contrary would "be very grateful" to the Tuscans for undertaking such a work; that he would never permit the silk mills, the bedrock of a vital industry, to run dry; and that the waters of the Serchio could be supplemented by new discharge streams leading from the lakes of Fucecchio and Bientina, along with the waters of the Monte Pisani.[74] Since this ambitious project would "be the enterprise of a Grand Duke of Tuscany," all such difficulties, he seemed to say, could be magically waved aside. Such an idealized portrayal of the unfettered, even godlike capacities of the prince, a leitmotif of ducal encomia and a burgeoning reason of state literature in sixteenth-century Italy, crucially fuelled and justified projectors' fantasies and absolutist territorial visions, as well.[75]

Albizi's underlying interest in the economic and commercial utility of Tuscany's aquatic landscape perhaps comes into sharpest relief, however, when he goes beyond discussing merely alluvial cutting to suggest his "caprice" to cut a passage through the mountain above San Giuliano, just over 8 kilometers north-northwest of Pisa. A project he attempts to raise repeatedly throughout the text, only to be drawn in other directions

[73] "... il Serchio ha poca acque, a tale che Pisa rimarrebbe asciutta, e barche non potrebbero esercitarsi ..." Albizi, 30.
[74] Albizi, 30–31.
[75] R. Burr Litchfield, for example, stated that "the idealistic view of a ruler with with unrestricted authority acting through Ministri to procure the common good continued to develop through the official historiography of the Medici Court." He linked this tendency to the general shift towards absolutist tendencies in ducal politics. *Emergence of a Bureaucracy*, 132. See also Tazzara, *The Free Port of Livorno and the Transformation of the Mediterranean World*, 47 and 47 n.1, who states that "When treating economic affairs, authors like Botero and Sassetti placed tremendous--and unwarranted--confidence in his capacity to control outcomes."

by his interlocutors, Albizi finally comes to elaborate on this intervention near the dialogue's conclusion. After successfully draining the marshlands of Nodica and Vecchiano, he states his wish to convince the duke to cut through the Monte di San Giuliano to "create a convenience for travelers, because the mountain street, while not that long, is very disastrous and steep."[76] In response to Fortini and Caccini's initial protests that transit in that zone could be facilitated by simpler means, Albizi defends the value of his projections as at once useful material improvements and worthwhile intellectual pursuits. His "thoughts on the passage," after all, "have not brought it into being"—they were, after all, mere thoughts, not actions—but "if there was no one to make proposals," Albizi admonishes, "many things would not be done, which the discourses of the wise put into effect."[77] A state's territory, and consequently its future developmental path, were firmly in human hands.

His critics thus silenced, Albizi reveals the details of his plan: a two-lane passageway to convey north- and south-bound traffic between Pisa and Lucca. The mountain tunnel would be dug on an angle such that light could penetrate it as the sun transited across the sky, while earthen berms would gently raise the road through the plains to meet the mountain passage on either side.[78] As elsewhere in the dialogue, Albizi refrains from explaining in technical terms precisely how so formidable an undertaking would be realized. He focuses instead on its myriad benefits in a bid to win over Caccini and Fortini, who continue to raise doubts about its difficulty and costs. For example, he

[76] "... perche sebbene la strada del monte non è molto lunga, ella è tanto disastrosa, e rapida, che una donna, o uomo che sia a cavallo, difficilmente la puo salire, se non con grande pericolo, e sinistro della cavalcatura." Albizi, "Ragionamento sopra il bonificare il Paese di Pisa," 32.
[77] "Il mio pensiere per questo non ha fatto il detto passaggio, ma se non vi fosse, chi proponesse non si farebbe molte cose, che discorse da savi si mettono in effetto." Albizi, 32.
[78] Albizi, 31–32.

imagines several uses for the soil and stones quarried from the tunnel: they could be repurposed not only to construct the mountain berms, but also to build walls and make mortar for building projects in Pisa.[79] He even raises the possibility of finding "in the body of the mountain something of value," alluding, perhaps, to the recent discoveries and growing exploitation of additional silver mines and marble quarries in the area.[80] He finally envisions levying tolls on the route, rhyming off a series of tonnage rates to charge travelers and merchants to augment tax revenues.[81] He surmises, after all, that it would be frequented by people coming from Lucca, the Garfagnana, and as far afield as Ferrara and Lombardy. By all counts, Albizi framed this challenging project as an investment whose difficulty and expense "pale in comparison to its commodity and utility."[82]

At last convinced of the merits of Albizi's circulatory visions and the myriad benefits they promised, Fortini and Caccini compliment him on his valiant spirit.[83] With the dialogue thus reaching its denouement, its protagonists bid farewell, committing to discuss improvements to the marshlands of the Val di Chiana near Arezzo and of the State of Siena on the occasion of their next meeting.[84] As far as I am aware, however, no apparent sequel to their conversation exists, leaving Albizi's plausible designs on these regions a mystery. Areas of active ducal intervention during Ferdinando's reign, these zones, as we will see after first exploring projects for improving navigation along the Arno, would nonetheless exercise a later generation of projectors.

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[79] Albizi, 33.
[80] "E chi sà, che non si potesse trovare nel corpo a questo monte qualche cosa d'importanza?" Albizi, 33; Calonaci, "Taking Over the Economy," 331–32.
[81] As he narrated: "Le carra vote, una crazia; le cariche dua, i mulini carichi, una crazia, i voti due quattrini, e così cavallo, e cavalli carichi andassero in quel mezzo fra i muli, e somari." Albizi, "Ragionamento sopra il bonificare il Paese di Pisa," 32.
[82] "Non sarebbe la spesa senza evidente profitto, e comodo...." Albizi, 33.
[83] Albizi, 33.
[84] Albizi, 34.

Wilhelm de Raet in the Valdarno

Interests in expanding internal commercial circulation in Tuscany under the early grand dukes also drew enterprising men to try their hands at one of the era's most intractable aquatic challenges: improving navigation along the Arno River. Even though the watercourse served for centuries as the region's most vital connective artery, it could not be relied upon for continuous year-long transit. Rather, all the factors that made it prone to flooding—the seasonal changes in its water levels, its miles of precarious embankments, the sediments that accumulated in its bed, and the various structures that people and communities built into and across it to fish and mill—also made trafficking its course, however more efficient than over-land transit, still slow, intermittent, and laborious.[85] Shipping cargoes by river between Florence, the duchy's largest consumer market and manufacturing hub, and the Porto Pisano, Tuscany's principal emporium for commodities, luxury items, and semi-finished goods acquired from and destined for ports around Europe, North Africa, and the Levant, was a halting, multi-step process that required transiting through a series of alluvial ports and disembarking and reembarking in incrementally smaller or larger vessels along the way.[86] Moving upriver, for example,

[85] For more on navigation of the Arno and other Tuscan rivers, see, among others, Rossano Pazzagli, "La circolazione delle merci nella Toscana moderna. Strade, vie d'acqua, porti e passi di barca nel bacino dell'Arno," *Società e storia* 26, no. 99 (2003): 1–30; Francesco Salvestrini, "Navigazione, trasporti e fluitazione del legname sulle acque interne della Toscana fra Medioevo e prima età moderna (secoli XIII–XVI)," *Bollettino storico pisano* 78 (2009): 1–42; Francesco Salvestrini, "Navigazione e trasporti sulle acque interne della Toscana medievale e protomoderna (secoli XIII–XVI)," in *La civiltà delle acque: tra Medioevo e Rinascimento*, ed. Arturo Calzona and Daniela Lamberini, Ingenium: Centro Studi L. B. Alberti, n. 14 (Firenze: Leo S. Olschki, 2010), 197–220; Emanuela Ferretti and Davide Turrini, *Navigare in Arno. Acque, uomini e marmi tra Firenze e il mare in Età Moderna*, Le terre del Rinascimento. Quaderni didattici 1 (Firenze: Edifir, 2010); Emanuela Ferretti and Davide Turrini, "Regimare le acque e navigare il fiume. Il basso corso dell'Arno fra Medioevo ed Età Moderna," in *Leonardo e l'Arno*, ed. Roberta Barsanti (Ospedaletto-Pisa: Pacini Editore, 2015), 79–98.

[86] Cargoes were diverse and included building materials, such as brick, stones, gravel, and iron ore, in addition to timber, floated as rafts. Other products included foodstuffs, household products, and industrial

goods were first unloaded at the Porto Pisano from seafaring galleys and subdivided among large river barges (*chiatte* and *barconi*) that were piloted by sail or oar, or pushed along the bed or banks of the river with a pole. At Empoli or Capraia, these cargoes were unloaded and subdivided again onto smaller, lighter boats (*navicelli*) of various sorts. These vessels were then towed with rope through the Gonfolina, a narrow, torrential zone of the river, by packs of horses, cattle, or mules, and sometimes even teams of young men (*bardotti* and *redaroli*) who negotiated difficult riverside towpaths (*alzaie*) (figure 25). Once they reached Signa, the vast majority of cargoes were unloaded and readied for overland shipment by mule to Florence, Prato, Pistoia, or Bologna, though occasionally some goods were transferred yet again onto even slighter vessels and piloted to the Pier of Pignone or Porta di San Frediano, landings on the southern shore of the Arno just west of the city. The weir of Santa Rosa stretched across the Arno's bed just beyond this point, and along with the weir of San Niccolò on the opposite edge of the city, blocked navigation entirely within Florence's urban tract. In optimal conditions, during the cooler autumn and winter months when the water levels were at their highest, the trip upriver to Signa could take three days at best, while travelling downriver toward Pisa required two days.[87] In addition to the various obstacles they were forced to negotiate, the boats and barges that made this journey also shared the river with floating rafts of timber stands fastened together with ties. Floated or piloted along local stretches to supply building sites in growing cities, they frequently broke apart and became lodged in elbows of the river, further impeding transit.[88]

materials from ports along both sides of the Italian peninsula and North Africa. For a full list, see Salvestrini, "Navigazione e trasporti," 204–5.

[87] For a discussion of this process in detail, see Salvestrini, 206–11.

[88] Salvestrini, 212–18.

Due to these many persistent difficulties, facilitating passage along the Arno to better link Florence to the sea was in fact an old and abiding dream. From the communal period, the Florentine Republican government worked to maintain the Arno banks and clear its bed to improve local communication.[89] Authorities also contemplated ways to facilitate navigation in segments close to the city. In 1487, for example, the architect Luca Fancelli (ca. 1403–1502) proposed channeling the Arno from Signa to the neighborhood of Ognissanti.[90] And in ca. 1503, when Leonardo da Vinci addressed his mind to the problem, as we saw above, he instead reckoned that "the Arno will never be put into a canal."[91] Convinced that any attempts at channelling such a volatile watercourse were futile, he preferred to devise a new course entirely, proposing to divert its waters into the new, curving channel he outlined in the map now in the Windsor Library (figure 23).

Despite the hesitations of so formidable an engineer as Leonardo, the canalization of the Arno was nonetheless resurrected as a utopian idea in the early ducal period. The notion appears to have been enthusiastically supported by Cosimo I, who engaged the prelate and mathematician Ignazio Danti (1536–1586) to devise a plan to implement this goal. A letter from Cosimo's secretary Bartolomeo Concini (1507–1578) to Vincenzo Borghini (1515–1580) briefly described Danti's ambitious proposal, now lost, for a "Gran Canale" to "unite the sea above [the Adriatic] with the sea of Livorno."[92] Danti's

[89] Salvestrini, 199–200.
[90] Grifoni and Rombai, "Del dirizzare i corsi a'grandissimi fiumi: gli ingegneri dei fiumi e gli interventi idraulici nel bacino dell'Arno da Cosimo I a Ferdinando I," 198.
[91] Rombai, "Il sistema delle infrastrutture," 867.
[92] The letter is from 26 March 1572, and is discussed and transcribed in Jodoco Del Badia, *Egnazio Dànti cosmografo e matematico e le sue opere in Firenze: memoria storica di Jodoco del Badia* (Florence: Cellini, 1881), 43–44, at 44. It reads, in part, as follows: "Il Serenissimo Padrone finalmente ha fissato di fare il Gran Canale ideato fin l'anno passato, come sa, e da Lei consigliato, nel Casentino, per unire il mare di sopra a questo di Livorno. Al O. Ignazio Danti sarà raccomandata quest'impresa, il quale ha detto che

plan for this peninsula-crossing endeavor would have anticipated the French engineer Pierre-Paul Riquet's (1609–1680) project for the Canal du Midi by almost a century. And while Danti deemed the plan, envisaged as a network of locks, artificial lakes, and Appenine tunnels to be "implementable with less difficulty than was first believed," it never came to fruition.[93] Some years later, after Francesco ascended to the ducal throne, a similar proposal would soon surface. Devised by an outsider to Tuscany, the little-known Flemish architect, artillery technician, and hydraulic engineer Wilhelm de Raet, it was a more modest but no less visionary scheme to link Florence with the sea.

From the Low Country town of 's-Hertogenbosch, Raet spent his early career in the 1550s working as architect to Emanuele Filiberto, Duke of Savoy (r. 1553–1580). Thereafter, he lived in Antwerp before moving to the German lands in 1574, where he was summoned by the Duke Julius of Brunsviga and Lüneberg to oversee artillery, pyrotechnics, and fortification works. He served Duke Julius for the next few years in Wolfenbüttel, where he directed construction on a new fortress for the town, while also becoming involved with ongoing alluvial projects promoted by Julius.[94] One consisted in extending and clearing the beds of the Radau and Ecker Rivers, which emerged from the

può effettuarsi con meno difficoltà che fu ceduto, e ha spinto il Serenissimo Padrone a determinarsi. Fra le tante grande cose di questo Principe la maggiore sarà questa, e spero che presto se ne vederà il principio". The letter is printed in full in Lorenzo Cantini, *Vita di Cosimo de' Medici primo, gran-duca di Toscana* (Florence: Nella Stamperia Albizziniana da S. Maria in Campos, 1805), 668–69.

[93] See note above for full transcription, copied from Cantini, *Vita di Cosimo de' Medici primo, gran-duca di Toscana*, 668–69, and Badia, *Egnazio Dànti cosmografo e matematico e le sue opere in Firenze*, 44. On the Canal du Midi, see Chandra Mukerji, "Demonstration and Verification in Engineering: Ascertaining Truth and Telling Fictions along the Canal Du Midi," in *The Mindful Hand: Inquiry and Invention from the Late Renaissance to Early Industrialisation*, ed. Lissa Roberts, Simon Schaffer, and Peter Dear, History of Science and Scholarship in the Netherlands, v. 9 (Amsterdam: Koninkliijke Nederlandse Akademie van Wetenschappen, 2007), 169–86; Chandra Mukerji, *Impossible Engineering: Technology and Territoriality on the Canal Du Midi* (Princeton: Princeton University Press, 2009). On Danti, see Francesco Paolo Fiore, "Egnazio Danti," in *Dizionario Biografico Degli Italiani* (Rome: Istituto della Enciclopedia Italiana, 1986), https://www.treccani.it/enciclopedia/egnazio-danti_%28Dizionario-Biografico%29/.

[94] Oskar de Smedt, "Guglielmo de Raet e la bonifica del territorio lucchese," *La provincia di Lucca. Periodico di informazione e attualità* 3, no. 2 (1963): 29–31.

Harz mountains, to better transport precious metals, timber, and shale deposits sourced from the region. The other involved devising a means of building a channel between Wolfenbüttel and Magdeburg to connect the Oker and Elbe rivers. While bed-cleaning work had commenced along the Harz waterways, the ambitious Oker canal never came to fruition.[95]

In 1576, in the midst of his engagements with Julius, Raet travelled to Italy where he seems to have stayed for the rest of his life.[96] In the summer of 1577, he turned up in Lucca, where he presented before the Republic's Consiglio Generale a project for draining 1,600 hectares of terrain around the coastal Lake of Massaciuccoli and marshes of Sesto, a longstanding government endeavor over which the Luccans had recently come to an impasse.[97] But just a couple of months later, under circumstances that remain obscure, he approached Francesco I on improving the navigability of the Arno River.[98]

What survives of this project today is not Raet's original solicitation to the duke, but rather a "convention, pact, and promise" recording "for all time" the terms of an ostensible agreement on the matter.[99] Though much briefer than Albizi's project and

[95] Smedt, 30–31; Asmussen, "Affective Projecting: Mining and Inland Navigation in Braunschweig-Lüneburg," 96–101.
[96] As for how and why Raet ended up in Italy, Oskar Smedt mentions the hypothesis of the 19th-century Lucchese historian Salvatore Bongi, who suggested that Raet may have caught wind of hydraulic projects in Lucca from Lucchese merchants in Antwerp or their countrymen in Germany. Smedt, "Guglielmo de Raet e la bonifica del territorio lucchese," 31. Salvatore Ciriacono, for his part, says he was "called there by a local merchant, Landi, who had business interests in Antwerp." *Building on Water: Venice, Holland and the Construction of the European Landscape in Early Modern Times*, trans. Jeremy Scott (New York and Oxford: Berghahn Books, 2006), 160.
[97] The Lucca project was dated 30 July 1577. Smedt, "Guglielmo de Raet e la bonifica del territorio lucchese," 31–35; Ciriacono, *Building on Water*, 160.
[98] I have not examined Raet's proposal for Lucca, although it is preserved today in the Archivio di Stato di Lucca, at Cons. Generale, Scritture, filza 571 c. 291 et passim. Judging from Oskar Smedt's discussion of this proposal, it bears many of the same formal and rhetorical conventions as Raet's proposal for the Arno. Smedt, "Guglielmo de Raet e la bonifica del territorio lucchese."
[99] ASF, Miscellanea Medicea, 28/7, 3r. The opening of the convention reads: "Sia noto a chi vedra per ogni tempo la presente scritta come vedra il Ser.mo Sig.re Don Franc.o de Medici Dignis.o Gran Duca di Toscana, et M.ro Guglielmo di Arrigo Raet native di Balduch in Brabant Ingegner' dell Ill.mo et Ecc.mo Sig.re Duca di Bronsvich sono state fatte, stabilite, et ferme l'infrastritte conventioni, patti et promesse."

devoid of its literary pretentions, Raet's proposal advances a similar fabulist optimism and trumpets the familiar agglomeration of public benefits. Written in the third person, it exists in three manuscript copies, each in a different secretarial hand (figure 26–28).[100] Filed under its own contemporaneous cover sheet in the Florentine state archive's Miscellanea Medicea collection, it is difficult to discern the project's precise itinerary and reception, shorn as it is from its original documentary context.[101] Like Albizi's project, it probably enjoyed a limited and rarified readership, and almost certainly stood outside of the normal course of government business.

The terms of the agreement outlined the basic formal and functional attributes of Raet's proposed "navigation" (*navigatione*). The engineer promised to make the Arno trafficable from its Mediterranean outlet up to Florence, "or wherever the duke would desire."[102] To accomplish this, Raet would, by means of a "canal, or ditch, or embankments, or other devised invention"—like Albizi, he refrained from specifying technical details—fix the river's depth and breadth, the former to four *braccia*, and the latter such a dimension that could "simultaneously hold at least two galleys," large commercial seafaring ships certainly out of place on Italy's torrential rivers.[103] The

[100] All three copies are contained in ASF, Miscellanea Medicea, 28/7, 1r–11r. Henceforth my citations come from the cleanest, likely most recent copy, on 3r–4r.
[101] The Miscellanea Medicea is a collection in the Archivio di Stato di Firenze that was formed from masses of documents extracted from their original institutional filing locations in the Grand Ducal government archive and never properly reintegrated. The 19th-century historian Fillipo Moisè places the blame for this disorganization primarily on the 18th-century court historian Jacopo Riguccio Galluzzi, who apparently gathered and never returned troves of official documents when researching and writing his history of the Grand Duchy of Tusany. The result was his *Storia del granducato di Toscana*, vol. 1–5 (Florence, 1781). For more on the formation of the Miscellanea Medicea, see Silvia Baggio and Piero Marchi, "Introduzione," in *Miscellanea Medicea. Vol. I (1–200). Inventario*, ed. Silvia Baggio and Piero Marchi (Florence: Istituto Poligrafico e Zecca dello Stato – Archivio di Stato, 2002), 17 especially.
[102] "Per fino a quell termine che piacera a S.A. Ser.ma." ASF, Miscellanea Medicea, 28/7, 3r.
[103] "Et à di lungo possino detti vasselli per detta navigatione sia per canale, fosso, ò Argini, ò altra invention compita che sia condursi à vela ò a rimorchiarsi di Mare per sino a detta Citta di Fiorenza …." / "… di detto Arno una Navigatione di larghezza tale che vi possa capire 2 cioè dua Galere a paro per il meno …." ASF, Miscellanea Medicea, 28/7, 3r.

project would permit vessels of all sizes to travel in both directions along the river by sail or tow. Finally, Raet even promised ambitiously to ensure this navigability "in every season and time of the year, that is, during the winter, when the waters will be higher, and lower in the summer."[104]

Beyond resolving all of the day's most pressing hindrances to easy travel along the Arno, Raet's utopian project, also like Albizi's, had other utilitarian aims. His proposed alluvial works would "resist inundations," permitting the surrounding lands to "improve in time, and much less frequently sustain damages."[105] Ordering the river would also facilitate its exploitation in other ways. According to the convention, Raet had affirmed "that there will be much more copiousness and multiplication of fish, that have never before existed in this space."[106] Moreover, his proposed interventions would not come to the detriment of milling operations, whose amphibious structures so often obstructed the orderly and even flow of rivers, but rather would permit "anyone present on the river to have two mills, or more."[107] Insisting the project would be "permanent and durable for many years to come," Raet promised that it would deliver sundry other benefits and conveniences for the collective enrichment of the duke and the public, ones so plainly self-evident, "that for now, it is not necessary to manifest them."[108]

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[104] "Et questa viaggio ed navicatione habbino a poter fare dette navi et vasselli in ogni stagione e tempo del Anno, cioè allhora quando saraño l'acque del verno piu alte, e nella state piu basse." ASF, Miscellanea Medicea, 28/7, 3r.

[105] "… affermando che detto suo acconcimi resistera contro le inondationi …." ASF, Miscellanea Medicea, 28/7, 3r.

[106] Cosi promette che si hara maggior copia assai, et multiplicatione di pesce, chem ai fin qui sia stata in questo spatio." ASF, Miscellanea Medicea, 28/7, 3r.

[107] "Et in oltre promette et si obbliga, che quanto alle Mulina non solo per questa sua invention ne verra mancamento, ma che per uno che di presente sia sul fiume sene potra havere dua, et piu." ASF, Miscellanea Medicea, 28/7, 3r.

[108] "Promette ancora à S.A. Ser.ma che da questa invention, et nuovo modo da navicare questo fiume, ne risulteranno à lei, et altri private molte altre utilità, et commode, come conosceranno, et confesseranno quando sia messo mano all'opera che per adesso non occorre manifestarli." ASF, Miscellanea Medicea, 28/7, 3r.

After outlining the project's functional criteria, the agreement described its terms of production. To make the undertaking an even more attractive proposition for Francesco, Raet would take on a great deal of personal and professional risk. First, he offered to personally oversee the work to completion, a process whose duration he estimated at fifteen months, forfeiting supervision of his projects in Wolfenbüttel for Duke Julius during that period, save for three months of each year.[109] And although Francesco would supply for the work "all the things, materials, and men that Guglielmo will request and demand," the duke would withhold Raet's compensation until its completion, when the engineer could demonstrate, as the convention stated repeatedly, that "ships can come from the sea in to Florence, and from there return to the sea."[110] Only at this point would Raet be paid for his services, to the tune of 60,000 *scudi* disbursed in four instalments, in addition to a "provision and gift" of 1000 *scudi* per year for the remainder of his life.[111] Additionally, beyond promising to freely provide Francesco with a copy of his design "in painting," he offered to provide a mock-up at his own expense, "a piece of the work in its proper place, and in its proper mode," should the duke desire "greater certainty of the effect" in advance.[112] But if Raet were willing to place his time and efforts on the line, his *ideas*—the essence of any project—would remain fiercely protected. Should Francesco decide to defer the undertaking, he would

[109] ASF, Miscellanea Medicea, 28/7, 3v.
[110] "… promette di suo provedere tutte lel cose, materie, et huomini, che per detto effetto li saranno da detto M Guglielmo domandate et richieste." / "… et quando si vedranno li vasselli della qualita dette, et per il modo narrato venire per essa navigtione dal Mare fino a Fiorenza, et ritornare in Mare." ASF, Miscellanea Medicea, 28/7, 3r and 3v.
[111] "… et liberamente donargli per sua provisione et donativo …" ASF, Miscellanea Medicea, 28/7, fol. 3v.
[112] "Item si offera detto M. Guglielmo a S.A.Sera^{ma} che doppo che quella havera visto li disegni, et modelli per detta navigatione, volendo ancora maggior certezza dell effetto di fare à sue spese un pezzo di detto lavoro in sul proprio luogo, et nel proprio modo …." ASF, Miscellanea Medicea, 28/7, fol. 3r. On the "ritratti simiglianti in pittura," see idem, fol. 4r.

owe Raet the agreed-upon sum on the occasion of its eventual completion. This condition would even hold beyond Francesco and Raet's lifetimes; any ducal successor who might decide to implement the plan in the future would in like manner be obliged to compensate Raet's heirs. But were Francesco to refuse the design for any reason, Raet would not be compensated for his efforts.[113] All of these conditions (which also, it should be said, structured the engineer's drainage agreement with Lucca's government[114]), must be viewed as gambits to secure Francesco's trust and to prompt him to make the project a reality—persuasive tactic, that is. At the end of the most recent copy of the convention, Raet's unmistakable signature testifies to his sincerity in underwriting the audacious vision he proposed (figure 29). But it stood alone; without Francesco's final assent, this project remained stillborn, yet another circulatory "future past."[115]

Although not quite as discursive or emphatic as Albizi's *Ragionamento*, Raet's project to connect the Tuscan interior seamlessly to the Mediterranean must be read in light of surging optimism among technocrats at the time—in the ducal state and, evidently, beyond it—to support and stimulate profitable industrial and commercial activities.[116] His utilitarian vision for the Arno River reflects a keen grasp of the vital link between aquatic geographies—the form of the territory and its infrastructures—and state welfare.

Giovanni Rondinelli in the Val di Chiana

[113] ASF, Miscellanea Medicea, 28/7, fols. 3v–4r.
[114] Smedt, "Guglielmo de Raet e la bonifica del territorio lucchese," 31–32.
[115] Koselleck, *Futures Past*.
[116] As Raet's activities in the German lands demonstrate, circulatory projects also animated political and economic planning in small princely states of northern Europe at the time, as well. For a discussion of this, see Asmussen, "Affective Projecting: Mining and Inland Navigation in Braunschweig-Lüneburg," 96–101.

After the Arno and Pisa's countryside, the Val di Chiana was a third aquatic region that attracted the attention of the Tuscan government and projectors alike in the latter decades of the sixteenth century. Named for its ancient, slow-moving Chiana River[117] that branched from the upper reaches of the Arno and flowed south for over 40 kilometers before feeding, via a subordinate emissary, into the Tiber near the town of Chiusi, this valley, once a fertile agricultural plain, had by the sixteenth century transformed into an immense malarial marsh.[118] From late antiquity, the disintegration of embankment maintenance systems in the region, coupled with tectonic shifts and bed aggradation that flattened and eventually inverted the valley's gradient, caused the river to progressively widen and engulf its flood plain.[119] At some point between the eleventh and thirteenth centuries, extensive wetlands had already materialized along the valley's southern reaches around Chiusi, and by the early sixteenth century, these marshes extended from Arezzo at its northern end to Carnaoila, approximately 80 kilometers south.[120] The gradual transformation of this valley into swampland over the course of the Middle Ages forced the communities that had farmed its plains for centuries to resettle dryer lands in the surrounding foothills. These relocated populations nonetheless selectively exploited the wetland for fishing and milling, while building numerous ports along its shores to facilitate traffic along its slow, sometimes stagnant waters.[121]

[117] Or, as it was called in Latin in antiquity, the Clanis.
[118] The tributary that connected the Clanis to the Tiber is called the Paglia. David Alexander, "The Reclamation of Val-Di-Chiana (Tuscany)," *Annals of the Association of American Geographers* 74, no. 4 (1984): 530.
[119] Barsanti and Rombai, *La "Guerra delle acque" in Toscana*, 93.
[120] Alexander, "The Reclamation of Val-Di-Chiana (Tuscany)," 537; Barsanti and Rombai, *La "Guerra delle acque" in Toscana*, 93–94.
[121] Grifoni and Rombai, "Del dirizzare i corsi a'grandissimi fiumi: gli ingegneri dei fiumi e gli interventi idraulici nel bacino dell'Arno da Cosimo I a Ferdinando I," 193.

Drainage works in the Val di Chiana began in the early fourteenth century and proceeded in a fragmentary manner, yielding slow and uneven progress. Prompted by growing demands for arable land on the part of the expanding towns and communities bordering the valley, this reclamation effort concentrated mainly along the valley's northerly stretches, where successive commissions worked at Florence's behest to excavate a principal drainage channel, the Fosso Maestro della Chiana, to funnel water from the marshlands into the Arno at Arezzo. Inching forward slowly over the course of several decades, under the direction of the Ufficiali dei Fiumi, the channel was extended progressively south, a few kilometers at a time, along the trace of the ancient Chiana River. By the mid-sixteenth century, the channel reached the town of Foiano, almost halfway down the valley, although much of its central plateau and southerly stretches on the border of the Papal States remained largely waterlogged.[122]

After slowing over the course of the 1550s and 1560s, drainage in the Val di Chiana resumed again under Francesco. From the mid-1570s, the Ufficiali dei Fiumi collected a maintenance tax from the towns and communities bordering the Fosso Maestro and began to dredge and embank its feeding tributaries.[123] Reclamation work and extension of the Fosso Maestro then lagged again later in the decade before taking off again in earnest under Ferdinando. This upsurge in activity may have been prompted by the poor harvests and recurring famines that struck many parts of in Tuscany 1588 and 1591, making easy shipping connections between the population-dense centers of the

[122] Barsanti and Rombai, *La "Guerra delle acque" in Toscana*, 95; Alexander, "The Reclamation of Val-Di-Chiana (Tuscany)," 534–37.
[123] Barsanti and Rombai, *La "Guerra delle acque" in Toscana*, 95–96; Grifoni and Rombai, "Del dirizzare i corsi a'grandissimi fiumi: gli ingegneri dei fiumi e gli interventi idraulici nel bacino dell'Arno da Cosimo I a Ferdinando I," 194.

Valdarno and the Val di Chiana's slowly expanding acreage of fertile, grain-producing fields all the more urgent.[124]

It was during these years that improvement work in the region began to excite projectors like Rondinelli.[125] Of elite social standing and patrician extraction like Albizi,[126] he held administrative positions within and adjacent to the ducal government at different stages of his career, while also actively pursuing scholarly activities. From the 1560s through the 1580s, Rondinelli was a member of the Accademia Fiorentina, the beating heart of Florentine intellectual culture, and is listed intermittently in its payment records as the academy's censor.[127] Like many of its members, he took a great interest in Florentine and Tuscan history and in the customs and evolution of the societies that inhabited the region from antiquity to his present day.[128] On three separate occasions, Rondinelli was appointed to govern peripheral subject towns of the Val di Chiana: he was dispatched to Volterra and Arezzo at some point during Francesco's principate, and to Cortona under Ferdinando. Combining these professional obligations with his intellectual pursuits, he composed local histories of each town while serving as its chief minister.[129]

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[124] Grifoni and Rombai, "Del dirizzare i corsi a'grandissimi fiumi: gli ingegneri dei fiumi e gli interventi idraulici nel bacino dell'Arno da Cosimo I a Ferdinando I," 194; Barsanti and Rombai, *La "Guerra delle acque" in Toscana*, 95–96.

[125] There were other scholars who were interested in draining the valley, such as Baldassarre Nardi, whom I will investigate in a future study.

[126] R. Burr Litchfield includes the Rondinelli family in his list of patrician houses of Florence. See *Emergence of a Bureaucracy*, 376, 379.

[127] The Appendix to Jonathan Davies, *Culture and Power: Tuscany and Its Universities 1537–1609*, Education and Society in the Middle Ages and Renaissance, 34 (Leiden: Brill, 2009), 237, 247, 266, lists records of payments to "Messer Giovanni Rondinelli censore dell'Accademia Fiorentina" in 1563/64, 1572/73, and 1586/87. On the Accademia Fiorentina, see, among others, Ann E. Moyer, *The Intellectual World of Sixteenth-Century Florence: Humanists and Culture in the Age of Cosimo I* (Cambridge, United Kingdom: Cambridge University Press, 2020).

[128] Moyer, *The Intellectual World of Sixteenth-Century Florence*, chap. 3.

[129] For his history of Arezzo, see the eighteenth-century published edition, Giovanni Rondinelli, *Relazione sopra lo stato antico e moderno della città di Arezzo l'anno 1583; illustrata con note e corredata con l'aggiunta di due racconti del 1502 e del 1530 spettanti alla medesima citta* (Arezzo: Michele Bellotti, 1755), 7, in which Rondinelli mentions "avendomi V.A.S. quest'anno mandato al governo della nobil Città di Arezzo...". His history of Cortona, "Discrizione di Cortona e suo contado fatta da Gio' Rondinelli alla

Not unlike his better-known contemporaries who studied Florence, Rondinelli lavished significant attention in these writings "on the site, and its territory," displaying, like Albizi, an intimate knowledge of and sensitivity to the local geographies of the places he administered.[130]

Among the myriad topics Rondinelli addressed in his historical writings on the towns of the Val di Chiana, the long evolution and present geography of the valley featured with some prominence. In his 1583 *Relazione sopra lo stato antico e moderno della città di Arezzo,* for example, he detailed the progress of recent drainage work, commenting approvingly of the fruits of that labor that "the fertility of the Country, and of its Marshes, produces most abundantly all those things that are necessary for nourishment, in great quantity and quality; and not only for its own population, but also sends it to several other places, especially to Florence."[131] He similarly praised the valley in his 1591 *Descrizione di Cortona,* noting that during the desolate famine years, the fertile valley was an exception. It continued to produce surplus harvests of grain, as well as a number of other agricultural products that fetched high prices in Florence and elsewhere.[132]

Ser.ma G Duchessa di Toscana 1591," is in the Biblioteca Nazionale Centrale di Firenze. In it, he mentions "l'haver io prima fatta relatione di Volterra, e poi d'Arezzo al G. Duca Franc.o." See BNCF Magl. XXV 437, fol. 197. Edward St John Fairman, *A Treatise on the Petroleum Zones of Italy* (London: E. & F. N. Spon, 1868), 65, mentions that Rondinelli served as Commissary of Volterra. In his *Relazioni d'alcuni viaggi fatti in diverse parti della Toscana per osservare le produzioni naturali: e gli antichi monumenti di essa, dal Gio. Targioni Tozzetti* (Stamperia Granducale, per G. Cambiagi, 1774), 513–28, Giovanni Targioni Tozzetti included an excerpt of Rondinelli's history of Cortona, which he copied from the BNCF manuscript, followed by the text of his *Discorso del disseccar la Chiana*.

[130] "...ragioneremo del sito, e suo territorio...." Rondinelli, *Relazione sopra lo stato antico e moderno della citta di Arezzo l'anno 1583*, 8.

[131] "Quanto alla fertilità del Paese, e delle sue Chiane, produce egli abbondantissimamente tutte le cose, che al vitto sono necessarie in gran quantità, e bontà; e non solamente produce per lo suo popolo, ma ne condisce ancora dimolti luoghi, e la Città di Firenze specialmente." Rondinelli, 76.

[132] BNCF, Magliabechiana XXV 312, fol. 9v.

But it was in this last study that Rondinelli, after nearly a decade in the Val di Chiana, began to project about the future of the region. Duchess Maria Cristina had ostensibly solicited his views on the matter, and he answered her in a brief missive appended to the *Descrizione* in which he outlined a vision for how reclamation works should ideally proceed.[133] Beyond merely draining the valley, he advised that it should be made navigable from its northern end to its southern, "for a space of 40 miles."[134] In his concise explanation, Rondinelli drew upon his knowledge of the ancient history and geography of the region to advance an argument for extending the Fosso Maestro and converting it into a navigable channel traversing the entire valley, to once again connect the Arno and Tiber rivers, restoring the valley to its ancient state.

Though the specifics of Rondinelli's vision are challenging to ascertain (his missive mentions several obsolete place names), its general outlines can be pieced together. He recommended first that the ducal couple acquire all of the land of the Val di Chiana. By purchasing from all towns of the region the marshlands over which they claimed ownership, the prince, he reasoned, could completely control drainage works and bring the valley's reclamation to completion.[135] "For a work of such kind," he explained, "it does not suffice to be a Prince, but rather it is necessary to be a great and magnanimous Prince, all other remedies being scarce."[136] The standard institutional channels would simply not do: after all, "the rich do not give a desire for glory; the poor cannot; neighbors doubt it; the distant ones do not care; the communities are in discord;

[133] BNCF, Magliabechiana XXV 312, fols. 12r–14v.
[134] "… l'altro é che del renderla navigabile, che sarà uno spatio di quaranta miglia, cominciando da Mulini di frati di Badia per insino a carnaiolo …." BNCF, Magliabechiana XXV 312, fols. 12v.
[135] This is a theme developed throughout. BNCF, Magliabechiana XXV 312, fols. 12r–14v.
[136] BNCF, Magliabechiana XXV 312, fols. 12r–v.

and the people lack order."[137] Rondinelli then outlined how, after acquiring the valley, the work of reclamation and channel construction ought to proceed. He recommended discharging water to the south through the Salarco, Foenna, and Musarone Rivers.[138] Once drained, the bed of the ancient Chiana River would be revealed in the traces of the valley's topography, "so it then would be known precisely in which part to make the Canal."[139]

Throughout, Rondinelli pre-emptively addressed any possible ducal hesitations that lingered by directly addressing the "doubt that some have" about the viability of his scheme.[140] More than rhetorical overtures, these asides alluded to a larger debate, one that lies beyond the scope of this chapter, about the environmental risks and ramifications of draining the Val di Chiana.[141] Early modern commentators in Florence and Rome, like their ancient forebears, seem to have occasionally sparred over the reclamation works each one and the other pursued in the region, fearing that draining the valley would inevitably inundate one or both cities, since any discharged waters would have to flow out through the Arno or Tiber Rivers. Rondinelli assured the duchess that he had carefully considered this risk, while objecting that "for more and very clear reasons, I do not believe it."[142] Just as Albizi and Raet too had promised, so Rondinelli pledged that

[137] BNCF, Magliabechiana XXV 312, fols. 12r–v.
[138] BNCF, Magliabechiana XXV 312, fols. 13r–14v.
[139] "Sarebbe bene dar l'andata al acque come poco fa dicemmo: perche ritirata che fossi l'acqua tutte le melme che hora galleggiano si posarerebbaro nel letto della terra, et si vedrebbe ove fossi l'alto e il basso, onde allora per appunto si cognoscerebbe in qual parte fossi da fare il Canale." BNCF, Magliabechiana XXV 312, fol. 14r.
[140] "Quanto poi al dubbio, che anno alcuni che questo ristringimento non allaghi Firenze …." BNCF, Magliabechiana XXV 312, fol. 14r.
[141] The contested nature of the valley's reclamation becomes clear from reading Rondinelli's text alongside another manuscript, by Baldassarre Nardi (BR, Ricc. 2575), which I will focus on in a separate study, and Lupicini, *Discorso d'Antonio Lupicini sopra i ripari delle inondazioni di Fiorenza*.
[142] "… Ma per più, et chiarissime ragioni non lo credo…." BNCF, Magliabechiana XXV 312, fol. 13r.

confining unruly waters into a massive, navigable channel would pose no flood hazards. He did not speak more explicitly about industry, commerce, or enrichment in his missive to the duchess, but in the context of the wider panorama I have painted of aquatic projecting in Grand Ducal Tuscany, his promotion of an orderly and navigable canal must be seen as part of a rising chorus on the exhilarating benefits the improvement of aquatic circulation would bring to the state and to the reputation of its prince.

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In the latter decades of the sixteenth century, people were beginning to think about Tuscany's watery territory in a new light. Though still an unpredictable and hazardous space, one that demanded careful regulation, expert oversight, and the compromise and cooperation of landowners, peasants, bureaucrats, and engineers alike, observers within the Grand Duchy and beyond it were beginning to perceive the very early fruits of this challenging labor in limited pockets of the territory. Buoyed by the modest progress of such "small beginnings," as our *capomastri* might call them, and cognizant of the evolving political and economic needs of the state as it entered into a tentative era of peacetime, a new class of projectors, all loosely connected with the spheres of influence adjacent to the ducal Court and its government ministries, began rather optimistically to conceive of the territory in a mechanical sense, actively imagining its utilitarian affordances as a seamlessly navigable space. Though many of these men were not necessarily involved in the quotidian tasks of governing water, it may be no coincidence that residence amid the duchy's hinterlands and resource frontiers formed a common shared experience for the characters sketched out in this chapter. Indeed, it may very well have taken intimate familiarity with the conditions of remoteness—from

burgeoning centers of power, from markets—to appreciate the promises of communication and the connective infrastructures that made it possible. In this sense, as we will soon see, the sentiments of Albizi and Rondinelli (and to a lesser degree, the outsider Raet) perhaps encapsulated, however metaphorically, the experience of Italy vis-à-vis other rising European powers as it entered the seventeenth century.

But it was not, importantly, only in Tuscany that people began to project idealistically about recasting aquatic territory to realize these objectives. Across the Italian states over these very same years, projects for straightening rivers, cutting canals, draining marshlands, and embanking shorelines proliferated in manuscript circles and in the printed press. Though only a cursory survey, I have so far identified over 40 titles composed from the late 1550s through the early 1600s[143] in river cities beyond Tuscany, from the Papal States (Rome and Perugia), to the Duchy of Parma, to the Republic of Venice and its *terra ferma* (Venice, Verona, Padua), to the Duchy of Milan, and elsewhere—all of which treated audacious improvements to specific bodies of water and elaborated on their "associated benefits" (Appendix I).[144] Just as architecture and the industrial and military arts were transformed in the hands of fifteenth-century humanists and technicians into a kind of rationalized textual practice for new urban *signori*, intent on grounding their legitimacy in the trappings of magnificence and displays of martial prowess, so aquatic regional planning apparently became, for the late-sixteenth century prince, a field of exposition all of its own. As the city gave way to the territory as the

[143] With a notable increase from the 1590s.
[144] As noted, for example, in the title of Teodoro Da Monte, *Aggiunta al compendio di tutti gli raccordi et suppliche presentate da diuersi alla serenissima sig. di Venetia, in proposito d'irrigar la campagna di Verona, et di regolar l'impetuosissimo fiume Adige, con altri suoi adherenti beneficij* (Verona: Girolamo Discepolo, 1594).

principal site of government reflection and action under new, increasingly powerful rulers like the Medici dukes (at a time of exceptional environmental volatility no less), a widening circle of experts, sensitive to this changed political and material reality, treated the management of internal waterways and water bodies—systems that, in all their productive and destructive potentials, had the power to both make and unmake these very spaces—as a matter of conscious and deliberate forethought.[145] Designing aquatic territory was fast becoming a specialist domain of knowledge of urgent utility to states. Its theoretical elaboration and popularization will be the focus of the fourth and final chapter.

[145] For the fifteenth-century nexus between the building and mechanical arts and political patronage, see Long, "Power, Patronage, and the Authorship of Ars". On theories of urban magnificence in the fifteenth century see, among others, A. D. Fraser Jenkins, "Cosimo de' Medici's Patronage of Architecture and the Theory of Magnificence," *Journal of the Warburg and Courtauld Institutes* 33, no. 1 (January 1, 1970): 162–70; Patricia L. Rubin, "Magnificence and the Medici," in *The Early Medici and Their Artists*, ed. Francis Ames-Lewis (London: Birkbeck College, University of London, Department of History of Art, 1995), 37–49; Rupert Shepherd, "Republican Anxiety and Courtly Confidence: The Politics of Magnificence and Fifteenth-Century Italian Architecture," in *The Material Renaissance* (Manchester: Manchester University Press, 2007), 47–70; Alessandro Polcri, "L'etica del perfetto cittadino: la magnificenza a Firenze tra Cosimo de' Medici, Timoteo Maffei e Marsilio Ficino," *Interpres. Rivista di studi quattrocenteschi* 26 (2007): 195–223.

CHAPTER 4

WATERS AND WEALTH

> In truth it seems that God created water not merely as an element necessary for the perfection of nature, but even more as a most convenient way to transport goods from one place to another … in this way East is connected to West, and South to North, so that one can say that what is produced in one place, because of the ease with which it can be obtained, is produced everywhere.[1]
>
> —Giovanni Botero, *On the Causes of the Greatness and Magnificence of Cities* (1588)

The foregoing chapters have examined the watery landscapes of Tuscany, and the cumulative efforts of ducal technocrats to order and make sense of them. The present one will depart from this specific context to explore, instead, how many of the urgent hydraulic problems that exercised the Medicean government and the rulers of other Italian states also animated a much broader political-economic discourse on the management and design of territory beginning around the turn of the seventeenth century. This discourse was first codified in the new reason of state tradition that originated in Italy, and spread, before long, to other parts of early modern Europe. Over the course of decades, even centuries, it would inspire set of theories about commerce and improvement underpinning many of the politically-directed terraforming enterprises that have, for better and for worse, produced the modern capitalist landscapes that form the fabric of our present. This chapter, more explicitly perhaps than the others in this dissertation, seeks to draw some of these longer historical lines to explore how some of

[1] Giovanni Botero, *On the Causes of the Greatness and Magnificence of Cities, 1588* (University of Toronto Press, 2012), 20.

these now very naturalized assumptions about the relationships between power and place were historically produced.

In the following pages, I shall analyze these conceptual developments through a study of the writings of Giovanni Botero (1544–1617). A renegade Jesuit priest, secretary, and diplomat, the Piedmontese Botero was a prominent critic of the amoral, militant form of *realpolitik* promoted earlier in the century by Niccolò Machiavelli (1469–1527) whose writings, however controversial, had cast a long shadow over Renaissance political philosophy.[2] Yet beyond simply denouncing the Florentine secretary, as had so many pious scholars, Botero sought to thoroughly revise his precepts by articulating a new form of statecraft, "the true and royal way that a prince ought to follow in order to *become great* and to govern his people successfully."[3] Writing from Rome, Botero sought to comprehend the shifting circumstances that the crystallizing, medium-sized regional principalities of Italy were coming to face in Europe and around the world at a time of state consolidation and imperial expansion. Taking stock of the drastic religious, geopolitical, and economic reorientations that took hold over the course of the sixteenth century, Botero aimed at nothing less than distilling the underlying principles of "greatness" (*grandezza*), and one of his main achievements, as scholars have long recognized, lay in identifying wealth-generation and material advancement among its principal causes. Indeed, Botero was among the first political theorists of early modern

[2] Robert Bireley, The Counter-Reformation Prince: Anti-Machiavellianism or Catholic Statecraft in Early Modern Europe (Chapel Hill, NC: University of North Carolina Press, 1990), 1–3, 45–49; Sara Miglietti, "Botero, Giovanni," in Encyclopedia of Renaissance Philosophy, ed. Marco Sgarbi (Cham: Springer, 2016), 1–3.

[3] Emphasis is mine. Giovanni Botero, *The Reason of State*, trans. Robert Bireley (Cambridge: Cambridge University Press, 2017), 2. On Machiavelli's early critics, see Bireley, *The Counter-Reformation Prince*, 24–44.

Europe to treat economic concerns as a distinct sphere of government action.[4] As Romain Descendre has shown more recently, Botero's economic vision of statecraft also placed a novel emphasis on the territorial aspects of power, evincing a new consciousness of the importance of rationally administering land and resources that would become central to the government of the emerging monarchical states in Italy and the rest of Europe, both domestically and in the expanding colonial empires.[5] It is specifically in the context of this more capacious, economically- and geographically-minded notion of "governmentality" emergent in Botero's thinking that the management of aquatic territory was first comprehensively theorized as a matter of state concern.[6] This development saw the natural world, a space we today call the "environment," framed explicitly in terms of its economic utility, and its orderly planning conceived as integral to effecting political-economic progress on a national scale.[7]

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[4] The first scholars to recognize Botero's contributions to economic thought were Mario de Bernardi and Federico Chabod. See Mario De Bernardi, *Giovanni Botero economista* (Turin: Istituto Giuridico della R. Università, 1931), and Federico Chabod, "Giovanni Botero," in *Studi sul Rinascimento* (Turin: Einaudi, 1967), 301–51. For more recent assessments on this theme, see Romain Descendre, "Raison d'État, puissance et économie. Le mercantilisme de Giovanni Botero," *Revue de Métaphysique et de Morale* 93, no. 3 (2003): 311–21; Sophus A. Reinert, "Introduction," in *A Short Treatise on the Wealth and Poverty of Nations* (1613), by Antonio Serra, ed. Sophus A. Reinert, trans. Jonathan Hunt, *Economic Ideas That Built Europe* (New York: Anthem Press, 2011), 1–86; and Erik S. Reinert and Kenneth E. Carpenter, "German Language Economic Bestsellers before 1850: Also Introducing Giovanni Botero as a Common Reference Point of Cameralism and Mercantilism," in *Economic Growth and the Origins of Modern Political Economy: Economic Reasons of State, 1500–2000*, ed. Philipp R. Rössner (New York: Routledge, 2016), 26–54.

[5] Romain Descendre, *L'état du monde: Giovanni Botero entre raison d'état et géopolitique* (Librairie Droz, 2009).

[6] I borrow the term "governmentality" from Michel Foucault, "Governmentality," in *The Foucault Effect*, ed. Graham Burchell, Colin Gordon, and Peter Miller (Chicago, IL: University of Chicago Press, 1991), 87–104. On Botero's territorial consciousness, and for a brief discussion of Botero on water, see Descendre, *L'état du monde*, 209–12. For anything more than a passing mention of Botero's relevance to environmental thought prior to Descendre's contribution, see Clarence J. Glacken, *Traces on the Rhodian Shore: Nature and Culture in Western Thought from Ancient Times to the End of the Eighteenth Century* (Berkeley, CA: University of California Press, 1967), 368–74.

[7] The term "environment" and its cognates did not exist (not, at least, in their contemporary sense) in the early modern period. In this chapter, I use the words "environment" and "environmental" to refer to the natural world, conceived as the physical space that grounded and surrounded human settlements, in all its elemental and topographical variety. As Sarah Miglietti and John Morgan have rightfully noted, human intervention in the environment in early modern Europe was not imagined as having implications of an

Botero's conception of political economy was premised on the value of industry, and especially on the commercial processes that enabled it.[8] In his view, abundant natural resources furnished important raw materials for domestic manufacturing, and fertile agricultural lands helped to sustain a large population of urban and village craft laborers. But it was it was from exchange, the processes of importing raw resources and exporting finished goods on international markets, that profits chiefly flowed. To become "great," in other words, successful mercantile economies required a system of efficient communication routes—best furnished by a viable aquatic landscape encompassing both natural rivers and lakes, but also artificial trenches and canals, and even the sea—that permitted high volumes of transfer and exchange.

For Botero, moreover, this relationship between the hydraulic environment and the economic realm was both deterministic and reflexive. He first observed that political societies in territories streaming with abundant, well-ordered waterways tended to engage in the kinds of commercial transactions that generated wealth, and reasoned accordingly

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ecological nature, as such action is framed today, but rather in terms of its social, political, cultural, or religious effects. Moreover, the rigid nature/culture dualism implicit in many modern definitions of the environment does not necessarily apply to the earlier conceptions of human-nature relationships that concern us here. Sara Miglietti and John Morgan, "Introduction: Ruling 'climates' in the Early Modern World," in *Governing the Environment in the Early Modern World: Theory and Practice*, ed. Sara Miglietti and John Morgan (New York, NY: Routledge, 2017), 2; Sara Miglietti, "Between Nature and Culture: The Integrated Ecology of Renaissance Climate Theories," in *Early Modern Écologies: Beyond English Ecocriticism*, ed. Pauline Goul and Phillip John Usher (Amsterdam: Amsterdam University Press, 2020), 140–41.

[8] Following Michel Sellenert, some scholars have characterized Botero as a mercantilist: see Michel Senellart, *Machiavélisme et Raison d'état: XIIe-XVIIIe Siècle* (Paris: Presses Universitaires de France, 1989), 71–83, and, for example, Descendre, *L'état du monde*, 194. More recently, Sophus A. Reinert has cautioned against equating Botero's premises with mercantilism, given ongoing doubts about the definitions and utility of this term. See his "State Capitalisms Past and Present: The European Origins of the Developmental State," in *The Oxford Handbook of State Capitalism*, ed. Geoffrey T. Wood, forthcoming, as well as Philip J. Stern and Carl Wennerlind, "Introduction," in *Mercantilism Reimagined: Political Economy in Early Modern Britain and Its Empire*, ed. Philip J. Stern and Carl Wennerlind (Oxford University Press, 2013), 3–24, and Sophus A. Reinert, "Rivalry: Greatness in Early Modern Political Economy," in *Mercantilism Reimagined: Political Economy in Early Modern Britain and Its Empire*, ed. Philip J. Stern and Carl Wennerlind (Oxford: Oxford University Press, 2014), 348–70.

that states could foster these profitable activities and enhance their economic fortunes by intervening in the aquatic landscape, improving the navigability of natural waterways and constructing new ones where they altogether lacked.[9] In his writings, natural and artificial hydraulic conduits are framed as essential material networks that served both as supports for and catalysts of political-economic development.

This basic idea—this awareness of the significance of circulatory networks to development—is one we have already encountered, of course. A premise of the daring hydraulic projects and channeled utopias analyzed in the previous chapter, the nexus between aquatic geography and secular power was widely appreciated by technocrats in the closing decades of the sixteenth century in Tuscany and in many other consolidating Italian states. Botero's innovation, as the following pages explore, lay in clearly expounding it: in unveiling its underlying mechanisms, demonstrating its broad historical and geographical applicability, and integrating it within a coherent (and massively influential) theory of political economy, one that became ever more prominent over the arc of his political writings from the final decade of the sixteenth century.[10]

In so doing, as this chapter will argue, Botero revealed statecraft to be a deeply infrastructural enterprise.[11] Often remembered by intellectual historians for engaging a variety of new kinds of knowledge—demographic, geographic, and economic—in matters of government, Botero's vision for the aquatic landscape also brought material

[9] I borrow the concept of environmental reflexivity from Miglietti, "Between Nature and Culture," 155. She uses it to describe the early modern idea that humans and their environments were mutually entangled, with "a bidirectional relationship between causes and effects that mutually influence each other in an open-ended spiralling process."
[10] Reinert and Carpenter, "German Language Economic Bestsellers before 1850."
[11] Michael Mann, "The Autonomous Power of the State: Its Origins, Mechanisms and Results," *European Journal of Sociology* 25, no. 2 (1984): 185–213; Michael Mann, "Infrastructural Power Revisited," *Studies in Comparative International Development* 43, no. 3–4 (2008): 355–65.

intelligence of environments and their engineering to bear upon politics.[12] By unveiling how the design of territory came squarely into view in the writings of Botero and his followers as an articulated affair of state, this chapter will conclude a line of argument, elaborated cumulatively over the course of this dissertation, about how we must look ahead of the Enlightenment for the diffuse origins of profit-driven natural improvement as a modern political and cultural mission. As this study of Botero's ideas about the connections between aquatic terraforming and national welfare reveals, the insight that processes of rationalizing environments and developing economies were fundamentally interrelated motivated transformations to and shaped conceptions of states and their territories from a moment much earlier than we commonly acknowledge.

Botero on "*Grandezza*" and its Causative Infrastructures

Giovanni Botero penned his most consequential political works during the closing years of the sixteenth century, after a long intellectual formation in itinerant philosophical and theological study and preaching. From the small town of Bene Vagienna in the Duchy of Savoy, now part of the region of Piedmont, Botero studied at the Jesuit schools of Palermo and Rome during his youth. He was a curious student, deeply interested in the histories and cultures of Italy and especially of foreign lands in Europe, Asia, Africa, and the Americas, and he angled to partake in the Jesuits' overseas missions to view more of this expanding world. But in 1580, before he could live out this dream or even pronounce his final vows, he was ultimately expelled from the order for expressing some unorthodox

[12] On Botero's incorporation of new fields of knowledge into considerations of statecraft, see Harald E. Braun, "Knowledge and Counsel in Giovanni Botero's Ragion Di Stato," *Journal of Jesuit Studies* 4, no. 2 (2017): 273-275. While he notes a novel territorial and spatial awareness in Botero's work, he does not comment on the relevance of architectural knowledge to his statecraft.

doctrinal positions and displaying a generally meddlesome temperament.[13] Despite his humiliating departure from the Society of Jesus, Botero found work in the orbits of powerful clerics and temporal rulers throughout the 1580s and 1590s, first as a personal secretary to Archbishop Carlo Borromeo in Milan, then as Duke Carlo Emanuele I of Savoy's ambassador to France, and finally as an advisor and secretary to Cardinal Federico Borromeo, cousin of Carlo, in Rome.[14]

As he circulated through varied secular and religious courts during this period, Botero developed an abiding interest in statecraft and governance.[15] It was while he was in Rome during the late 1580s and through the 1590s that he brought these ideas to bear on a series of eclectic, yet thematically related political treatises:[16] *Delle cause della grandezza delle città* (*On the Causes of the Greatness and Magnificence of Cities*, henceforth *On the Causes*) (1588), a concise analysis of the causes of urban prosperity;[17] *Della ragion di stato* (*On the Reason of State*, henceforth *Reason of State*) (1589), his bestselling refutation of the secular political philosophy associated with Machiavelli and his intellectual successors such as Jean Bodin (1529/30–1596) and the French *politiques*, which he augmented in 1598 with a series of *Aggiunte* (*Additions*) on various governance-related subjects, as well as his brief *Relationi del mare* (*Relations of the Sea*),

[13] Botero's most grievous transgression appears to have been his denial, in a 1579 lecture in Milan on the topic of Psalm II, of Christ's temporal authority over the world prior to his Passion. Luigi Firpo, "Botero, Giovanni," in *Dizionario Biografico degli Italiani* (Rome: Istituto della Enciclopedia Italiana, 1971).
[14] Miglietti, "Botero, Giovanni," 1–2.
[15] Botero was but one of many Jesuits and Jesuit-trained scholars who would go on to leave a mark in European political thought. On this topic, see Harro Höpfl, *Jesuit Political Thought: The Society of Jesus and the State, c. 1540–1640*, Ideas in Context 70 (New York: Cambridge University Press, 2004).
[16] Although Botero's principal works have traditionally been studied separately, Romain Desendre makes a strong argument for reading these works together as a coherent attempt to think through political theory across geographic scales. Descendre, *L'état du monde*, 13–14.
[17] The first published edition was Giovanni Botero, *Delle cause della grandezza delle città libri III* (Rome: Giovanni Martinelli, 1588), but in this essay I follow a modern English translation. See Giovanni Botero, *On the Causes of the Greatness and Magnificence of Cities*, 1588, trans. Geoffrey Symcox (Toronto: University of Toronto Press, 2012).

all composed during the intervening decade;[18] and the *Relationi universali* (*Universal Relations*), an ambitious and comparative physical, political, and religious geography of the world, published in four parts from 1591 to 1596.[19]

Motivating each of these works was a protracted inquiry into the causes of the "greatness" (*grandezza*) of political societies, analyzed respectively on the scale of the city, the sovereign (mostly monarchical) state, and the increasingly interconnected world of global empire. In its essence, Botero's conception of *grandezza* remained relatively constant over time, and although the factors entering into its stated definition gradually expanded, a strong economy and the wealth it produced was always central to his formula.[20] In *On the Causes*, for example, he illuminated how wealth grew commensurately with the size of a population, which, by engaging in economic activities and forming a large tax base, produced surpluses and revenues for the state. "The greatness of a city," so Botero opens his treatise, "does not consist in the extent of its site or the circumference of its walls, but in the number of its inhabitants and their *possanza*," a multivalent, if obsolete Italian term that referred both to power in a political sense, but

[18] The first published edition was Giovanni Botero, *Della ragion di stato libri dieci* (Venice: I Gioliti, 1589). For a modern English translation, see Botero, *The Reason of State. Giovanni Botero, Aggiunte di Gio. Botero Benese alla sua ragion di Stato, nelle quali si tratta dell'eccelenze degli antichi capitani, della neutralità, della riputatione, dell'agilita delle forze, della fortificatione. Con una Relatione del Mare* (Venice: Gio. Battista Ciotti, 1598) is the first published edition of Botero's addenda to this text.

[19] Here I follow Giovanni Botero, *Le relationi universali di Giovanni Botero Benese, divise in quattro parti* (Venice: Giorgio Angelieri, 1596), a compiled edition of all four parts.

[20] To be sure, Botero was not the first to consider the positive effects of wealth circulation within civil society. As the economies of Italy's commercial republics underwent unrivalled expansion from the thirteenth to fifteenth centuries, wealthy merchants and humanist writers alike came to note the unique productive powers of industry and trade, causing earlier qualms about the barrenness and venality of money to give way to a growing realization of its salutary societal benefits. Yet while casual observers in Italy as well as abroad grew ever more aware of the fundamental economic basis of civic might, these insights were slow to make their way into political theory, which is why Botero's essential intuition about the political relevance of governing the economic realm appears so singular. Reinert, "Introduction," 19–46. For more on Botero's understanding of "*grandezza*," see Descendre, "Raison d'État, puissance et économie," 314–17, and Sara Miglietti, "Debating 'Greatness' from Machiavelli to Burton," in *Early Modern Philosophers and the Renaissance Legacy*, ed. Cecilia Muratori and Gianni Paganini, International Archives of the History of Ideas 220 (New York, N.Y.: Springer, 2016), 242–47.

also to wealth and riches, and the social gravity that accrued from their possession.[21] In *Reason of State,* greatness was likewise framed as a complex of money and people, but in the *Universal Relations*, a summary of the "causes, by which one state, or dominion becomes greater than the other" explicitly listed "the advantages of money" alongside that of a large population, in addition to a set of militaristic factors—not even Botero, with his bold anti-Machiavellian stance, could forever sidestep the early modern realities of war—that included the valor of subjects, the opportunities of the site, and "occasion," by which he meant the general political stability of neighboring states.[22]

After establishing *grandezza*'s ideal economic and demographic conditions, Botero could examine those associated factors—what modern economic theory might label "cumulative causations"—that operated in tandem to bring them about.[23] It is within this framework that infrastructures of aquatic transit are first brought to the fore. Introduced initially as just one among several circumstantial requirements for the growth of great cities and states, these systems, as we shall see, acquire a progressively larger presence within Botero's mental universe. By both interpolating these material and spatial armatures and revealing their fundamental agencies within social, economic, and

[21] "Città s'adimanda una ragunanza d'huomini ridotti insieme per vivere felicemente, e grandezza di città si chiama non lo spatio del sito, o'l giro delle mura; ma la moltitudine de gl'habitanti, e la possanza loro." Giovanni Botero, *Delle cause della grandezza delle città libri III* (Rome: Giovanni Martinelli, 1588), 1. In Geoffrey Symcox's modern English translation, "*possanza*" is rendered as "strength," which fails to convey the full meaning of the original term. Giovanni Botero, *On the Causes of the Greatness and Magnificence of Cities, 1588,* trans. Geoffrey Symcox (Toronto: University of Toronto Press, 2012), 9. On the layered meanings of "possanza," see Romain Descendre, "Raison d'État, puissance et économie. Le mercantilisme de Giovanni Botero," *Revue de Métaphysique et de Morale* 93, no. 3 (2003): 311–21, as well as John Florio, *Queen Anna's New World of Words, or Dictionarie of the Italian and English Tongues* (London: Melch. Bradwood, 1611), 393.

[22] Botero, Le relationi universali, pt. II: Proemio.

[23] Alisdair Rogers, Noel Castree, and Rob Kitchin, "Cumulative Causation," in *A Dictionary of Human Geography* (Oxford, UK: Oxford University Press, 2013), https://www.oxfordreference.com/view/10.1093/acref/9780199599868.001.0001/acref-9780199599868-e-340.

political spheres, Botero models a quintessentially *infrastructural* way of thinking about such networks, as well as the natural environment in general. In anthropology and science and technology studies, "infrastructure," while a slippery and capacious term, can at its most basic level be defined in terms of its function: as anthropologist Brian Larkin put it so succinctly, infrastructures are those "built networks that facilitate the flow of goods, people, or ideas and allow for their exchange over space," constituting, in short, a physical "architecture of circulation."[24] Yet infrastructures, crucially, are also intrinsically causal objects. By "[creating] the grounds on which other objects operate," they furnish a medium that, per architect and theorist Keller Easterling, "makes certain things possible and other things impossible."[25] Often idealized by scholars as an inherently modern concept, with roots in the Enlightenment, the fact that Botero was alive to infrastructure's material power and keenly aware of its foundational role in engendering the conditions of *grandezza* behooves a certain degree of circumspection about claims to the essential "modernity" of infrastructural politics, or at the very least, a more generous conception of this temporal signifier.[26]

In developing these ideas, Botero drew a number of lessons from his studies of ancient and contemporary states and empires from around the globe. Although he could not experience these cultures nor their heritage firsthand, he studied this world

[24] Brian Larkin, "The Politics and Poetics of Infrastructure," Annual Review of Anthropology 42, no. 1 (2013): 328.
[25] Larkin, 329; Keller Easterling, *Extrastatecraft: The Power of Infrastructure Space* (New York, NY: Verso Books, 2014), 13–14.
[26] Paul N. Edwards, "Infrastructure and Modernity: Force, Time, and Social Organization in the History of Sociotechnical Systems," in *Modernity and Technology*, ed. Thomas J. Misa, Philip Brey, and Andrew Feenberg (Cambridge, MA: MIT Press, 2003), 185–225, and again Larkin, "The Politics and Poetics of Infrastructure," 332. For an example of a history of infrastructure and communications networks that commences in the eighteenth century, see Armand Mattelart, *Networking the World, 1794-2000* (Minneapolis, Mn: University of Minnesota Press, 2000).

vicariously: as a member of Federico Borromeo's household in the Papal capital, and sometime *consultore* of the Congregation of the Index, Botero had access to a wide range of sources that he drew on extensively in composing his texts. These included works of ancient philosophy and history, theological tracts, and modern accounts of cities, countries, and empires across Europe and beyond it, in the form of travel narratives, diplomatic reports, and relations from merchants and Catholic missionaries.[27] He also drew on lessons from closer to home. While he admired the prudential rule of some Italian princes—perhaps above all, Cosimo I de' Medici, whom he described as "a prince of outstanding judgment"—he did not, on the whole, commend their states as exemplars of aquatic stewardship, in spite of the efforts of so many of their governments (like Tuscany's) to better order internal waters from the second half of the sixteenth century.[28] Aside from isolated acknowledgements of the urban channels in some of the Po Delta cities, such as Milan, Ferrara, Comacchio, and Venice, he was overwhelmingly critical of aquatic disorder on the Italian peninsula. He instead upheld France, the Low Countries, and especially non-Western ancient and contemporary empires, such as those of the Ottomans and of China, as superior models to emulate. He perhaps saw in these latter

[27] Botero's work with the Congregation of the Index likely began in 1587. Miglietti, "Botero, Giovanni," 2.
[28] Botero, *The Reason of State*, 47. Just as in Tuscany, other states in Italy began, in the 1550s, to form new specialized offices to deal with all matters related to the control and supply of natural waters. On activities in Rome and the Papal States (of which, we must assume, Botero was most certainly aware), see Domenico Chiari, *Il territorio pontino in epoca sistina: Immagini di riforma e vita nello Stato della Chiesa, 1585–1590* (Terracina: Comune di Terracina, 1990); Katherine Wentworth Rinne, "Hydraulic Infrastructure and Urbanism in Early Modern Rome," *Papers of the British School at Rome* 73 (2005): 191–222; Pamela O. Long, *Engineering the Eternal City: Infrastructure, Topography, and the Culture of Knowledge in Late Sixteenth-Century Rome* (Chicago: University of Chicago Press, 2018); Carmen Genovese and Daniela Sinisi, eds., *Pro Ornatu et Publica Utilitate: L'attività della Congregazione cardinalizia super viis, pontibus et fontibus nella Roma di fine '500* (Gangemi Editore, 2010). For the Venetian Republic, see Ugo Mozzo, *I magistrati veneti alle acque ed alle bonifiche* (Bologna: Zanichelli, 1927). For the Duchy of Milan: Giovanni Liva, "Il Collegio degli ingegneri architetti e agrimensori di Milano," in *Il Collegio degli ingegneri e architetti di Milano: Gli archivi e la storia*, ed. Giorgio Bigatti and Maria Canella (Milan: FrancoAngeli, 2008), 9–26.

polities, as would a number of European political commentators in his wake (and increasingly so in the Enlightenment), a model of the kind of political absolutism many of his countrymen were beginning to deem necessary to the provisioning of orderly and viable hydraulic landscapes.[29]

Hydraulic Utility, Natural Management, and Sovereign Duty

The relationship between aquatic order and *grandezza* was central to Botero's preoccupations from the time of his earliest economic imaginings. He first discussed this correlation in *On the Causes*, where he also detailed several ideas that would continue to shape his later work. To open his discussion, Botero outlines the characteristics of cities, discerns their origins, and reviews the set of contingent geographical and physical factors that determined their expansion. He first offers a definition for the city: not solely an architectural agglomeration, it is foremost a social entity, the gathering of a citizen body.[30] This statement segues into an explanation of that elusive quality at the heart of his inquiry, the creation of "great" cities by drawing in and sustaining vast populations and reaping the surplus values arising from their productive activities.[31] He proceeds to examine how cities originate, explaining that people congregate in urban centers because they are either attracted by the security of its political authority and elect to settle there,

[29] Joan-Pau Rubiés, "Oriental Despotism and European Orientalism: Botero to Montesquieu," *Journal of Early Modern History* 9, no. 1 (January 1, 2005): 109–80; Michela Catto, "La cina nelle Relazioni Universali di Giovanni Botero. Tra religione, civiltà e ragione," in *Milano, l'Ambrosiana e la conoscenza dei nuovi mondi (secoli XVII-XVIII)*, ed. Michela Catto, Gianvittorio Signorotto, and Joan Pau Rubiés, Studia Borromaica 28 (Milan: Biblioteca Ambrosiana and Bulzoni editore, 2015), 307–33.
[30] Botero, *On the Causes*, 9. This definition goes back at least as far as Aristotle; Aristotle, *The Politics and the Constitution of Athens*, ed. Stephen Everson, Cambridge Texts in the History of Political Thought (Cambridge: Cambridge University Press, 1996).
[31] Botero, *On the Causes*, 9–10.

or are compelled to by force.[32] Alternatively, however, people may also accrue to a place because they are drawn by its pleasures—the temperate weather or the beauty of the city, namely—or, a scenario Botero concedes as more likely, by its utility. A city's utility is grounded in a triad of accidental features—the convenience of its site, the fertility of its land, and its ease of accessibility—which contribute, in ascending order of importance, to its *grandezza*.[33] Convenient sites, such as Genoa and Venice, Lisbon and Antwerp, are located near trade routes (he does not indicate which kind), and partake in commerce as waystations or hubs.[34] These propitious locales, however, often possess additional features that contribute to civic prosperity. One is fertile agricultural lands, which help to sustain a large population, providing for its needs and for the raw materials required in industry. Since possessing fertile territory alone, however, risked compromising civic might—Botero cautioned that an overabundance of the earth's fruits bred indolence—a prosperous city also needed to be accessible, and connected to neighboring locales as well as to ones further afield through a network of transportation routes. Such affordances would permit a city to partake in manufacturing and international trade.[35]

Botero next treats the significance of a site's accessibility and ease of transport, the third and most important component of a place's utility. This section stretches across several pages, forming the second-longest chapter of his text. He first acknowledges the usefulness of a level and stable topography for the emergence of road networks, permitting people to transport goods by foot or with beasts of burden, but follows up by insisting on the superiority of water routes as a form of transport infrastructure.

[32] Botero, 11–14.
[33] Botero, 14–17.
[34] Botero, 17–18.
[35] Botero, 18–20.

"Transport by water, if it is navigable," Botero explains, "is incomparably better than transport by land, both for facility and speed, because incomparably bigger cargoes are transported from very distant lands by water than by land, in less time, at lower cost and with less effort."[36] In what follows, Botero figures water as a God-given instrument of trade:

> In truth it seems that God created water not merely as an element necessary for the perfection of nature, but even more as a most convenient way to transport goods from one place to another. For since it is His Divine Majesty's will that human beings should embrace one another, as members of a single body, He shared out His blessings in such a way that no single country received everything, in order that communication would arise between those who needed the goods of others, who similarly needed goods from them, which would give rise to communication, and out of this communication, love would arise, and out of love, unity. To facilitate communication he created water, of such nature and substance that through its density it is able to support the heaviest burdens, and by its liquidity to convey them wherever one wishes with the aid of the winds or oars. In this way East is connected to West, and South to North, so that one can say that what is produced in one place, because of the ease with which it can be obtained, is produced everywhere.[37]

In this poetic contemplation of the economic affordances of water as a natural resource, Botero figures the substance as amenable to the mercantile needs of humankind. In addition to facilitating the exchange of goods, however, a networked system of hydraulic navigation supports conciliation among human societies.[38] In insisting on the communal, unifying effects of commercial interaction, Botero, who had elsewhere lamented the general disarray brought on by the religious schisms of the European Reformations and

[36] Botero, *On the Causes of the Greatness and Magnificence of Cities, 1588*, 20.
[37] Botero, 20.
[38] The idea that nature's goods had been unevenly distributed across the globe by divine design precisely to encourage human and societal sociability is ancient. For more on this, see Anthony Pagden, "Human Rights, Natural Rights, and Europe's Imperial Legacy," *Political Theory* 31, no. 2 (2003): 186. Pagden mentions how in the notion's ancient rendering, it was the winds that were created by God to facilitate commerce.

the strife of the Italian Wars, may be advancing a subtle plea for peace.[39] But this statement also reads as a moral justification of the economic use of the earth, in anticipation of later French and English improvement discourses that framed environmental management as part and parcel of a spiritual mission to understand, rationalize, and command nature in the name of material progress.[40] Water thus perfects nature, reconciles the fractured state of Christendom, and advances political economies, permitting the kinds of active circulation and trade that bring wealth to states.

After first describing the general mercantile and communicative utility of internal rivers, in addition, briefly, to lakes and seas, Botero suggests that the territorial mobility afforded by natural aquatic systems can be augmented by building artificial waterways. By way of "canals and lakes constructed by human labor and skill," that is, states can improve their territories to better support commercial activity and bolster their material welfare.[41] Kingdoms that are not blessed by the convenience of long, navigable rivers like the "Po in Italy, the Scheldt in Flanders, the Loire and the Seine in France, and the Danube and the Rhine in Germany" ought to build monumental canals, "models or as it were manmade imitations of rivers."[42] As precedents for emulation, Botero cites the ancient canals constructed by the kings of Egypt to connect the Nile to Heroopolis, and

[39] In his *Del dispregio del mondo libri cinque* (Milan: Francesco & Simon Tini, 1584), 40–41, for example, Botero laments that the many religious sects "nell'Allemagna sola" impede exchange and traffic, and incite people to take up arms against one another. On this theme, see also Botero, *The Reason of State*, 65.
[40] As discussed in, among others, Richard H. Drayton, *Nature's Government: Science, Imperial Britain, and the "Improvement" of the World* (New Haven, CT: Yale University Press, 2000); Chandra Mukerji, "Material Practices of Domination: Christian Humanism, the Built Environment, and Techniques of Western Power," *Theory and Society* 31 (2002): 1–34; Paul Slack, *The Invention of Improvement: Information and Material Progress in Seventeenth-Century England* (Oxford, UK: Oxford University Press, 2015); Richard W. Hoyle, *Custom, Improvement and the Landscape in Early Modern Britain* (New York: Routledge, 2017).
[41] Botero, *On the Causes of the Greatness and Magnificence of Cities, 1588*, 20.
[42] Botero, 21.

the Red Sea to the Mediterranean, as well as conduits built by the Mamluk sultans to link the Euphrates River to Aleppo. He also discussed networks of urban waterways constructed more recently in Bruges, Ghent, and Milan, the latter rivalling the waterways of ancient Rome.[43] While not an engineer, Botero was eminently knowledgeable about several important hydraulic projects undertaken across the Mediterranean World and in Northern Europe from antiquity to the present day. Despite the technical challenges and great expense that came with planning and building these complex infrastructures, he maintained that such projects were well worth the investment, for they enriched the cities they linked with other sites and regions, bringing them access to "endless merchandise" and the "fruits and produce of … very bountiful [territories]."[44]

In a continued display of his impressive aquatic knowledge, Botero next considers the technical and formal attributes that optimize hydraulic corridors for the purposes of trade and transit. Riverbeds and canals that are lengthy, deep, broad, and only slightly inclined yield a placid and consistent current, enabling the safe and reliable conveyance of large, heavy cargoes, both up and downstream.[45] He approvingly remarks that waterways of this kind can be found across northern France, Belgium, Switzerland, and the Netherlands, enriching these regions "with immense wealth thanks to the ease of navigation and trade." By contrast, a commodious aquatic network of this sort "is certainly lacking in Italy" due to its topographical particularities. Because the region's watercourses run for only a brief distance—from the peaks of the Apennine mountains that bisect the peninsula, to the coastlines—"its rivers are short and cannot grow very

[43] Botero refers to the Mamluk rulers the "sultans of Cairo" in his text. Botero, 21–22.
[44] Botero, 22.
[45] Botero, 22–23.

much in size or moderate their violent currents." They therefore "deserve to be called torrents rather than rivers," save for "those brief stretches of the Arno or the Tiber [which] are scarcely worth mentioning."[46] In drawing such unfavorable conclusions about Italy's chaotic fluvial geomorphology in comparison that of its northern neighbors and the redoubtable ancient empires of the Mediterranean basin, Botero admonishes princes to continue improvements in this domain.

Botero also comments at length on water's optimal physical properties, focusing on the effects of density. A high concentration of salts and sediments enhances water's buoyancy, making it "stronger and more resistant" to bearing heavy loads. But the load-bearing benefits granted by this "earthy quality" are offset by a turbulent or uneven course, which can "thin out the water's substance and break up its viscosity."[47] This is why the Nile is, as he explains, despite its turbidity, less effective as a transit route in comparison to the more placid rivers of Germany and France.[48] While Botero's interests in water are primarily instrumental, in this section he demonstrates how his understanding of aquatic systems reaches far beyond economic and political considerations to encompass their natural properties and material qualities, an elemental knowledge he will continue to hone through his subsequent writings.

In concluding this section of *On the Causes*, Botero concedes that as crucial as hydraulic conduits are to the "consummation of a city's greatness," this factor cannot nonetheless alone determine political-economic prosperity. While water is indeed "so useful in so many ways," such that human societies cannot flourish without easy access

[46] Botero, 23.
[47] Botero, 25.
[48] Botero, 24.

to it, he observes that "where communications are always easy, one does not automatically see a notable city."[49] For example (and although Europeans' grasp of African and American demography during this era was still sketchy) Botero's sources seemed to indicate to him that several enormous rivers in these continents, despite their size, hosted few populous settlements.[50] Beyond the convenience that aquatic environments bring to travel and commerce, then, Botero was led to investigate those other cumulative causations (or, as he terms it, "attractive powers")—institutions ranging from churches, universities, and courts of justice, to abundant natural resources, to the presence of the nobility and monarchs—that conspire to make certain places more populous and prosperous than others. Of the several factors he surveys, industrial activities emerge as the most important, and a sector the prince ought to support, for "from this comes a flow of money and people."[51] For Botero, industry comprised the manufacturing processes that transformed the raw materials of nature into more costly finished goods, as well as the export activities that converted surplus craft products into commercial revenues.[52] This sector, it went without saying, could not flourish without an

[49] Botero, 26.
[50] Botero, *On the Causes*, 27. What he of course might not have realized, in the case of the Americas, is just how precipitously the populations on the continent (especially in South America) declined over the course of the sixteenth century. See William M. Denevan, ed., *The Native Population of the Americas in 1492*, Second Revised Edition (Madison: University of Wisconsin Press, 1992).
[51] Botero, *On the Causes of the Greatness and Magnificence of Cities, 1588*, 42.
[52] Botero's industrial program was innovative in stressing the transformative, value-added process of manufacturing. Through a profusion of examples—wool to finished cloth, mined ore to refined metals, marble rock to chiseled sculpture—he explains "how the finished work is worth far more than the raw material, and how many more people live by their crafts than from the fruits of nature." He advised princes to ban stocks of raw materials from leaving their countries to protect for use in domestic manufacturing, while encouraging the export of craft products and finished goods in vast quantities. It is during this final commercial step of the industrial process, at the point of sale abroad, where revenues are realized. Botero, 42–46; For an analysis of Botero's views on industry and their practical inspirations, see Sophus A. Reinert and Robert Fredona, "Political Economy and the Medici," *Business History Review* 94, no. 1 (2020): 125–30.

amenable aquatic network, whether naturally-endowed or provisioned by design: waters literally effected the transactions that brought wealth to states.

Yet even amidst his discussions of those other causative factors that draw people and wealth to cities, Botero circles back time and again to the fundamental necessity of industry, commerce, and aquatic infrastructures, creating a sense that internal waters and the economic activities they support are, despite his earlier statement, unavoidably foundational to civic greatness. For example, when speaking of the attractive pull exerted by the natural abundance of a valuable commodity in a certain place, he remarks that other regions can come into possession of that resource and share in its benefits through the "convenience of transportation." To enable these connections, Botero asserts that "it will be very beneficial if the prince understands the natural advantages of the site, and works judiciously to improve it" by building commercial hubs, for instance, which "[consist] of a safe, capacious harbour, convenient bays and inlets of the sea, navigable rivers that run through the cities or close by, lakes and canals, or let us say waterways, and safe, level roads."[53] Elsewhere, he notes that the mere presence of government offices and political institutions in a city tend to attract merchants and artisans, who bring wealth to capitals by simply plying their trade.[54]

Soon after, Botero moves from a prescriptive to an illustrative register, demonstrating his maxims with references to the comparative eminence of modern states across the globe. In his examples, intriguingly, *grandezza* is manifested in the hydraulic landscape itself, with its particular state of order or disorder figured as an almost indexical marker of the relative wealth and power of those states in question. In two

[53] Botero, *On the Causes of the Greatness and Magnificence of Cities, 1588*, 49–50.
[54] Botero, 53, 57–59.

prominent case studies, he elaborates at great length on the magnificence of China—in many ways his exemplary political society, and an enduring obsession across his body of work—in addition to Constantinople.[55] Speaking of the former, he heaps his praise on its industries, in addition to the "rivers and waterways of every kind [that] run throughout the land, with inexpressible convenience for navigation and agriculture."[56] Turning next to the Ottoman capital, he remarks on its propitious location at the intersection of two seas at the crossroads of Europe and Asia, concluding that "if it possessed a great, navigable river it would lack for nothing."[57] Yet in contrast to these lands of aquatic order stands the cautionary example of Italy, in all its hydraulic chaos. In spite of the burst of alluvial activity that marked the foregoing decades, improvements of which he was surely aware, the Italian principalities still had some ways to go:

> In truth we Italians are too fond of ourselves and too much the uncritical admirers of our own ways, when we prefer Italy and its cities over all the rest of the world. The shape of the Italian peninsula, long, narrow and bisected by the Apennines, and its scarcity of navigable rivers, do not allow it to contain any really big cities. I do not need to say that Italy's rivers are but rivulets in comparison to the Ganges, the Menan, the Mekong and the others, and that the Tyrrhenian and Adriatic Seas are mere ponds compared to the Ocean, so that in consequence our commerce is trifling when set against the markets of Canton, Malacca, Hormuz, Lisbon, Seville and the other cities situated on the Ocean.[58]

In Botero's view, the patriotism and self-importance of his countrymen are simply unjustifiable in light of the disordered state of Italy's aquatic landscape. Such thundering criticism probably read as a shot across the bow, for though buffeted somewhat by the unraveling of the Reformation and Spanish Imperial subjugation, the Italians had by the

[55] Rubiés, "Oriental Despotism and European Orientalism"; Catto, "La cina nelle Relazioni Universali di Giovanni Botero."
[56] Botero, *On the Causes of the Greatness and Magnificence of Cities, 1588*, 61.
[57] Botero, 64.
[58] Botero, 63.

late Renaissance gained something of a reputation among their European brethren for hubris, all too accustomed, as the English traveler Robert Dallington put it, to thinking their homeland "the fairest countrey of Europe."[59] But for Botero, what mattered most were not a nation's cultural traditions nor its intellectual legacies, the source of so much of this prideful fervor. After all, greatness depended fundamentally on the land and its resources. And in Italy, where disordered waterways and inferior hydraulic infrastructures impeded economic activity and stymied the growth of large, prosperous cities, princes had much to do to improve navigability and commerce in their territories to recover any hope of competing with the imperial ports of China, Spain, and Portugal. While only momentary, these asides evince a bubbling sense of economic and political rivalry, an emerging "jealousy of trade" playing out, in a very real way, over the space of the natural landscape.[60]

Together, Botero's persistent remarks about the beneficial affordances of waterways in *On the Causes*, both within his express treatment of these topics and in his discussion of others, indicates that these physical networks, created by nature and improved by human ingenuity, are perhaps far more instrumental to his understanding of wealth and *grandezza* than even he can initially articulate. Over the course of the text, he brings these material systems into relief as causative infrastructures, systems of natural and built circulatory networks that determine urban and territorial development.

[59] Robert Dallington, *A Survey of the Great Dukes State of Tuscany* (London: E. Blount, 1605), 10. See also Samuel Berner, "Florentine Political Thought in the Late Cinquecento," *Il Pensiero Politico* Anno III, no. 2 (1970): 183–84.
[60] For a recent treatment of "jealousy of trade," see Reinert, "Rivalry: Greatness in Early Modern Political Economy", who likens it to jealousy of *grandezza*. He in turn takes this concept from Istvan Hont, *Jealousy of Trade: International Competition and the Nation-State in Historical Perspective* (Cambridge, MA: Harvard University Press, 2005).

Grandezza and its Aquatic Indicators

In the wake of *On the Causes*, the significance of the aquatic landscape and the infrastructures that improved it would grow only more evident over the course of Botero's prolonged engagement with the mechanisms of political and economic prosperity. In the short term, however, his attentions were divided. In 1589, just one year after publishing his pathbreaking investigation of the causes of civic greatness, Botero came out with *Reason of State*, an immensely popular bestseller in its own time and throughout the seventeenth century, and to this day the most famous of Botero's assorted publications. While the entirety of his political output during these years was motivated to a greater or lesser extent by a desire to overcome Machiavellian "reasons of state," the eponymous *Reason of State* stands as his most direct confrontation with its infamous mastermind. Formulated principally as a direct refutation of Machiavelli's *Il Principe* (1532), the text largely follows its structure, addressing and modifying several of the topics the Florentine secretary had outlined in his inflammatory treatise.[61] The bulk of the text therefore stakes out a more moderate line on a variety of more traditionally "political" considerations, from courtly politics and princely comportment, to security and military strategy and foreign relations. While Botero does reassert some of his earlier advice on the importance of economic enterprises in a chapter, "On Industry," taken directly from *On the Causes*, his focus is centered primarily on the transformative, value-enhancing powers of manufacturing, with trading activities mentioned only incidentally as components of the industrial process. Given commerce's marginal presence in *Reason of State*, his earlier preoccupations with the *network* affordances of natural and artificial

[61] Niccolò Machiavelli, *The Prince*, trans. Quentin Skinner and Russell Price (Cambridge, MA: Cambridge University Press, 1988) is the standard English edition.

waterways is likewise not much in evidence in this text, although the management and improvement of inland waters in a general sense is addressed in a chapter on agriculture: to irrigate arid farmlands, it was "the duty of the prince, aiding nature, to channel rivers or lakes through the countryside," for instance, while reclaiming additional acreage required him to "drain swamps, uproot and prepare for cultivation useless or excessively wooded areas, and to aid and support those who undertake similar works."[62] Despite *Reason of State*'s professed anti-Machiavellian agenda, the text's silence on the commercial and economic benefits of aquatic infrastructure stands as a curious and unexpected omission, especially after having so exercised Botero's attentions in *On the Causes*.[63] In all likelihood, the texts were meant as two distinct but complementary inquiries; written simultaneously, and even bound together in most of their print runs, readers would have approached them synthetically.[64]

Aquatic mobility and commercial navigation nonetheless come into view again in Botero's subsequent, worldly masterwork, the *Universal Relations*, evincing his ongoing ruminations on the role of territorial waters in the circulations of global trade and economic development. If *On the Causes* first established the aquatic landscape as a foundational component of *grandezza*, in the *Universal Relations*, Botero reads these environments for the kinds of evidence they provide about the relative political-economic powers of different countries of the world then known to Europeans. Water and its

[62] Botero, *The Reason of State*, 153.
[63] It is perhaps the enormous popularity that *Reason of State* enjoyed over Botero's other writings that has led the aquatic and environmental aspects of his thinking to be largely overlooked by modern scholars.
[64] Starting with its second published edition (which was, like the first one, also issued in 1598), subsequent reprints of the *Reason of State* included *On the Causes* as a concluding essay. One exception is a French translation of *Reason of State* (Paris, 1599). "There appears to be just one later separate edition of *Delle cause* (Milan: Nella Stamperia del q. Pacificio Pontio, 1596)." Botero, On the Causes of the Greatness and Magnificence of Cities, 1588, xi.

infrastructures, in other words, are not simply required by *grandezza*: their presence also comes to stand in for it. Of the tome's four principal sections, these ideas are expressed specifically in parts I and II, on the physical and political geography of the globe. As Botero surveys various states, describing their topographies and analysing the causes of their greatness, aquatic territory emerges as one of the principal things he sees. While the various intricacies of the *Universal Relations* cannot be covered here due to the tome's vast length, its consistent, formulaic structure nevertheless permits an exploration of Botero's general mode of analysis.

In the first and by far the longest part of the *Universal Relations*, Botero lays the groundwork for his study by providing a comprehensive overview of the physical and human geography of the world across all four continents. In an order more or less replicated throughout the study's subsequent parts, Botero moves first through Europe, and then onto Asia, Africa, and the Americas, describing the various empires, principalities, and colonial provinces of each continent. Over the course of his accounts, the aquatic landscape emerges as a matrix that gives meaning to territory. Rivers and canals, lakes, gulfs, and seas are the signposts that orient us in space, for Botero so often introduces each country and city by describing their relative locations, with frequent reference to the waterways that hem or flow through their lands. Subsequently, aquatic resources are raised time and again as a principal feature of the physical geographies he surveys. For each country profiled, Botero begins by indicating its spatial extent, regional divisions, and principal cities before elaborating on its topographical and environmental qualities. Against the backdrop of nondescript mountains, forests, and planes, inland and coastal waters take pride of place. He consistently describes these aquatic features in

great detail, a granularity in stark evidence in the index to Part I, where the segment on rivers notably has more entries than any other topical category, filling the greater part of a page with proper names.[65]

As in *On the Causes*, in the *Universal Relations* Botero affirmed that natural rivers and artificial canals facilitated commercial traffic and enabled the exchange of merchandise, but also insistently read these aquatic systems as the *causes* of a region's economic vitality. To review just some examples, he stated that Nantes, one of the principal cities in Brittany, France, "is rich in traffic, favored greatly by the opportunity of the site; *because* it sits almost at the mouth of the Loire, and takes advantage of the river, and the sea." In like manner, Antwerp, Belgium "sits on the right bank of the Scheldt, which conducts boats from there to the sea (at a close distance of seventeen leagues), laden with every kind of merchandise."[66] Similarly, in "Cataio" (an old Portuguese term for the region of China corresponding with modern-day Guangdong), "the greatness of traffic, and the largeness of the cities of this country, *proceed from* the size of the lakes, and of the rivers, that are many."[67] Kannur, India, meanwhile, was "a site, which for the multitude of canals, and navigable waters, *seems made by nature* for the convenience of merchants."[68] By contrast, where Botero judged the landscape to be wanting, he identified opportunities for hydraulic improvements. As an Italian overawed

[65] Botero, *Le relationi universali*, sec. Indice delle cose più notabili contenute nella descrittione dell'Europa (unpaginated).
[66] First quote: "Le città principali sono Nantes, e Renes. Quella è più ricca di trafico favorito grandemente dall'opportunità del sito; perche giace quasi alla bocca del Ligeri, & si prevale e del fiume, & del mare." (Emphasis is mine.) Botero, pt. I, Book I, 27. Second quote: "Siede sopra la destra ripa della Schelda, che vi conduce le navi sino dal Mare (che an'è lontano diciasette leghe) cariche d'ogni mercantia." Botero, pt. I, Book I, 64.
[67] "La grandezza del traffico, & la grossezza delle città di questi paesi procede dall'ambiezza de' laghi, & de' fiumi, che sono molti." (Emphasis is mine). Botero, *Le relationi universali*, pt. I, Book I, 123.
[68] "Cananor è un sito, che per la moltitudine de i canali, & dell'acque navigabili, par fatto dalla natura per la commodità de i mercadanti." (Emphasis is mine.) Botero, pt. I, Book II, 133.

by much of Asia, and invested in the stakes of European, and specifically Spanish and Catholic imperial expansion, suggestions of this kind were reserved mostly for his sections on Africa and the Americas. In one example, he suggests constructing a shipping channel latitudinally across Nicaragua, bisecting Lake Nicaragua. The country's richness, Botero first explains, "consists in large part, of a most ample lake (they give it 300 miles in length) that sits twelve miles from the coast of the Pacific Ocean, but which, for all this, sends its waters to the Atlantic Ocean, however far away." To rectify this lost opportunity, he proposes "enlarging the present canal, and making another one from the lake to the Pacific Ocean," an intervention that "would open up a most happy navigation from east to west."[69] For Botero, the lessons learned in the so-called Old World ought to be followed not only in Italy, but also in Europe's colonies in the West Indies. The global environment in its entirety was a potentially improvable space.

If repeated descriptions of this kind throughout Part I reinforce Botero's awareness of the crucial role of aquatic infrastructures in the development of commerce and generation of state wealth, he draws these connections even more explicitly in Part II. In this portion of the text, Botero retraces his steps, focusing this time only on the world's "greatest principalities" and the causes of their eminence and riches. Despite his nominally "universal" survey, this section was focused primarily on Europe and Asia, with only a brief discussion of Africa, and no attentions paid at all to the kingdoms and empires of the Americas.[70] His state profiles rehearse much of the geographical

[69] "Ma la ricchezza di Nicaragua consiste in gran parte, in un lago amplissimo (li danno 300 miglia di lunghezza) che si accosta a dodici miglia al mare del Sur, e manda con tutto ciò le sue acque al mare del Norte, onde, egli è molto lontano. Molti stimano, che allargando il sudetto canale, e facendone un altro dal lago al mare del Sur, s'apprirebbe una felicissima navigatione da Ponente a Levante." pt. I, Book V, 218.
[70] Deemed a "new world" by Europeans, as far as Botero was concerned, the American continent was not home to any great states and thus merited no place in Part II of his survey. And although Africa formed part of the Old World, his treatment of the continent was similarly dismissive (a mere 20 pages on the however

information earlier provided in Part I of the text, but also move into an analytical register that recalls the comparative case studies he had earlier discussed in *On the Causes*. In this text too, the focus on the aquatic environment as a principal determinant of *grandezza* is striking. Speaking again of France, for example, Botero's most favored European kingdom, he repeats its geographical description, and commends the large size of the country and the quality of its terrain ("all useful, and fruitful").[71] He then devotes an entire page to its waterways, asserting that "there is nothing more worthy of honor and esteem, or more considerable, about France than the multitude, and amenability, of navigable rivers, that encircle part of it … and traverse it." Rendering the "entire Kingdom, above all trafficable, and communicable," the commerce these waterways facilitate "is the *cause* of the multitude, and the beauty of the cities and lands of France, which are situated, for the most part, on the banks of these rivers."[72] The networked infrastructure of France's commodious waterways encouraged the growth of so many vibrant towns and cities across the territory, which draw people and money to the state. He draws similar conclusions about the political-economic agency of natural and constructed aquatic geographies in a number of other European and Asian cities and states: from the duchy of Milan, to the Holy Roman Empire, to kingdom of Poland, and to the duchy of Muscovy; and from central Asia, to China, to Thailand, and Calicut. By

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apocryphal empire of Prester John, the Kingdom of Mutapa, and the kingdoms along the North African coast). Save for the regions of North Africa, it was also demeaning, rehearsing several early modern tropes about the languor of its populations and their disinterest in improvement: "Hanno fiumi, e acque," for example, "e non ne sanno bonificare le loro possessioni." ("They have rivers, and water, but they do not know how to improve their possessions.") Botero, pt. II, Book III, 103.

[71] "Il terreno poi vi è tutto utile, e frutiffero." Botero, pt. II, Book I, 3.

[72] "Ma non è cosa piu riguardevole, e piu considerabile in Francia, che la moltitudine, e l'amenità de' fiume navigabili, che parte la cingono ... parte la traversano ... che ne rendono tutto il Regno sopra modo traffichevole, e communicabile. ... La fertilità del terreno, e la commodità, che i fiumi porgono alla condotta della robba, è cagione della moltitudine, e bellezza, delle città, e terre di Francia, situate, per lo piu, su le rive d'essi fiume." (Emphasis is mine.) Botero, pt. II, Book I, 4.

arguing for the importance of these nations' hydraulic infrastructures in leading them to greatness, Botero again mounts an instructive case for princes to carefully steward the particular aquatic resources of their territories, and to create and improve these systems where they lack.

While the *Universal Relations* serve mostly as a global theatre for the application and extension of his simple, yet powerful insights about the relationships between hydraulic infrastructures and political economy—a repository of proofs, that is, for principles first articulated in *On the Causes*—Botero occasionally evolves his ideas, innovating new principles that add further complexity to his reading of aquatic territory. In one notable example, he draws on spatial observations about the relationship between political communities and the circumstances of their aquatic sites to draw astute conclusions about the kinds of economic activities afforded by different environments. Remarking that France's "major cities are situated not at marinas, but in places in the middle of the land," straddling rivers and canals, rather than maritime coastal ports, he deduces that the country's riches derive primarily from domestic industrial processes, involving the transformation of local resources, harvested from the land, into finished products conveyed by water across the territory and beyond it.[73] The same can be said for Milan, as well as the urban hubs of Flanders, Germany, and Hungary. But these circumstances stand in contrast to those that obtain in formidable maritime cities, such as Genoa, Venice, and Ragusa, which rely on the "help, and sustenance of the sea" for sourcing the inputs and disseminating the outputs of industrial processes.[74] On the whole,

[73] "...le sue maggioi città non sono poste alla marina, ma ne i luoghi mediterranei." Botero, pt. II, Book I, 4.
[74] Full quote: "Perche le città maritime sono maggiori delle mediterranee là, dove esse ricevono piu aiuto, e sostegno dal mare, che dalla terra." Botero, pt. II, Book I, 4.

however, in the *Universal Relations* the aquatic landscape is so routinized and its presence so repetitive that another commentator might have elided it entirely. As anthropologist Ashley Carse reminds us, the visibilities of infrastructural systems are situated; the familiar, seamless networks that might have otherwise faded into the background were, for Botero, a pressing item of fascination, a key agent in the circulations of early modern economies.[75]

Global Mobilities: Seas as Macrocosmic Infrastructures

That the communicative and mercantile affordances of aquatic territories remained a longstanding interest of Botero's and a fundamental theme in his conception of *grandezza* is clear, finally, from a dedicated study of nothing other than the greatest reserves of the world's waters, his *Relations of the Sea*. Unlike his other texts under examination here, this short essay is structured not as an assessment of statecraft or terrestrial politics, but rather as a survey of the geography and physical characteristics of the world's oceans and their interconnected systems of lakes and rivers. Presenting a succinct synthesis of a wide range of sources, from the conventional Hippocratic corpus and pre-Socratic philosophers on the balance of natural elements, to the natural histories of Plato and Aristotle, to the geographies of Ptolemy and Strabo, to more recent accounts of oceanic behaviour, the text covers a wide range of topics, from the volume and extent of the earth's waters, to their varied salinity levels and colors, to the internal and external causes of their movements, evincing our author's ongoing intellectual engagement with aquatic matters on an elemental and technical level. Yet in addition to describing the

[75] Ashley Carse, "Nature as Infrastructure: Making and Managing the Panama Canal Watershed," *Social Studies of Science* 42, no. 4 (2012): 543.

natural properties of seas and oceans, Botero digresses at times into extended analyses of their political-economic utility to humankind, summarizing and reinforcing again a number of his earlier ideas about the efficacy of nature's waters as a material substrate for mobility, navigation, and commerce. Despite the obvious divergences between this oceanographic treatise and his earlier political writings, the fact that he published this essay in 1598 as a part of his *Aggiunte* to *Reason of State* offers proof of the relevance he believed it to have to political knowledge. That these continuities were evidently clear to his early modern readers is demonstrated by the essay's inclusion in subsequent editions of some of his other political writings, both, for example, in Part I of a compiled edition of his *Universal Relations* from 1600, and in a later edition of *On the Causes*.[76]

Botero addresses the instrumental utility of the waters of the globe in the first section of his short treatise, in the midst of a discussion of the seas' immense depth. Turning from physical explication, he asks about the benefits "such plenty of water" yields for humanity. The vast extension of the oceans, Botero observes, is necessary "for the beauty of the world," evincing an emergent aesthetic appreciation for this aquatic expanse; the "proportionate disposition of the elements"; and for navigation, which "facilitates the communication of very far distant countries, and the fruits that originate there."[77] Rehearsing the reasoning he put forth in *On the Causes*, his elaborated explanation juxtaposes the efficiencies of maritime travel with the shortcomings of land cartage. "So as with navigation," he stated, "the East enjoys all of that, which arises in the

[76] For example, Giovanni Botero, *Le relationi universali di Giovanni Botero benese, divise in quattro parti* (Venice: Giorgio Angelieri, 1600), and Giovanni Botero, *The Cause of the Greatnesse of Cities. Three Books. With Certaine Observations concerning the Sea*, trans. T. H. (London: Henry Seide, 1635).
[77] "Diciamo, che questa tanta grandezza di Mare è a servitio dell'huomo, prima per che ella è necessaria alla bellezza del mondo, & alla proportionata dispositione de gli elementi ... reca anche servitio all'huomo, perche per mezo della navigatione, facilità la communicatione di lontanissimi paesi, e de' frutti, che vi nascono." Botero, *Aggiunte*, 85v.

West, and contrariwise, the West, the goods of the East; which could not succeed by means of land, because the trip would be infinite, and the expense immense, and the difficulty of the voyage insuperable; and the goods would arrive from one distant extremity, to the other, tainted, perished, and deprived of their natural virtue, and goodness."[78] The seas, in fact, are simply extensions of the fluvial network he discoursed on elsewhere, and share its benefits: "From the above mentioned infinite quantity of water of the Ocean proceed the rivers, so necessary, so useful, so favourable to the life, and needs of man."[79]

Beyond these aquatic affordances, the theme of improvement also carries over to the *Relations of the Sea*, albeit in a more generalized and abstract manner. Although the oceans are, by virtue of their material substance and extrajuridical space (at least beyond the immediate littorals) excluded from the state's field of action, and while it is impossible to physically erect built aquatic networks across the high seas, as can be done on firm land, our author holds that humanity can nonetheless still dominate the world's oceans by means of the art of navigation. It is this form of mastery that Botero, a vicarious party to the Spanish, Catholic inroads across the globe, celebrates and encourages.[80] The sheer extent of maritime space, he explains, represents the "industry of man, and the courage with which he dominates the Sea, however untamed, and rides, and

[78] "Si che con la navigatione il Levante si gode di tutto ciò, che nasce in Ponente, et all'incontro il Ponente de' beni del Levante. Il che non potrebbe riuscire per via di terra, perche il viaggio sarebbe infinito, e la spesa immensa, e la difficoltà della condotta insuperabile; e le robbe arrivarebbono da un estremo all'altro, logre, e consumate, e prive della lor natural virtù, e bontà." Botero, 85v–85r.
[79] "Di più dalla sudetta quantità infinita d'acqua dell'Oceano procedono i fiumi, tanto necessarii, tanto utili, tanto favorevoli alla vita, & al bisogno dell'huomo." Botero, 85v.
[80] Elizabeth Horodowich and Lia Markey call Italians like Botero "virtual and vicarious explorers of the Americas." See Elizabeth Horodowich and Lia Markey, "Italy's Virtual Discovery: An Introduction," in *The New World in Early Modern Italy, 1492–1750,* ed. Elizabeth Horodowich and Lia Markey (Cambridge: Cambridge University Press, 2017), 15.

governs, and rules it." There is no operation, he continues, "in which man demonstrates greater ingenuity, daring, or industry, than navigation."[81] Revisiting his earlier contrastive trope of land and sea travel, Botero illustrates this point by comparing horsemanship with seafaring, the latter "so much more excellent than [the former], as the sea is greater than a horse, and the fury of the winds, than the courage of a jennet."[82] The heroism and "greatness of spirit" humans exercise through navigation in fact bears resemblance to the ingenuity and "infinite goodness" of God, who first mastered these waters during Creation.[83] Here again, we see evidence of the moral logic that, in reconciling the useful with the spiritual, would become so central to cultures of improvement in the early modern period.

Thereafter, Botero even goes so far as to suggest that these enterprises grant a certain *formal order* to amorphous waters. Through blustering storms and tempests, the sailor "regulates the winds, furrows the waves, and *finds the street* ("*strada*") through the middle of the ocean."[84] He again employs this curious, land-locked metaphor for seafaring and aquatic pathfinding when commending the feats of the "cunning mariner at sea, who *opens a street* ("*strada*") through the Ocean."[85] Expressions of this kind might have played well to an audience of statesmen, so accustomed to trading in visions of territorial domination, but also likely reflects an emerging conception about the novel

[81] "Ma la grandezza del Mare non solamente suggerisce materia di ammirare, e di celebrare l'infinita bontà di Dio, ma l'industria anche dell'huomo, e l'ardire, col qual domina esso Mare benche indomito, e lo cavalca, e governa, e regge ... Non è, se vogliamo dir il vero, operation alcuna, nella quale l'huomo dimostri, ò ingegno, ò ardire, ò industria maggiore, che la navigatione." Botero, *Aggiunte,* 86r.
[82] "Perche, che cosa è l'arte del cavalcare a paragone del navigare? Certo è tanto maggior di quella, quanto il Mare, che un cavallo; e la furia de' venti, che la bravura di un gianetto." Botero, 86r.
[83] Botero, 86r.
[84] "...per lo cui mezo l'huomo ingolfandosi sopra una fragil navicella in alto Mare, regola i venti, e solca le onde, e trova la strada in mezo l'Oceano?" Botero, 86r.
[85] "...che commendatione si deve à un Nocchiero, che si acpre la strada per l'Oceano." Botero, 86v.

network potentials of the high seas. With the successes of the Portuguese and later Spanish voyages around the Cape of Good Hope and across the Atlantic, the dangerous and undifferentiated aquatic spaces that that had long imposed definite limits to European territorial expansion instead presented new pathways for circulation, forming a new infrastructural field for forging connections to distant lands.[86]

After an extended return to natural philosophical considerations, Botero again revisits political-economic ones in the concluding segment of his essay, where he frames commodious aquatic geographies as an integral component of the *grandezza* of cities and states. His argument is functionalist, deeply material, and hinges on accessibility: regions where the land and water intermingle and infiltrate one another, creating interfaces that facilitate movement through and across these spaces, are best suited to benefit from the profits of mobility and commerce. He uses the example of the Mediterranean Sea, which he deems the "most excellent" of all inland seas for its large size, and because it is the only one of its kind to so closely connect Europe, Asia, and Africa across it shores. Yet by his assessment, it is his own continent of Europe that most benefits from the affordances of its maritime situation. While the Mediterranean Sea bathes the coasts of all three Old World continents, carving interstitial zones along their littorals, "this sea makes more retreats, and havens in Europe, than in other parts; whereby people are invited to navigation, to merchandise, to traffic; and from these things arise the magnificence of

[86] Michel Foucault hints at the early modern thalassic imaginary at the end of his essay "Of Other Spaces," trans. Jay Miskowiec, *Diacritics* 16, no. 1 (1986): 22–27. For further discussion of the sea-space imaginary, see Hannah Baader and Gerhard Wolf, eds., "Maritime Tableaus. Eine Vorbemerkung," in *Das Meer, der Tausch und die Grenzen der Repräsentation* (Zurich: Diaphanes, 2010), 7–11. Alfred W. Crosby offers an informative outline of the incremental process by which European mariners harnessed maritime winds to complete so-called "round trips" across the high seas in the fifth chapter of his book, *Ecological Imperialism: The Biological Expansion of Europe, 900–1900* (New York, NY: Cambridge University Press, 2004), 104–131.

cities, and the *possanza* of the subjects."[87] Here is his most general admission of the economically- and environmentally-deterministic form of reasoning he built up inductively over the course of his previous writings. In the case of Europe's southern border, it is the abundant maritime proximities created by the particular formal dispositions of land and sea that incite commercial action, feeding the growth of large, prosperous, *great* cities. Closing a dedicated encomium to the seas, this is perhaps Botero's most explicit statement yet about the role of the aquatic environment in effecting political-economic development.

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During the closing years of the sixteenth century, Giovanni Botero developed a novel vision of statecraft that redrew the boundaries of Renaissance political thought. Looking globally to examples of celebrated powers from the ancient world to his present day, he argued that to become "great," Italy's princely states need not conquer new lands nor radically expand their territories. Rather, they had first and foremost to grow wealthy by engaging their subjects in industrial and commercial activities, transforming the raw materials of nature into finished goods to be exported abroad and converted to riches. This political-economic program, as the present chapter has shown, was noteworthy in centering the natural world, and specifically aquatic landscapes, as targets of governance: for Botero, water formed an infrastructural matrix that lubricated the processes of transfer and exchange that funneled wealth and power to states. Presented initially in *On the Causes* as only one among a host of factors that supported commerce and contributed to

[87] "E di più, esso mare fa più ritirate, e seni nell'Europa, che in altra parte: da quali i popoli sono invitati alla navigatione, alla mercatantia, al traffico; e da queste cose nasce la magnificenza delle città, e la possanza de' popoli." Botero, *Aggiunte*, 95r.

economic growth, over the course of the *Universal Relations* and *Relations of the Sea*, Botero eventually came to conceive of systems of aquatic navigation as a fundamental underlying cause of prosperity, and even as powerful symbols of *grandezza*'s good fortunes. As a proponent of statist intervention across all realms of political life—he would eventually describe the state as a form of raw "material," and the prince, its "artificer"—hydraulic improvements were also a central feature of Botero's environmental statecraft.[88] Therefore, while regions endowed with generous, viable waterways could engage in commerce with ease, states lacking in these natural affordances could instead create them artificially by straightening and quelling rivers, building canals and trenches, and containing waters with seawalls and dams. In seeing the aquatic landscape as a field of potential, amenable to spatial and material action, Botero granted architecture and infrastructure a novel and expanded political charge, incorporating territorial design quite explicitly into an ever-widening conception of affairs of state.

There is evidence that Botero's aquatic infrastructural insights went on to inform a much wider body of Italian political economic thought from the turn of the seventeenth century, virtually immediately after his work appeared in print. For example, in his political treatise, the *Discorsi sopra Cornelio Tacito* (1594), the Florentine scholar and courtier Scipione Ammirato (1531–1601) advised princes to construct circulatory routes by channelling and diverting rivers.[89] In the same way that "nature needs to be aided by

[88] This metaphor, in the introduction to his 1596 edition of *Reason of State*, read thus: "The reason is that reason of state presupposes the prince and the state (the former as the artificer, the latter as the material), which are not presupposed at all by foundation and in part by expansion; rather they are preceded by them." Giovanni Botero, *The Reason of State*, ed. Robert Bireley (Cambridge: Cambridge University Press, 2017), 4, n. 2.

[89] The chapter heading is "De congiungimenti de fiumi per via di fosse e di divertimenti di essi per varie cagioni." Scipione Ammirato, *Discorsi del signor Scipione Ammirato sopra Cornelio Tacito, nuovamente*

art," he explained, so rulers ought to ease passage through the landscape by manipulating waterways "to liberate the going and coming to everyone, such that merchandise from hence and thence may be transported to supply the needs of mortals."[90] Likewise moved by Botero's considered reflections on the aquatic aspects of power, the friar and political philosopher Tommaso Campanella (1568–1639) advised the king of Spain, in a treatise outlining a program for expanding and enriching his empire, to fill the sea with "wooden cities"—that is, merchant fleets—and to build ports and havens along their coastlines in the Mediterranean and Atlantic.[91] While only brief chapters within lengthy, sprawling political commentaries, these reflections evince the rapid diffusion of Botero's significant realizations about the formidable powers of aquatic landscapes and the connective infrastructures and processes of improvement that rendered them navigable within the competitive arena of the emerging European state system.

Before long, however, Botero's teachings would also shape aquatic and territorial political economy beyond Italy, as well. Those scholars and statesmen recognized most readily by modern historians as early modern Europe's foremost economic thinkers and improvement idealists, from Francis Bacon, to William Petty, to Veit Ludwig von Seckendorff, to Antoine de Montchrestien, to Adam Smith, to name only a handful, were all indebted to the former Jesuit's ideas, even if they did not (as was usual) always

posti in luce (Florence: Filippo Giunti, 1598), 305. I intend to examine how Ammirato and other Tacitist writers discussed aquatic territories and infrastructures in a future study.

[90] "Ciascuno puo vedere in se medesimo; che la natura hà bisogno d'esser aiutata dall'arte." / "... per far libero l'andare e'l tornare a ciascuno; onde le merci quinci e quindi trasportate a bisogni de mortali sovvengano." Ammirato, 305.

[91] In Italian, the quoted words read as "città in mare di legname." See Tommaso Campanella, *Monarchie d'Espagne et Monarchie de France*, ed. Germana Ernst, trans. Nathalie Fabry (Paris: Presses universitaires de France, 1997), 357–62 for the definitive text of this chapter.

acknowledge this fact.[92] In their writings, from mirrors for princes, to manuals on the sciences of Cameralism and mercantilism and the diversifying traditions of would soon be called "political economy," navigation and its material, territorial infrastructures came to form canonical and enduring topics.[93] Yet if the Italians were clairvoyant about *grandezza*'s aquatic and territorial essences, they would, in the final accounting, be beaten at their own game, surpassed by states that could extend Botero's maxims beyond domestic landscapes to vaster, imperial "liquid plains."[94]

[92] On Botero's centrality to a vast tradition of political economic writings in the Cameralist and mercantist traditions, for instance, see Reinert and Carpenter, "German Language Economic Bestsellers before 1850", and Reinert and Fredona, "Political Economy and the Medici," 176–77.

[93] See for example, the chapter "De la navigation" in Antoine de Montchrestien, *Traicté de l'oeconomie politique: dedié en 1615 au roy et à la reyne mère du roy*, ed. Théophile Funck-Brentano (Paris: E. Plon, Nourrit et Cie, 1889), 273–333; Jerónimo de Uztáriz, *Teoría y práctica de Comercio y Marina en diferentes discursos* (Madrid, 1724), who discussed the importance of building canals and improving rivers and ports; and the chapter, "Of the public Works and Institutions for facilitating the Commerce of the Society," in Adam Smith, *An Inquiry into the Nature and Causes of the Wealth of Nations*, ed. Edwin Cannan (New York: Modern Library, 1994), 780–818.

[94] While rendered in the original French as "plaines liquides," it appears in Siân Reynolds's English translation as "plains of the sea." Fernand Braudel, *La Méditerranée et Le Monde Méditerranéen à l'époque de Philippe II* (Paris: Colin, 1949), 73; Fernand Braudel, *The Mediterranean and the Mediterranean World in the Age of Philip II*, trans. Siân Reynolds, vol. 1 (Berkeley: University of California Press, 1995), 103.

CONCLUSION

Throughout this study, I have argued that the problems of aquatic disorder in early ducal Tuscany gave rise to a novel way of thinking about state building in highly material terms. For the engineers, architects, technocrats, and scholars examined in the foregoing chapters, unruly rivers became tools to think with. As climatic changes on the eve of the Little Ice Age precipitated a crisis of alluvial flooding, during the very same years in which a new and untested ducal regime worked to consolidate power and project authority across the Florentine dominions, aquatic territory arose, both as a problem and as an opportunity. As government experts dispatched to resolve problems and restore order in the landscape grappled to comprehend and tame waterways, they came to realize that subduing these systems, in all their physical and scalar complexity, demanded centralized and coordinated forms of political action. If the Medicean state in this period can best be characterized as overwhelmingly pactist in nature—tied together in large part by reciprocal agreements that preserved, under ducal tutelage, varying degrees of customary local autonomies and administrations—the exigencies of hydrographic management were the exception that proved the rule.[1] For better and for worse, technocrats developed a set of pragmatic arguments about how the welfare of the state and the common good of its people justified the pursuit of integrationist policies in matters of aquatic stewardship. Eventually, these forms of territorial control were

[1] For a historiographical overview, see Andrea Gamberini and Isabella Lazzarini, eds., *The Italian Renaissance State* (Cambridge, UK: Cambridge University Press, 2012); for two examples of scholarship from the leading historians of this model, see Elena Fasano Guarini, "Potere centrale e comunità soggette nel Granducato di Cosimo I," *Revista storica italiana* 89 (1977): 491–538; Luca Mannori, *Il Sovrano tutore: pluralismo istituzionale e accentramento amministrativo nel principato dei Medici (Secc. XVI-XVIII)* (Milan: Giuffrè, 1994).

invoked and pursued not merely to maintain order—to return alluvial ecologies to some putative primeval balance—but also to reimagine the state's hydraulic environments as utopian, utilitarian infrastructures of communication, and to begin to slowly act on this audacious vision.

Soon enough, these sorts of practices and their motivating aims received synthetic elaboration as a keystone of good government in an increasingly interconnected and competitive world. For the *Cinquecento* prince and his absolutist progeny (as much as, for that matter, their later parliamentary and liberal detractors), the prudential design of aquatic territory became a material affair of state, as crucial to firmly consolidating secular power as were matters treated in the older Machiavellian canon. Since we saw at the end of the final chapter how Botero's influential pronouncements on these themes were readily set alight in political economic theory within Italy and other parts of Europe, it seems only fitting to conclude by adumbrating, however briefly, an example of how such ideas could also, in turn, be refracted back upon the landscapes of central Italy, animating and sustaining meliorist visions of its watery environments in the aftermath of our story.

In the years around 1600, the little-known Aretine scholar, secretary, and prelate Baldassarre Nardi (b. 1565) seemed to invoke Botero's lessons in an erudite defense of the drainage projects then being pursued by Ferdinando I's government in the Val di Chiana.[2] Prompted by the chance observation, so he explained in his opening dedication

[2] Nardi's study is BR, Ricc. 2575. Draft fragments of this work are in ASA, Fondo Fossombroni, 9/5. The only modern study I have found of Nardi is Maria Chiara Milighetti, "Un aretino a Bruxelles. Le lettere di Baldassarre Nardi (1565–1642) a Giovanni Francesco Guidi di Bagno," *Atte e memorie della Accademia Petrarca di Lettere, Arti e Scienze* LXVII–LXVIII (2006 2005): 321–58. See 324-327 for his brief biography.

to Maria Cristina, of "the desiccation of the Chiana, not far away" from his villa (where he had retired one summer to "draw up advice for political and moral prelates on the instruction of Christian princes"), Nardi decided to compose "a few discourses" on the utility of "so laudable a work."[3] He hoped that his study, the resulting *Discorsi intorno alla diseccatione delle Chiane*, would disarm the projects' detractors, who had criticized the ongoing reclamation as a principal cause of the continuously unpredictable surges and floods of the Tiber River in Rome.[4] A substantial manuscript tome, it described, in 19 chapters, the hydrogeographical evolution of the Val di Chiana and argued for the public benefits of its reclamation (and of the reclamation of marshlands in general, for that matter). These Nardi identified principally as the amelioration of the air, flood mitigation, the opening up of further lands to settlement, and navigation. He also underlined how these benefits were reciprocally linked; as he pointed out, for example, sustaining an active commerce demanded the careful maintenance of waterways, which in turn prevented them from swelling into boggy wetlands that putrefied the air.[5]

Grounding his arguments upon layers of historical and contemporary precedents, the learned Nardi harvested a dizzying array of sources to compare and distil models of

[3] The part of the dedication I quote from selectively here reads as follows: "Mentre che, Serenissima Signora io m'era questa passata estate in una mia villa ritirato per raccogliere alcuni avvertimenti co' i quali io credo che facilmente si possa i politici, e i morali prelitti con quelli della Religione congiugnendo insegnare un Principe Cristiano, hebbi piu volte occasione di rimirar quindi poco lontano la diseccattione delle chiane fatta per ordine del Serenissimo Gran Duca suo consorte e mio Signore, e considerando quanto utile ella habbia comunemente apportato, riconosceva in essa la bontà di cosi gran Principe, e l'altezza dell'animo suo tra me stesso commendava; meravigliandomi dall'altra parte che opera cosi lodevole fosse da molti biasimata; e particolarmente da coloro, i quali vogliono che la chiana dell'inondar del Tevere sia cagione; la onde sicome la verita subitamente l'animo nostro commove, mi senti dalla propria opinione, ne so dir come tirato a scriverne questi pochi discorsi, i quali comunque si siano d'ogni ornamento ignudi, ma di ricco manto di devotione vestiti à V.A.S. …" BR, Ricc. 2575, fols. 2r-v.

[4] BR, Ricc. 2575, fol. 2v.

[5] One of Nardi's chapters, "Che la Chiana tralasciatasi la navigatione del Tevere, una palude divenne," is about how the Chiana River became a swamp once navigation along the Tiber slowed or ceased after the fall of the Roman Empire. BR, Ricc. 2575, fols. 15r–22v.

aquatic territorial management from around the world. He toggled often between his local Italian peninsular context to the global examples of republics, kingdoms, and empires past and present, stretching from Rome, to France, to China, to Persia, to Egypt, and many other places besides.[6] A constant refrain of his writing, however, was that "art," in the form of aquatic terraforming, navigation, and commerce, "could supply the defects of a place" to enrich princes and their peoples.[7] The entire text of the *Discorsi* is suffused with these sorts of Boterean logics, which draw in turn on examples set by utopian visionaries and projectors, those bureaucrats and technicians who labored to order territory in practice, day in and day out. And if Nardi never clearly credited Botero (in this period, contemporary writers were not, after all, noted as consistently as ancient authorities were), we may be fairly certain that the former Jesuit's works served him as a fundamental source of inspiration. Nardi, after all, was an associate of the cosmopolitan Florentine Cardinal Guidi di Bagno (1578–1641), whose court at Rome was a thriving center for discussions of the latest *avant garde* ideas in politics and letters—which centered, unsurprisingly for this time and place, on the reason of state.[8] By tackling head-on the art of "conserving states" from the specific and very real menaces of *water*, Nardi appears to bring us full circle: in his marshy mirror for princes, he made clearer than ever the nature and the stakes of the problem of aquatic territorial design that consolidating states and their burgeoning societies could not but afford to face.

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[6] His sources included classical Greek and Roman authorities, medieval jurisprudence on property and riparian matters (Bartolus of Sassoferato is cited often), and, while not always cited, contemporary geographies, surveys, and relations of cities and states from around the world.
[7] "…l'arte facilmente potrebbe al difetto della natura del luogo supplire…." BR, Ricc. 2758, fol. 161r.
[8] Milighetti, "Un aretino a Bruxelles. Le lettere di Baldassarre Nardi (1565–1642) a Giovanni Francesco Guidi di Bagno," 322–23.

For all the concerted efforts of the sixteenth- and early-seventeenth-century experts examined in these pages to improve aquatic territory, it would, in the end, take many more decades, centuries, even, for Tuscans to realize in any lasting fashion some semblance of the aquatic order they so keenly envisaged. By Ferdinando's death, significant though still relatively modest steps had been made in this direction. Piecemeal alluvial defense works had been built and rebuilt along the Arno, Sieve, Serchio, and other populous alluvial corridors; parcels of land were slowly coming to be reclaimed in the Pisan Maremma, Val di Chiana, and Val di Nievole; and the Canale dei Navicelli, perhaps the most monumental of the early ducal period's aquatic legacies, was completed in 1575, but posed chronic problems and required ongoing maintenance.[9] During the following century, the scale of aquatic planning would receive new impetus under the direction of Galileans, like the mathematician Vincenzo Viviani (1622–1703), who increasingly joined the ranks of the burgeoning Ufficiali dei Fiumi of Florence, Ufficio dei Fossi di Pisa, and sister offices in Siena, Pistoia, Grosseto.[10] But it would not be until the eighteenth century that the Tuscan state could begin to boast a more certain success in acting upon territory on the audacious scale only earlier dreamed about. Over the course of the 1700s, several of the most slaloming and volatile alluvial meanders were cut and straightened out, and more rivers and streams were confined to ever longer stretches of continuous stone and pile embankments. One such project, along a 25-kilometer stretch

[9] Anna Maria Galleriani and Benedetta Guidi, "Relazioni e rapporti all'Ufficio dei Capitani di Parte Guelfa - Parte II, Principato di Ferdinando I," in *Architettura e politica da Cosimo I a Ferdinando I*, ed. Giorgio Spini (Florence: Leo S. Olschki, 1976), 259–329.

[10] Loredana Maccabruni and Carla Zarrilli, eds., *Arno: fonte di prosperità, fonte di distruzione: storia del fiume e del territorio nelle carte d'archivio: mostra per il 500 anniversario dell'alluvione di Firenze (1966–2016)* (Firenze: Edizioni Polistampa, 2016); Cesare S. Maffioli, *Out of Galileo: The Science of Waters 1628–1718* (Rotterdam: Erasmus Publishing, 1994); Cesare S. Maffioli, *La via delle acque (1500–1700). Appropriazione delle arti e trasformazione delle matematiche* (Florence: Leo S. Olschki, 2010).

of the Arno upstream of Florence, freed extensive floodplain in the area for development.[11] But of all these endeavors, this century is renowned perhaps most of all for its immense reclamation enterprises, the famed *bonifiche* of which many Tuscans speak with an unmistakable regard to this day. Extending the initial and halting progress made under the first Medici dukes, several thousand hectares of marshland and lakes were drained from the Pisan Maremma, Val di Nievole, and especially the Val di Chiana, while its Fosso Maestro was extended and transformed into a navigable canal.[12] Though floods continued their occasional menace, never quite ceasing as hoped, the cumulative effects of this labor in the landscape dried up vast regions, yielding the Tuscan landscape as we more or less know it today. These uncovered grounds were summarily settled and put to seed, in accordance with the plans and projects emanating from the halls of the scientific academies sponsored by the new Habsburg-Lorraine dukes for rationalizing agriculture and sericulture across the state.[13]

Yet as aquatic territorial design continued to develop and evolve in Tuscany, absorbing the tenets of the new sciences and harnessing the energies of the Enlightenment-era reforms that pulsed across the European world, its proponents nonetheless continued to look back to the sixteenth century as a guide. In contrast to their present scholarly obscurity, the late Renaissance hydraulic engineers who staffed ducal administrations were a topic of keen academic and practical interest in the eighteenth century. In fact, a general rule I realized in the course of working on this project, as will

[11] Maccabruni and Zarrilli, *Arno*, 29–30.
[12] Danilo Barsanti, "Le bonifiche nell'Italia Centrale in età moderna e contemporanea: profilo storico e prospettive di ricerca," *Rivista di Storia dell'Agricoltura* XXVII, no. 2 (1987): 13–28.
[13] Eric Cochrane, *Tradition and Enlightenment in the Tuscan Academies, 1690–1800* (Chicago: University of Chicago Press, 1961), 149–155.

be evident from my bibliography, is that if the writings of this dissertation's protagonists saw the light of day at all, it was probably because they were published by an engineer, mathematician, or naturalist of the Tuscan *Settecento*.

Among them all, it was probably the prolific physician and travelling naturalist Giovanni Targioni Tozzetti (1712–1783) who most forcefully extolled the merits of this usable past. While he explored facets of sixteenth-century hydraulic undertakings across his multi-volume natural historical chorographical surveys of Tuscany, he eventually decided to devote an entire study to the matter, which he titled a *Disamina di alcuni progetti del XVI secolo di salvare Firenze delle alluvioni* ("*Examination of some sixteenth-century projects to save Florence from floods*").[14] As Targioni Tozzetti declared in his opening dedication to Pietro Leopoldo II (r. Tuscany 1765–1790), "the long-awaited execution of these [sixteenth-century] projects … was reserved for happier times in Tuscany"—by which he meant, whether sincerely, out of flattery, or perhaps both, that they were destined to be realized precisely in their lifetimes.[15] With curiosity and overwhelming reverence, he detailed the works undertaken by the Capitani di Parte Guelfa and Ufficiali dei Fiumi in those early experimental years, while also discussing the surviving manuscripts and publications of many of the hydraulic architects and engineers I studied in these very pages. Like many of his fellow travellers, Targioni

[14] Giovanni Targioni Tozzetti, *Disamina d'alcuni progetti fatti nel secolo XVI per salvar Firenze dalle inondazioni dell'Arno umilmente presentata all'altezza reale del serenissimo Pietro Leopoldo principe reale d'Ungheria e di Boemia Archiduca d'Austria Granduca di Toscana &c. &c.* (Florence: Stamperia Granducale per Gaetano Cambiagi, 1767). On Targioni Tozzetti, see Franco Venturi, "Scienza e riforma nella Toscana del settecento: Targioni Tozzetti, Lapi, Montelatici, Fontana e Pagnini," *Rivista Storica Italiana* 89, no. 1 (1977): 77–105.

[15] "La tanta sospirata esecuzione di alcuno di essi Progetti, o di qualunque altro sia giudicato migliore, era riserbata a tempi più felici per la Tosacna, l'epoca dei quali ella conta da quel Fostissimo giorno, in cui VOSTR' ALTEZZA REALE per la prima volta la ravvivò, e la consolò colla sua Augusta Presenza." Targioni Tozzetti, *Disamina d'alcuni progetti fatti nel secolo XVI per salvar Firenze dalle inondazioni dell'Arno*, v-vi.

Tozzetti deemed the progresses of his age not as a radical departure from the past, but as extensions of the achievements of his society's sixteenth-century forebears.[16] He hoped, as he explained in bringing his study to a close, that posterity might extend him the same graces:

> I wish only that many years after I am gone, that those benevolent readers should set aside their esteem and spite, which spoil the world, and should deign to pronounce their sincere judgment on my Plan, with that same impartiality, with which I examined the plans of Girolamo di Pace, of Lupicini, of the Anonymous; and if they found it well founded, executable, and useful … that they would not object."[17]

Although the eighteenth-century engineers would eventually doubt some of the technical solutions of their late-Renaissance forebears—many, for example, came to rue the vast straightening projects so enthusiastically pursued in those earlier years, gradually judging them to have done more harm than good[18]—they could nonetheless, as Targioni Tozzetti seemed to say, benefit from the collective example of this earlier generation. From them, they might learn not only about what had been trialled and attempted in the past, but also of the necessity of approaching the territory systematically, of following water's monumental movements, and of working with its forces, rather than against them.

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[16] For a recent discussion of the Tuscan Enlightenment, and for more on how its denizens perceived their relationship to the Medicean past, see Corey Tazzara and Paula Findlen, "Introduction: Tuscany and Enlightenment in the Atlantic World," in *Florence after the Medici: Tuscan Enlightenment, 1737-1790*, ed. Corey Tazzara, Paula Findlen, and Jacob Soll, Routledge Studies in Renaissance and Early Modern Worlds of Knowledge (New York: Routledge, Taylor & Francis Group, 2020), 1–37, indebted to earlier pathbreaking work in the area, and in the history of the Italian Enlightenment in general, by Franco Venturi. See his *Utopia and Reform in the Enlightenment* (Cambridge, UK: University Press, 1971), and Venturi, "Scienza e riforma nella Toscana del settecento: Targioni Tozzetti, Lapi, Montelatici, Fontana e Pagnini."

[17] "Unicamente desidererei, che i Benigni Lettori ponendo da parte i rispetti, e i dispetti, che guastano il mondo, e considerandomi come già morto da molti anni, si degnassero di proferire il loro sincero giudizio sul mio Piano, con quella medesima imparzialità, colla quale io ho esaminato i Progetti di Girolamo di Pace, del Lupicini, dell'Anonimo; e se lo trovassero ben fondato, eseguibile, ed utile per Firenze, non contrariassero." Targioni Tozzetti, *Disamina d'alcuni progetti fatti nel secolo XVI per salvar Firenze dalle inondazioni dell'Arno*, 74.

[18] Giancarlo Severini, *Fortificazioni e controllo delle acque in Toscana fra '500 e '600: il caso di Pisa* (Pisa: ETS, 1999), 38 and passim.

To these insights on the importance of scalar thinking, the *Settecento* Tuscans therefore added another element: the aquatic environment is, as they saw it, a palimpsest, the product of generational action and inaction, and its repercussions over vast spans of time. If we, in turn, are to take any lessons from this history, confronted as we are with our own flood crises, and with environmental devastation more dire and on scales far vaster than we have ever previously measured, we could do worse than to remember the example of some of our intrepid architect-engineers.[19] Faced with a muddy and dangerous landscape, and cowed by its destructive and incomprehensible powers, they resolved, against all odds, to find solutions—"going along," as the elderly Girolamo di Pace advised, "bit by bit."[20]

[19] On the case for threading a *via media* between climate "doomism" and techno-utopianism, see Dagomar Degroot, "Our Planet Is Not Doomed. That Means We Can, and Must, Act," *Washington Post*, October 7, 2021, sec. Opinion, https://www.washingtonpost.com/opinions/2021/10/07/our-planet-is-not-doomed-that-means-we-can-must-act/.

[20] Girolamo di Pace da Prato: "…ma andandola seguitando à poco à poco…." BNCF, Manoscritti Palatini 788, fol. 3v.

APPENDIX I

Sixteenth-century printed and manuscript texts on aquatic territory, ordered by location of publication or collection

Arezzo

1. Nardi, Baldassare. "Discorsi di Baldassarre Nardi Aretino intorno alla disseccazione delle chiane." BR Ricc. 2758, late 16th–early 17th century.

Cesena

2. Mengoli, Cesare. *Della nauigatione del Po' di Primaro, et dell'essicatione delle paludi, che le sono a destra in Romagna. Discorso di Cesare Mengoli*. Cesena: Francesco Raverio, 1600.

Ferrara

3. Aleotti, Giovanni Battista. *Dell'interrimento del Po di Ferrara e divergenza delle sue acque nel ramo di Ficarolo [16th century]*. Ferrara: Domenico Taddei, 1847.

4. Vivoli, Giuseppi. *Discorso di d. Gioseppe Viuoli da Rauenna canonico regol. Latteranense intorno all'essicatione delle valli di Romagna, Bologna, & Ferrara*. Ferrara: Vittorio Baldini, 1599.

Florence

5. Albizi, Lorenzo. "Ragionamento sopra il bonificare il Paese di Pisa fra Messer Gio. Caccini, Maestro Davitte Fortini, e Lorenzo Albizi, al Serenissimo Cardinale, e Gran Duca Unico mio Signore [1568]." In *Raccolta d'autori che trattano del moto dell'acque, divisa in tre tomi. Tomo primo*, 25–34. Florence: Stamperia di S. A. R., 1723.

6. De Raet, Wilhelm. "Scritta fra il Serenissimo Gran Duca di Toscana e Guglielmo Raet per farsi navigabile il Fiume d'Arno." ASF, Miscellanea Medicea, 28/7, 1577.

7. Di Pace da Prato, Girolamo. "Memoriale sopra la natura, il corso, ed i ripari di quasi tutti i fiumi e fossi dello Stato Vecchio, e sopra i regolamenti, che vi erano stato fatti fino all'anno 1558, e che si sarebbero dovuti fare nell'avvenire." BNCF, Landau Finaly, 97, 1558?.

8. Di Pace da Prato, Girolamo. "Memoriale sopra la natura, il corso, ed i ripari di quasi tutti i fiumi e fossi dello Stato Vecchio, e sopra i regolamenti, che vi erano stato fatti fino all'anno 1558, e che si sarebbero dovuti fare nell'avvenire." BNCF, Manoscritti Palatini 788, 1558.

9. Lupicini, Antonio. *Discorso d'Antonio Lupicini, sopra i ripari del Po, et d'altri fiumi, che hanno gl'argini di terra posticcia*. Florence: Giorgio Marescotti, 1586.

10. ———. *Discorso d'Antonio Lupicini sopra i ripari delle inondazioni di Fiorenza. Al Sereness. Don Ferdinando Medici Gran Duca di Toscana*. Florence: Giorgio Marescotti, 1591.

11. Rondinelli, Giovanni. "Discorso del disseccar la Chiana, alla Serenissima Granduchessa di Toscana, fatto l'Anno 1591." BNCF, Magl. XXV 312, fols. 12r–14v, 1591.

Fucecchio

12. Ceseri Frullani, "Gl'Avvenimenti del lago di Fucecchio e modo del suo governo di Ceseri Frullani da Cerreto Guidi. Con un breve sommario di tutta l'opera nel Principio, e con la tavola de capitoli nel fine del libro." ASF, Carte Strozziane, Serie I/116, late 16th–early 17th century.

Milan

13. Duchy of Milan. *Capitoli dell'impresa delle noua nauigatione del fiume d'Adda*. Milan: Leonardo da Ponte, 1591.

14. ———. *Capitulatione fatta tra l'illust. signori deputati a nome della inclita città di Milano, con l'egr. Gioseppe Medda, architetto d'essa città per ridurre il fiume d'adda nevigabile dal Lago Di Como, sino alla bocca del Naviglio Di Martesana*. Milan: Leonardo da Ponte, 1580.

15. Mazenta, Guido. *Discorso del sig. Guido Mazenta vno delli signori Sessanta del Consiglio generale della città di Milano. Intorno il far nauigabile il fiume Adda*. Milan?, 1599.

Padua

16. Angeli, Bonaventura. *La decrittione del Po tratta da commentarii de fiumi*. Padua: Lorenzo Pasquato, 1578.

17. Cornaro, Alvise. *Arricordo del Magnifico m. Aluise Cornaro nobile Venetiano del modo che si ha da tenere per fare che il fiume Musone con la Brenta vadi al mare per il Porto di Chioza*. Padua: Grazioso Percacino, 1560.

18. ———. *Trattato di acque del Magnifico M. Luigi Cornaro nobile Vinitiano*. Padua: Grazioso Percacino, n.d.

Parma

19. Angeli, Bonaventura. *Della descrittione del fiume Della parma et dell'historia della città di Parma, libri otto*. Parma: Erasmo Viotto, 1590.

20. *Della descrittione del fiume della Parma, et dell'historia della città di Parma, libri otto. di Bonauentura Angeli Ferrarese. Doue si ragiona particolarmente d'alcune delle più nobili famiglie della città, et delle cose pertinenti all'historia vniuersale di tutta Italia. Con la tauola di tutte le cose notabili contenute nell'opera*. Parma: Erasmo Viotto, 1590.

Perugia

21. Chiarante, Paolo. *Della inondatione del Teuere, et della nuoua foce del medesimo*. Perugia: Pietro Giacomo Petrucci, 1577.

Rome

22. Bacci, Andrea. *Del Teuere della natura et bontà dell'acque & delle inondationi. Libri II di m. Andrea Bacci*. Rome: Valerio e Luigi Dorico in luogo di quella di Vincenzo Luchino, 1558.

23. ———. *Del Teuere libro quarto. Con un sommario di Ludouico Gomes di tutte le prodigiose inondationi dal principio di Roma*. Rome: Stamperia Camerale Roma, 1599.

24. Beni, Paolo, and Gaspare Ruspa. *Discorsi sopra l'inondation del Teuere alla santità di nostro sig. Clemente VIII doue oltr'il disputarsi e risoluersi in questa materia varij e diuersi dubbij non men'vtili che curiosi, si va mostrando con particolar diligenza, quali siano state le vere cagioni di tal'inondatione, e quai siano i sicuri & efficaci rimedij. Del s. Paolo Beni da Vgubbio. Posti in luce da Gaspare Ruspa*. Rome: Niccolò Muzi & Guglielmo Facciotti, 1599.

25. Castiglione, Giacolo. *Trattato dell'inondatione del Teuere di Iacomo Castiglione romano doue si discorre delle caggioni e rimedij suoi e si dichiarano alcune antichità e luoghi di autori vecchi. Con una relatione del diluuio di Roma del 1598. Raccolta da molti diluuij dalla fondatione sua, et pietre poste per segni di essi in diuerse parti di Roma, con le sue altezze, e misure. E con un modo stupendo col quale si saluarono molte famiglie in Castel sant'Angelo. Nouamente posto in luce*. Rome: Guglielmo Facciotto & Giouanni Martinelli, 1599.

26. *Consiglio e deliberatione del Teuere*. Rome?, 1557.

27. *Consiglio, e deliberatione del Teuere, con gli altri fiumi suoi vassalli ... con una frotola bellissima che narra il danno che il Teuere ha fatto per Roma*. Rome?, 1557.

28. Modio, Giovanni Battista. *Il Teuere di m. Gio. Battista Modio. Doue si ragiona in generale della natura di tutte le acque, et in particolare di quella del fiume di Roma*. Rome: Luchino, Vincenzo, 1556.

29. Mora, Domenico. *Del colonello Domenico Mora bolognese sopra l'innondatione del Teuere di Roma, della fortificatione di Castel S. Angelo, & del porto da farsi alla foce del Teuere* .. Rome: Guglielmo Facciotti, 1600.

30. Steuco, Agostino. *Ad Paulum III pontificem maximum de restituenda nauigatione Tiberis a Trusiamno agri Perusini castello vsque Romam, Augustini Iguini Bibliothecarii sui Oratio*. Rome: Baldassarre Cartolari, 1541.

31. Trevisi, Antonio. *Fondamento del edifitio nel quale si tratta con la santità de n.s. Pio Papa Iiii. sopra la innondatione del fiume. Doue se declara l'origine, et qualità, delle acque, celeste, terrestre, e maritime, e la loro distantia, con la qualità et origine de tutti i fonti et fiumi, e la causa della salvezza del mare, e come si generano, et procedono tutte le inondationi del mondo. Con un breue discorso come se potriano recuperare tutti li vascelli che affondati fussero nelle acque maritime. Fondato con la ragione delli quattro elementi. Per l'honorabile architetto m. Antonio Triuiso della città di Leccie*. Rome: Antonio Blado, 1560.

32. Venice

33. Bacci, Andrea. *Del Teuere di m. Andrea Bacci medico et filosofo libri tre, ne' quali si tratta della natura, & bontà dell'acque, & specialmente del Teuere, & dell'acque antiche di Roma, del Nilo, del Pò, Dell'arno, & d'altri fonti, & fiumi del mondo. dell'vso dell'acque, et del beuere in fresco, con neui, con ghiaccio, et con salnitro. delle inondationi, & de rimedii, che gli antichi Romani fecero, & che hoggidì si possan fare in questa, & in ogni altra inondatione*. Venice: Aldo Manuzio, 1576.

34. Republic of Venice. *Carrattada da esser compartida tra li particolari per occasion del taglio del Pò, decretada nell'eccellentiss. Senato à 16 Settembre 1599*. Venice?, 1599.

35. ———. *Parte presa nell'eccellentis. Cons.o di Pregadi 1599 adi 16 settembre. Carattada per il nouo taglio del Po*. Venice: Giovanni Antonio Rampazetto, 1599.

36. Rondinelli, Giovanni. "Discorso del disseccar la Chiana, alla Serenissima Granducchessa di Toscana, fatto l'Anno 1591." BM, Codice Marciano It. VI, 93 (=5897), Part IV, fols. 11r–13v.

37. Silvestri, Marino. *Discorso di M. Marino Silvestri D. sopra la regolazione di Po*. Venice: Nicolo Bevil'acqua, 1563.

Verona

38. Da Monte, Teodoro. *Aggiunta al compendio di tutti gli raccordi et suppliche presentate da diuersi alla serenissima sig. di Venetia, in proposito d'irrigar la campagna di Verona, et di regolar l'impetuosissimo fiume Adige, con altri suoi adherenti beneficij*. Verona: Girolamo Discepolo, 1594.

39. ———. *compendio di tutti li raccordi et suppliche presentate da diuersi alla serenissima signoria di Venetia con le contraditioni, e scritture publiche passate sopra di esse suppliche in proposito d'irrigar la campagna di Verona, cosi con l'acqua dell'adige, come con quella del lago, et di regolar l'impetuosissimo fiume Adige, con grandissimi beneficij d'irrigationi, nauigationi commodissime, et essicationi di molto paese di valli*. Verona: Girolamo Discepolo, 1594.

40. ———. *Del Signor Theodoro Da Monte quinta aeditione, nel proposito suo continuato della regolatione dell'adige. con suoi adherenti beneficij d'irrigationi, nauigationi, essicationi de valli, reparatione da lozzi, & influenze d'acque Vicentine, et Altri profiteuolissimi affetti a beneficio di tutto l'illustrissimo dominio Veneto et particolarmente della città di Verona*. Verona: Girolamo Discepolo, 1596.

41. ———. *Discorso generale sopra la regolatione dell'Adige fatto per il sig. Teodor da Monte auanti gl'illustrissimi sig. Giouanni Nani, & sig. Andrea Bragadino Rettori degnissimi di Verona. Et auanti gl'illustrissimi sig. Gio. Battista Bernardo, et sig. Siluan Capello sopraintendenti deputati dall'illustriss. & excellentiss. Senato sopra la regolation dell'Adige & sue debite prouisioni*. Verona: Girolamo Discepolo, 1598.

42. ———. *instruttione delle ragioni che ha questo sereniss. d.d. nella campagna di Verona, preuia all'irrigation sua, & altri maggior benefitij del stato suo, con il sommario delle ragioni che ha sua serenità sopra la detta campagna, dell'ill. s. Theodoro Di Monte*. Verona: Angelo Tamo, 1600.

43. ———. *liuellationi fatte per Gieronimo Pontara et Bartolomeo Montino, predicatori et liuellatori publici, l'uno di s. Marco, l'altro del territorio Veronese; ad instantia del Signor Theodoro Di Monte, in proposito della regolation dell'Adige, con i suoi adherenti benefitij, per esso auttore proposta auanti s. serenità, & rimessa per l'informatione a gl'illustrissimi ss. rettori Di Verona, con la scrittura declaratoria di esse livellationi ... con tutte le oppositioni sue più importanti fattole da diuersi, et resolutioni sue ...nouamente per l'istesso auttore aggiunta al suo compendio, et dissegno*. Verona: Girolamo Discepolo, 1595.

44. Sorte, Cristoforo. *Modo d'irrigare La Campagna Di Verona e d'introdur più nauigationi per lo corpo del felicissimo stato di venetia trouato, fino dal 1565 da m. Christoforo Sorte primo perito ordinario dell'officio dei beni inculti; con molte altre cose sue in proposito di acque molto gioueuoli, & anco di m. Antonio Magro e del Sig. Theodoro Da Monte*. Verona: Girolamo Discepolo, 1593.

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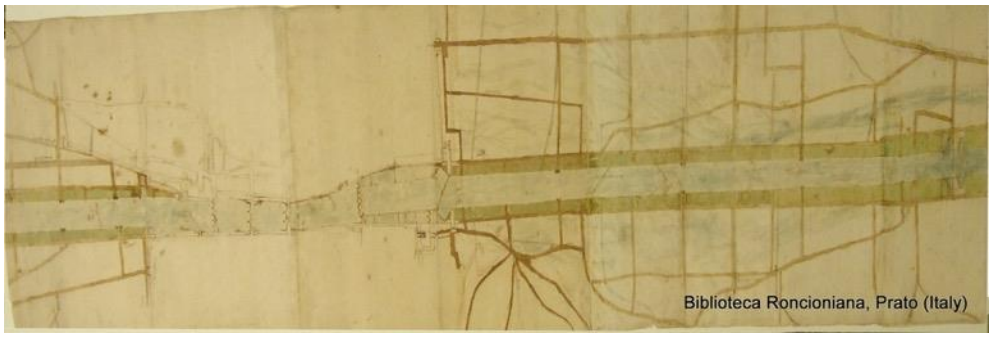
FIGURES



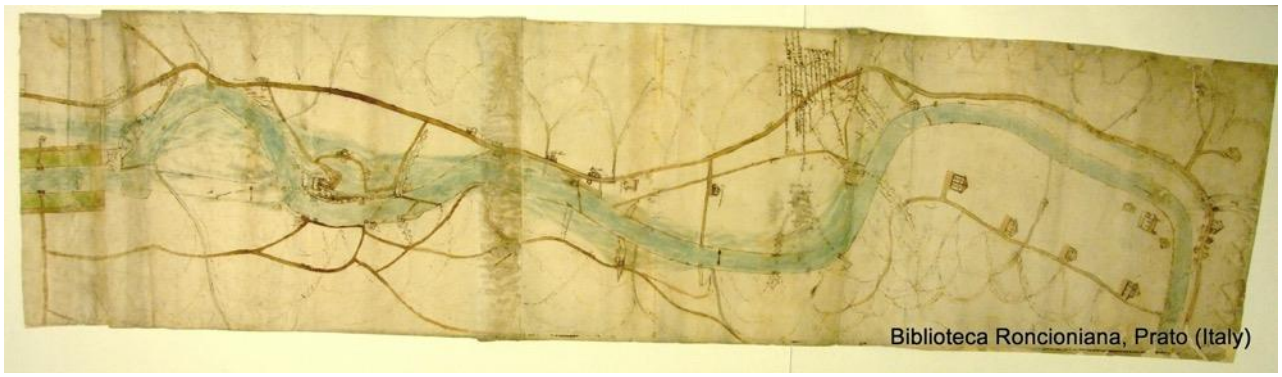


Figure 1: Girolamo di Pace, map and design of the Arno River upstream and downstream of Florence, sheets 1–4, 1534–1558, BRP, Carta Fiume Arno

Figure 2: Girolamo di Pace, map and design of the Arno River upstream and downstream of Florence, sheet 4, 1534–1558, detail showing his proposed channel cut from the Rovezzano weir to the Girone mill, BRP, Carta Fiume Arno

Figure 3: Girolamo di Pace, map and design of the Arno River upstream and downstream of Florence, sheet 1, 1534–1558, sheet 1, detail showing his proposed redirection of the Greve Torrent, BRP, Carta Fiume Arno

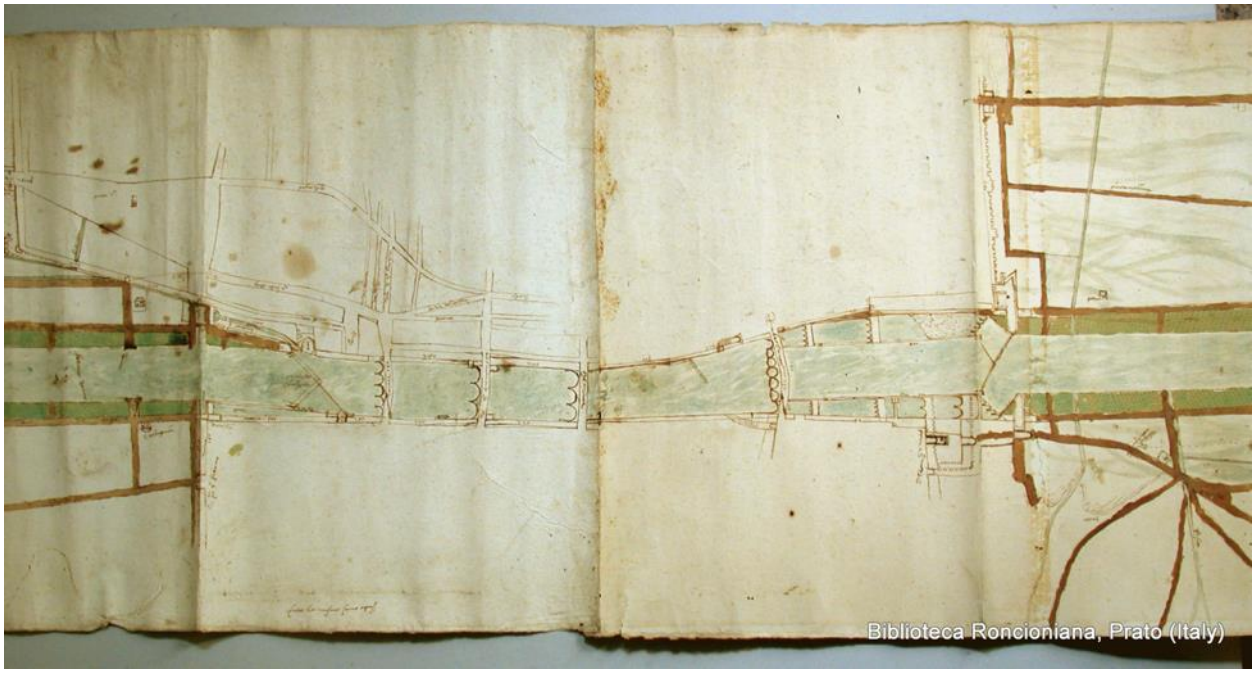


Figure 4: Girolamo di Pace, map and design of the Arno River upstream and downstream of Florence, sheet 3, 1534–1558, detail showing the trace of Florence, BRP, Carta Fiume Arno

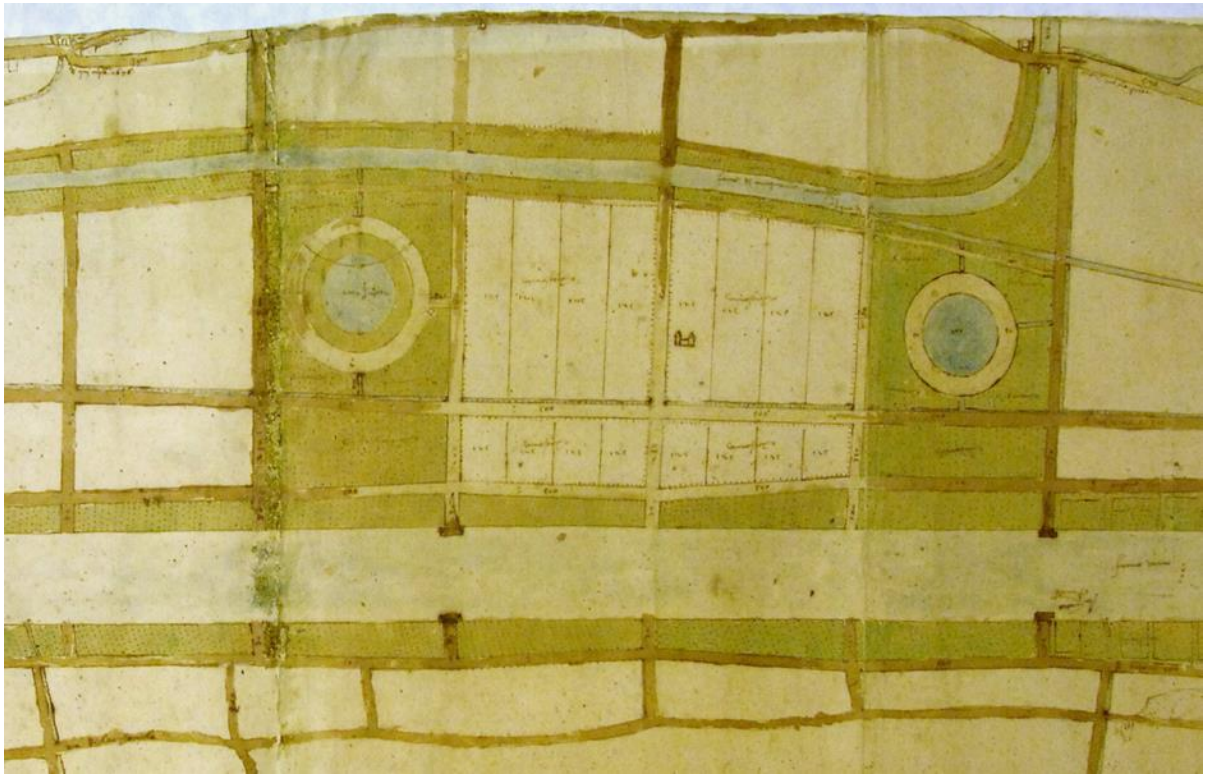


Figure 5: Girolamo di Pace, map and design of the Arno River upstream and downstream of Florence, sheet 2, 1534–1558, detail showing his proposed design for the Medici estate on the Cascine dell'Isola, BRP, Carta Fiume Arno

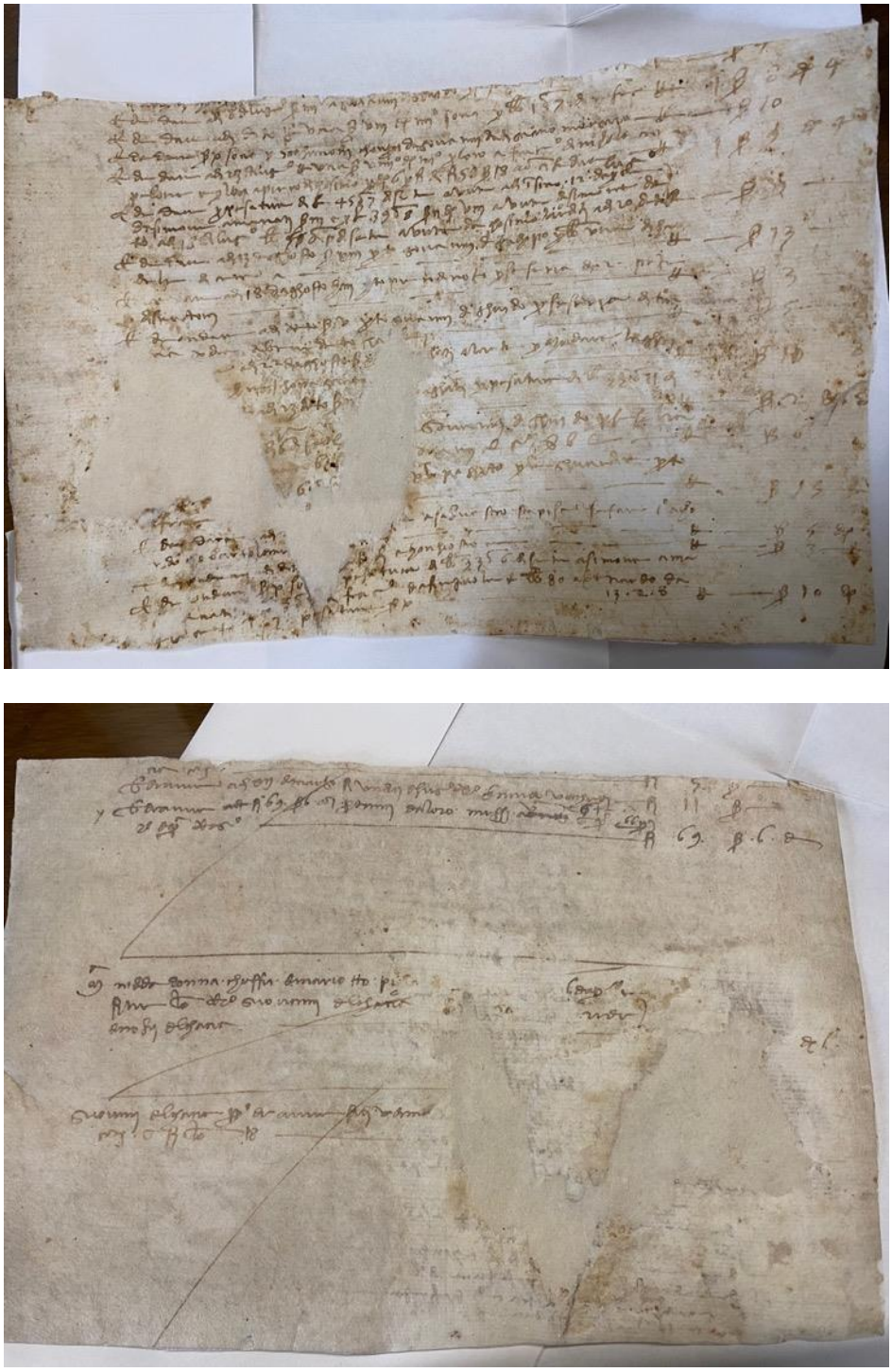


Figure 6: Visibly damaged tax tally by Mariotto di Pagolo and Niccolo di Chimenti, appended to Girolamo di Pace's map and design of the Arno River, 1534–1558, view of front and back, BRP, Carta Fiume Arno

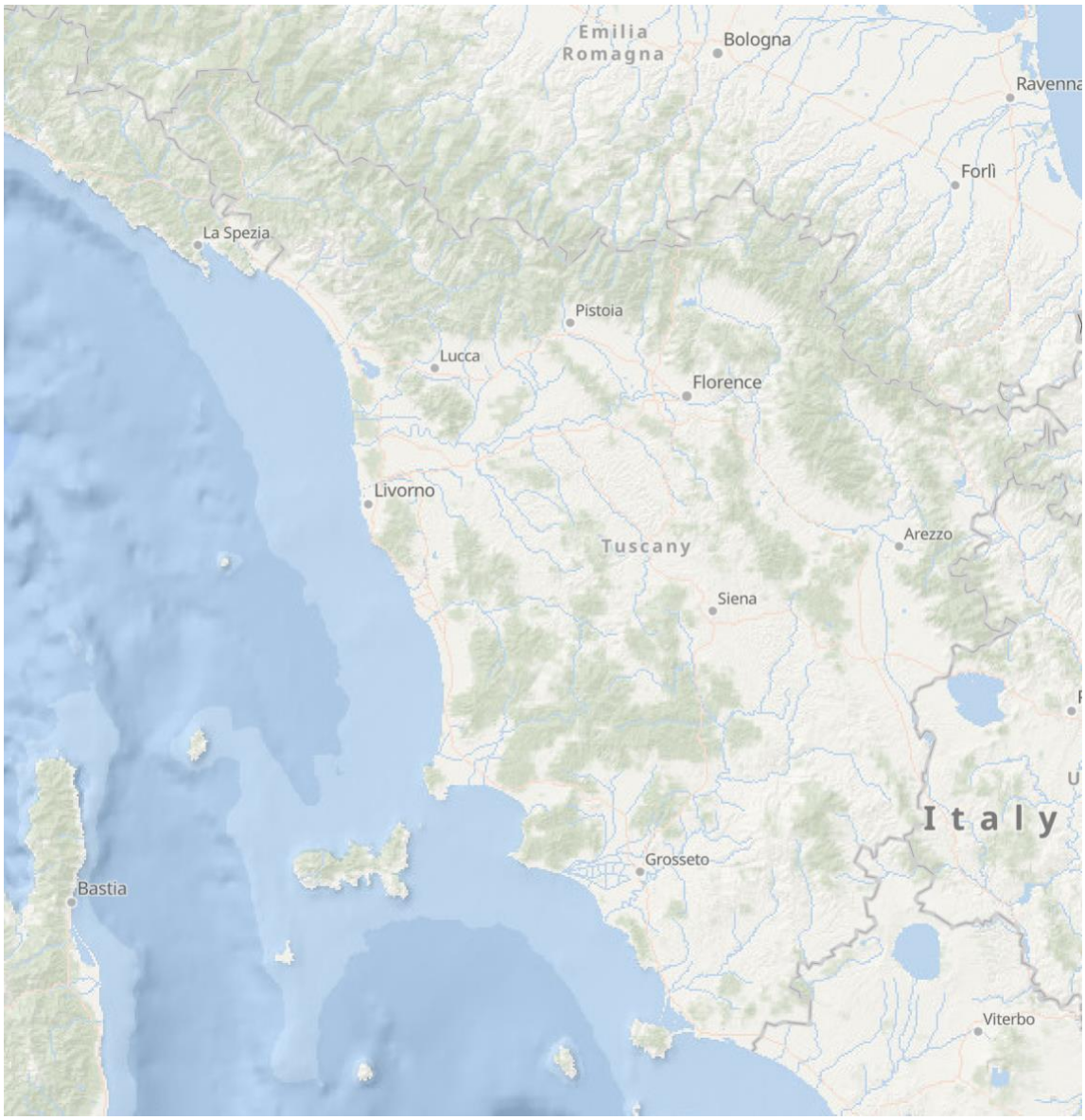


Figure 7: Arcgis map of modern Tuscany, showing its aquatic topography

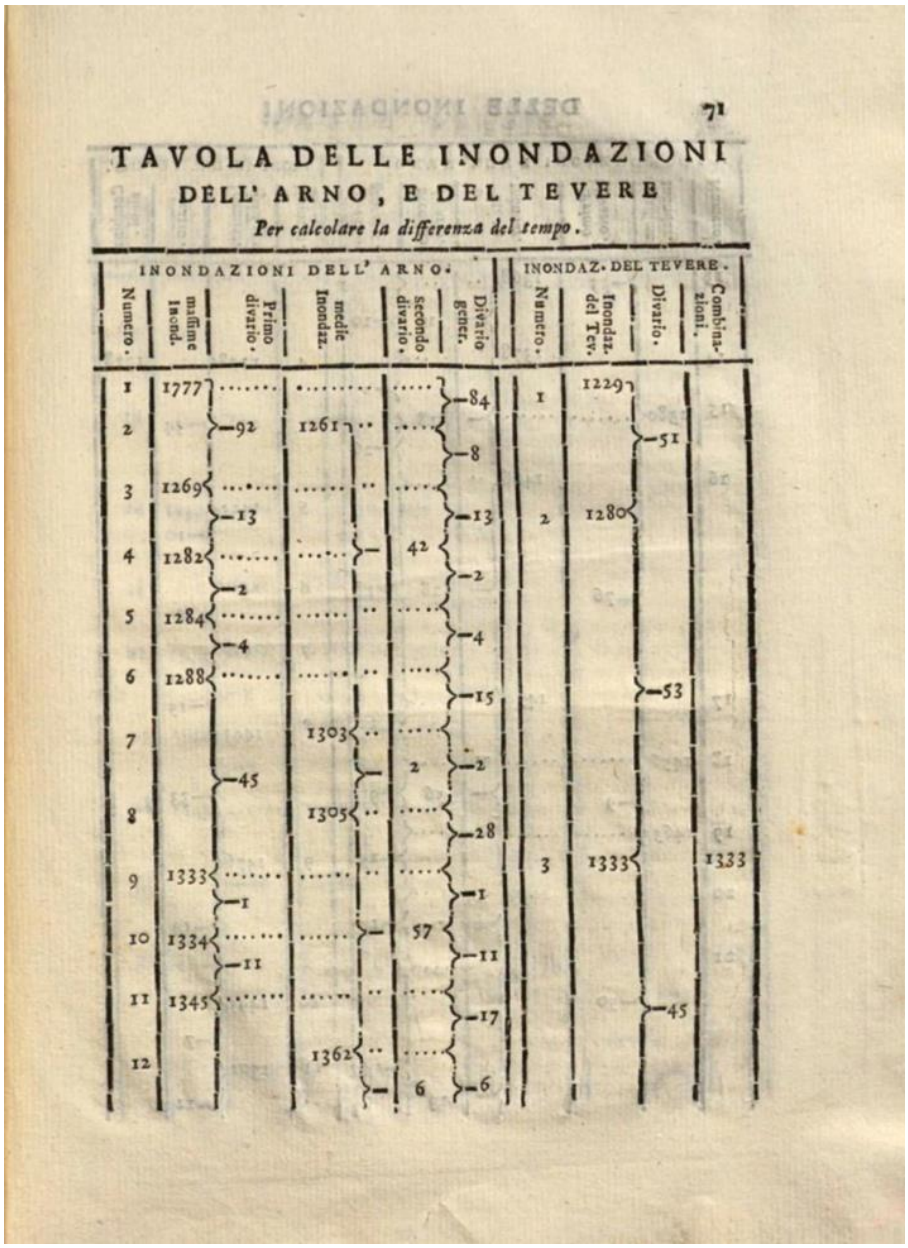


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TAVOLA DELLE INONDAZIONI
DELL' ARNO, E DEL TEVERE
Per calcolare la differenza del tempo.

INONDAZIONI DELL' ARNO.

Numero.	Inond. massime	Primo divario.	Inondaz. medie	Secondo divario.	Divario gener.
1	1777				84
2		92	1261		8
3	1269	13			13
4	1282	2		42	2
5	1284	4			4
6	1288	45			15
7			1303	2	2
8			1305		28
9	1333	1			1
10	1334	11		57	11
11	1345				17
12			1362	6	6

INONDAZ. DEL TEVERE.

Numero.	Inondaz. del Tev.	Divario.	Combinazioni.
1	1229	51	
2	1280	53	
3	1333	45	1333

Figure 8: Ferdinando Morozzi, *Dello stato antico e moderno del fiume Arno*, 1762, p. 71, showing flood tables

Figure 9: Marker of the 1333 flood, Florence, corner of Via San Remigio and Via dei Neri

Figure 10: Palagio di Parte Guelfa, Florence

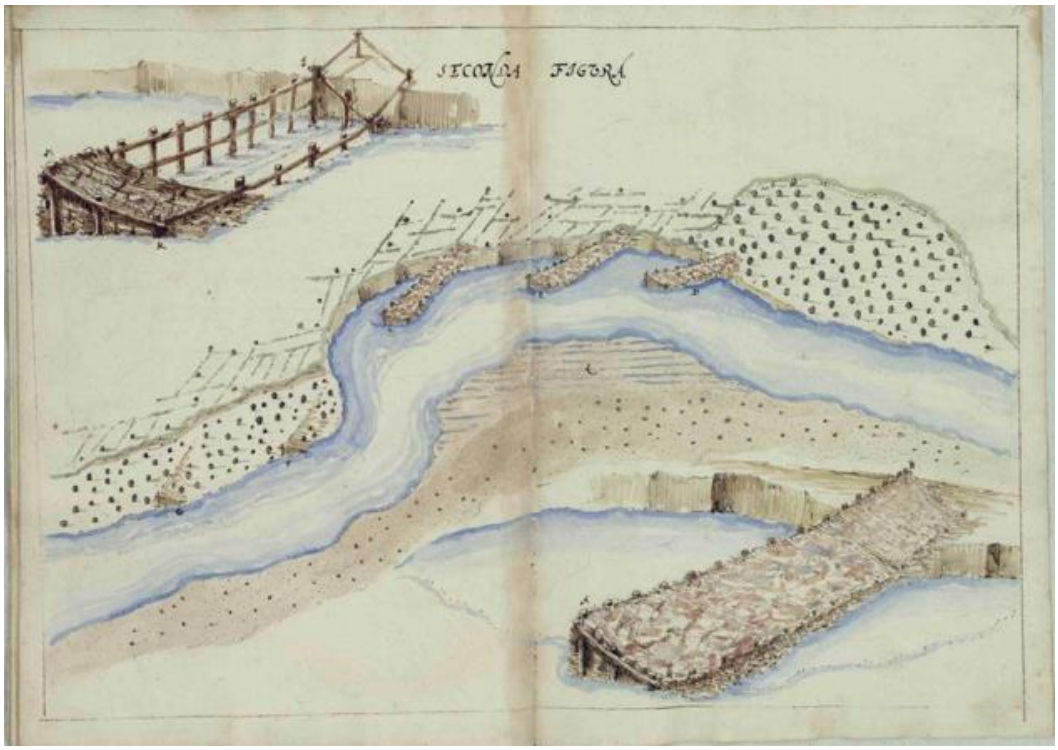

Figure 11: Cosimo Noferi, "La Travagliata Architettura," showing river embankment defenses (*ripari*), ca. 1656, BNCF, Galileiana, 124

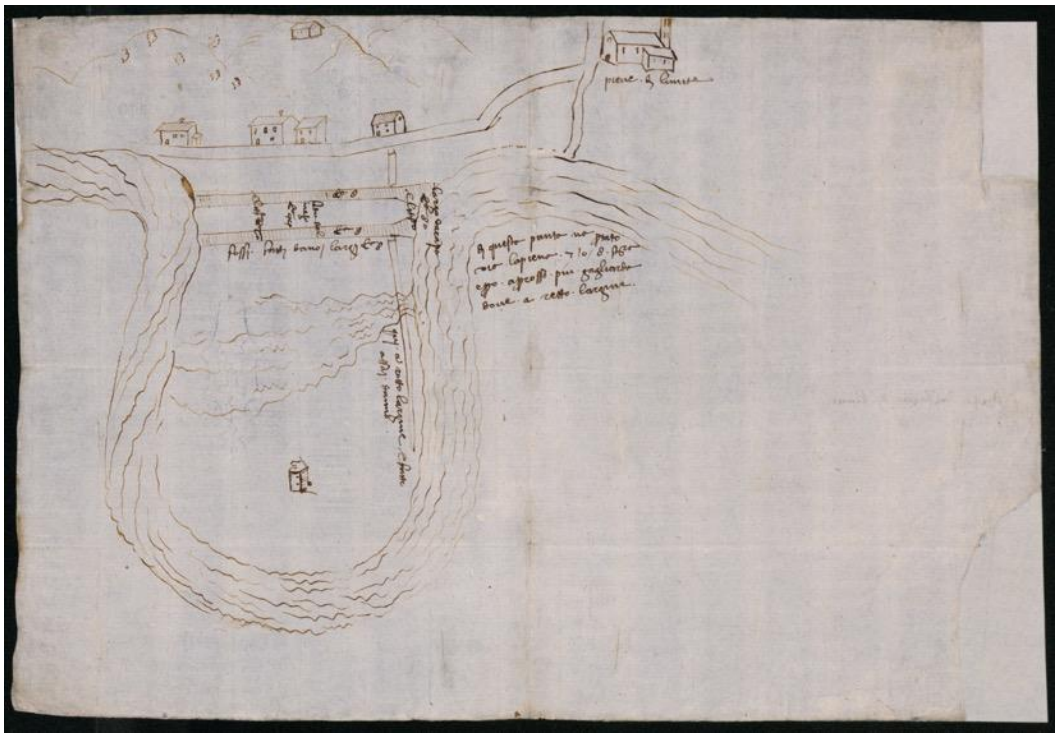

Figure 12: Anonymous, sketch of a meander cut (*taglio*) of the Arno, likely the one at Empoli and Limite executed during the 1550s, 16th century, ASF, Miscellanea Medicea, 93/III, 113

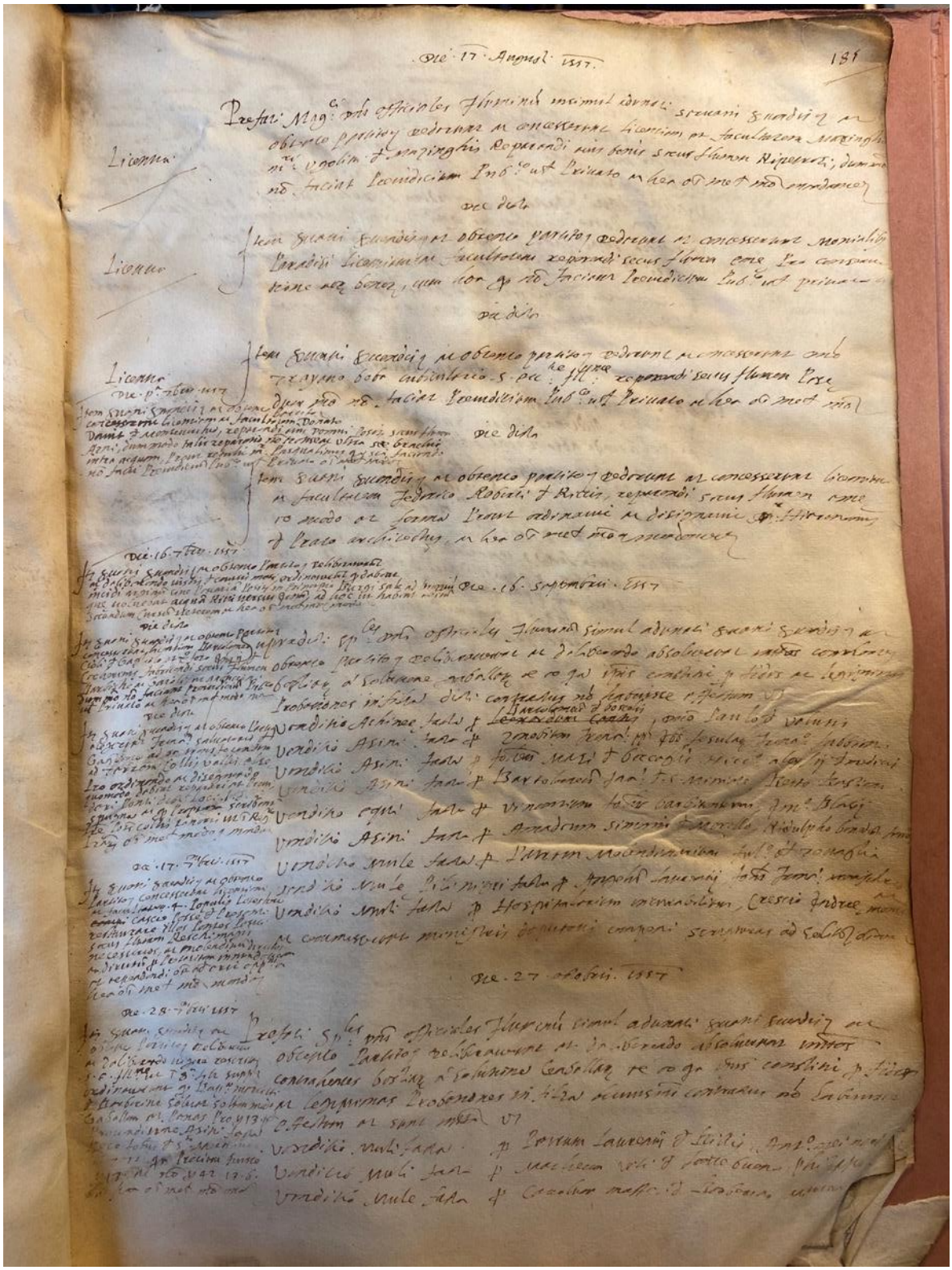

Figure 13: Page from the *partiti* of the Ufficiali dei Fiumi, ASF, Capitani di Parte Guelfa, Numeri Neri, 190, fol. 185r

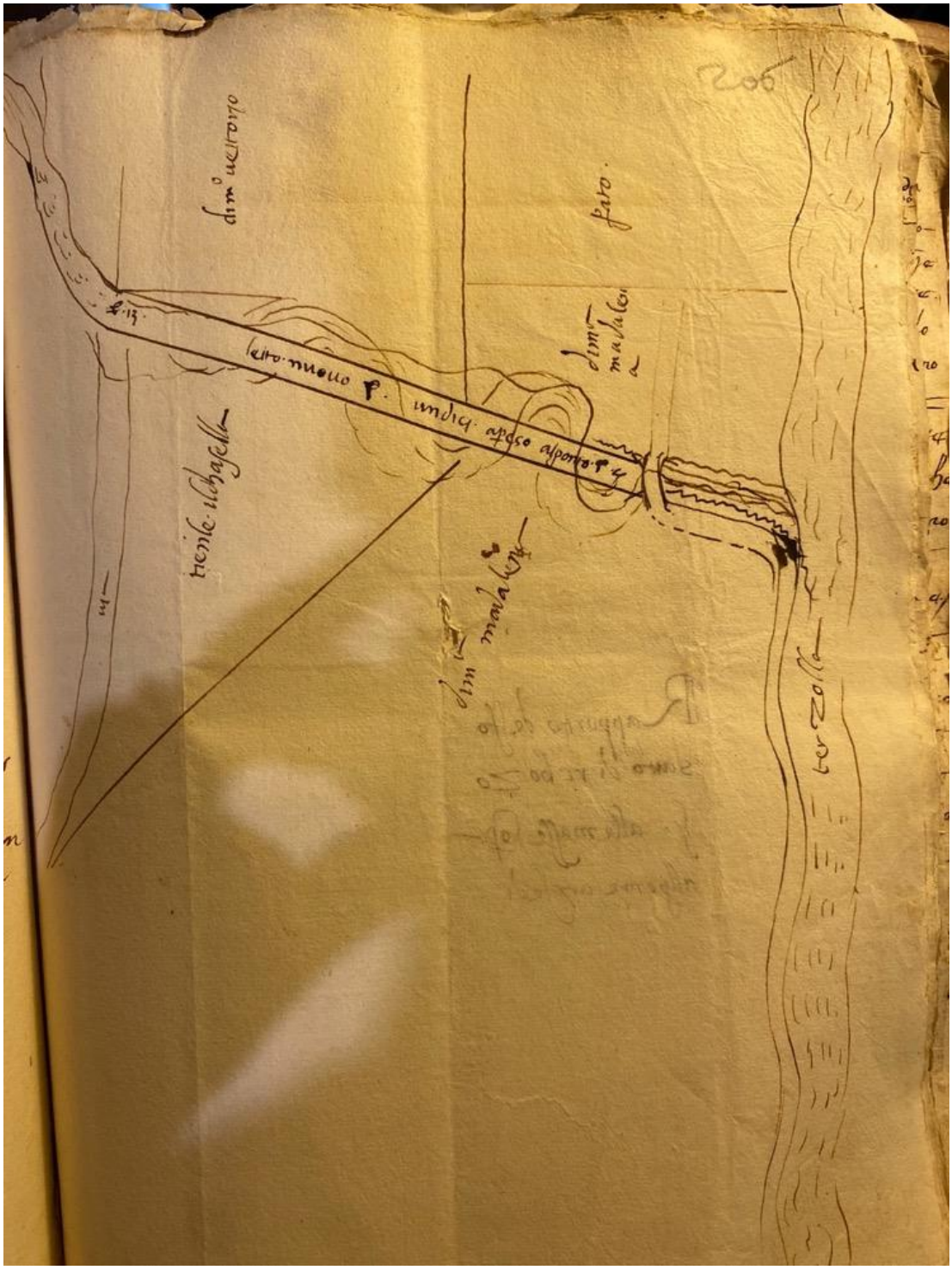

Figure 14: Piero di Francesco di Donnino, map-design appended to a report describing a *taglio* of a stream flowing into the Terzolla River, ASF, Capitani di Parte Guelfa, Numeri Neri, 957, fol. 206r

Figure 15: Girolamo di Pace, map-design appended to a report describing a weir to construct on the Pesa River, ASF, Capitani di Parte Guelfa, Numeri Neri, 958, fol. 34r

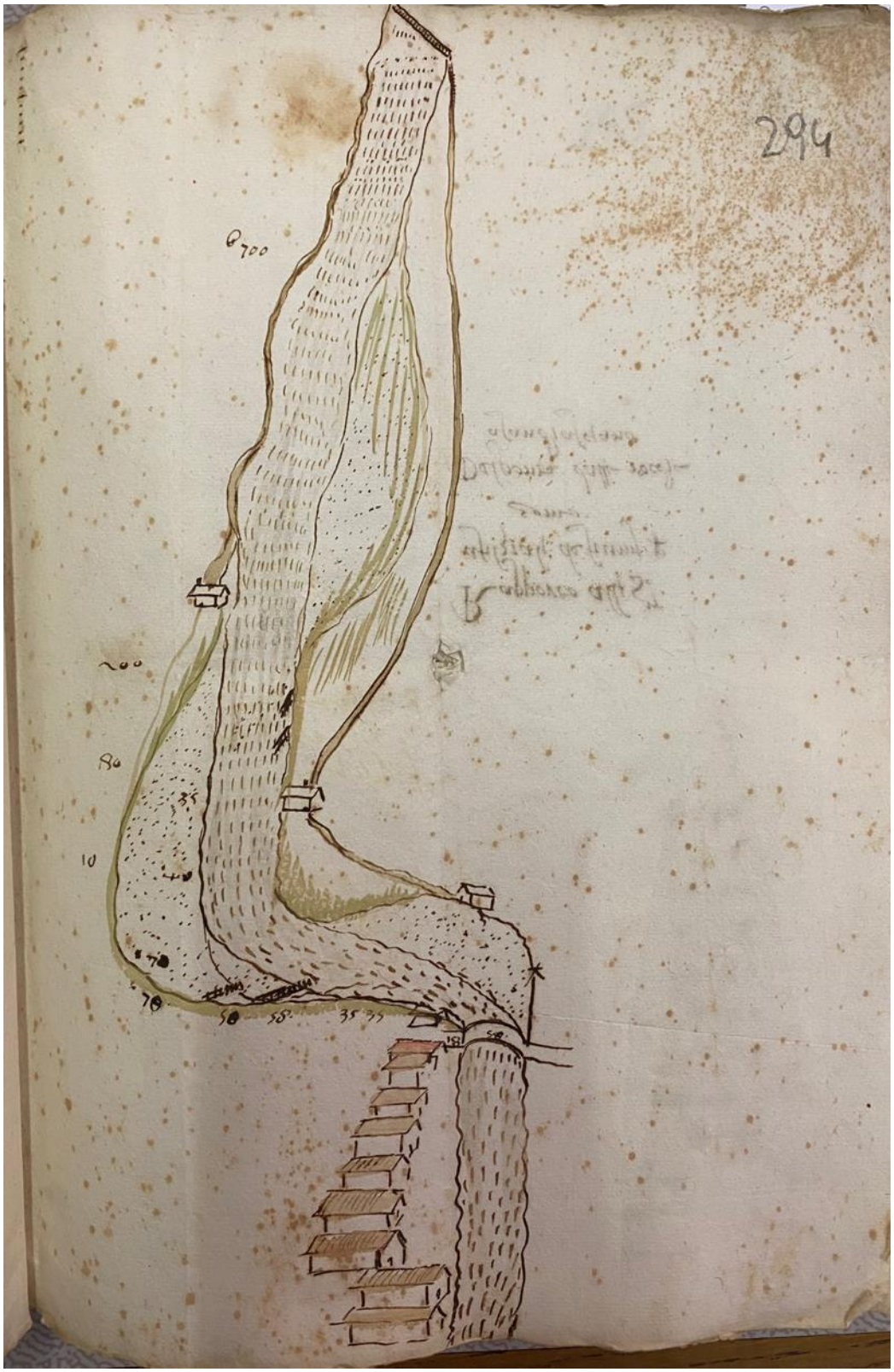

Figure 16: Piero di Francesco di Donnino, map-design appended to a report describing a bridge to be constructed on the Montone River, ASF, Capitani di Parte Guelfa, Numeri Neri, 959, fol. 294r

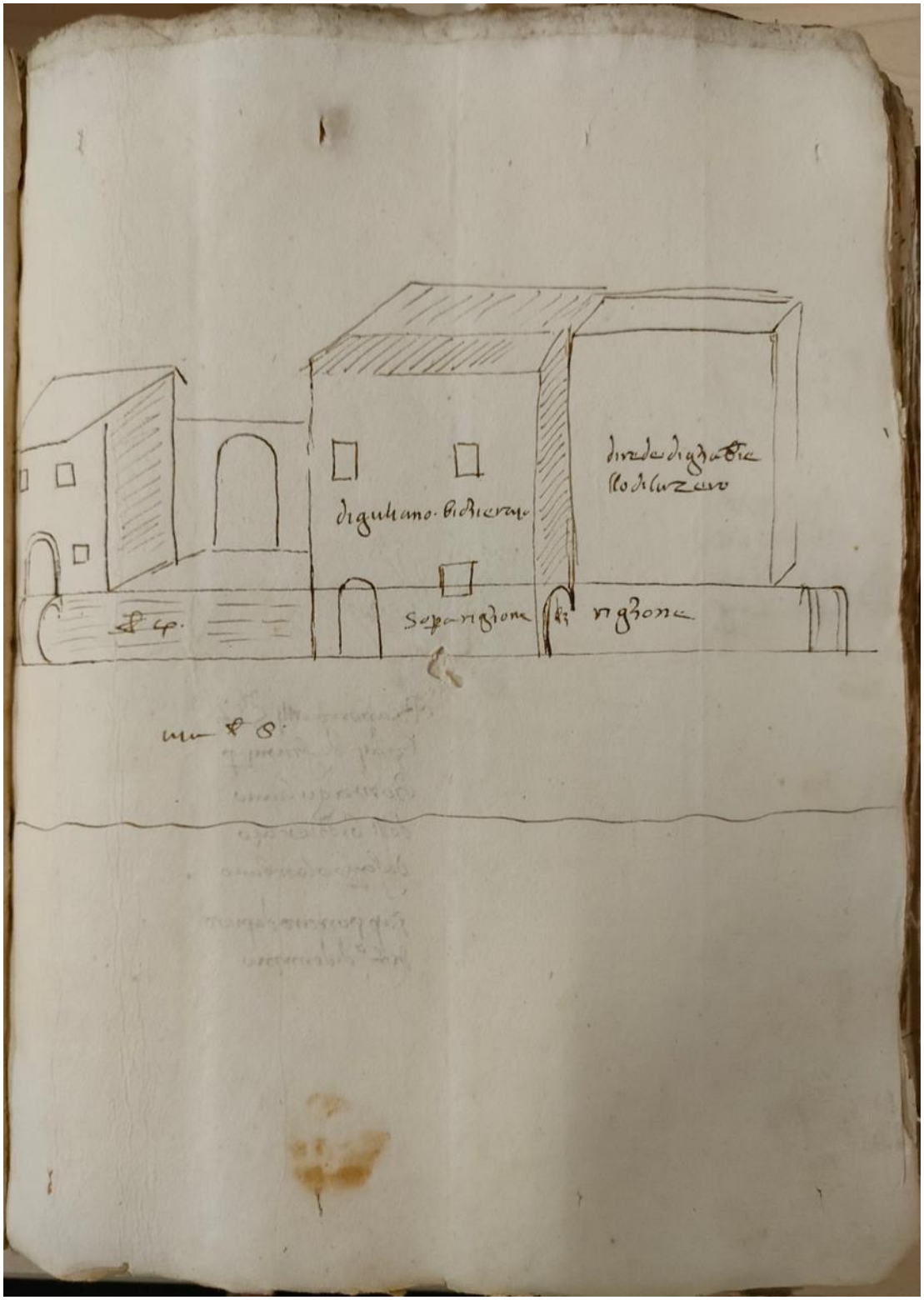

Figure 17: Piero di Francesco di Donnino, map-design appended to a report describing repairs to be done to the Ringone Stream, ASF, Capitani di Parte Guelfa, Numeri Neri, 960 (folio unknown)

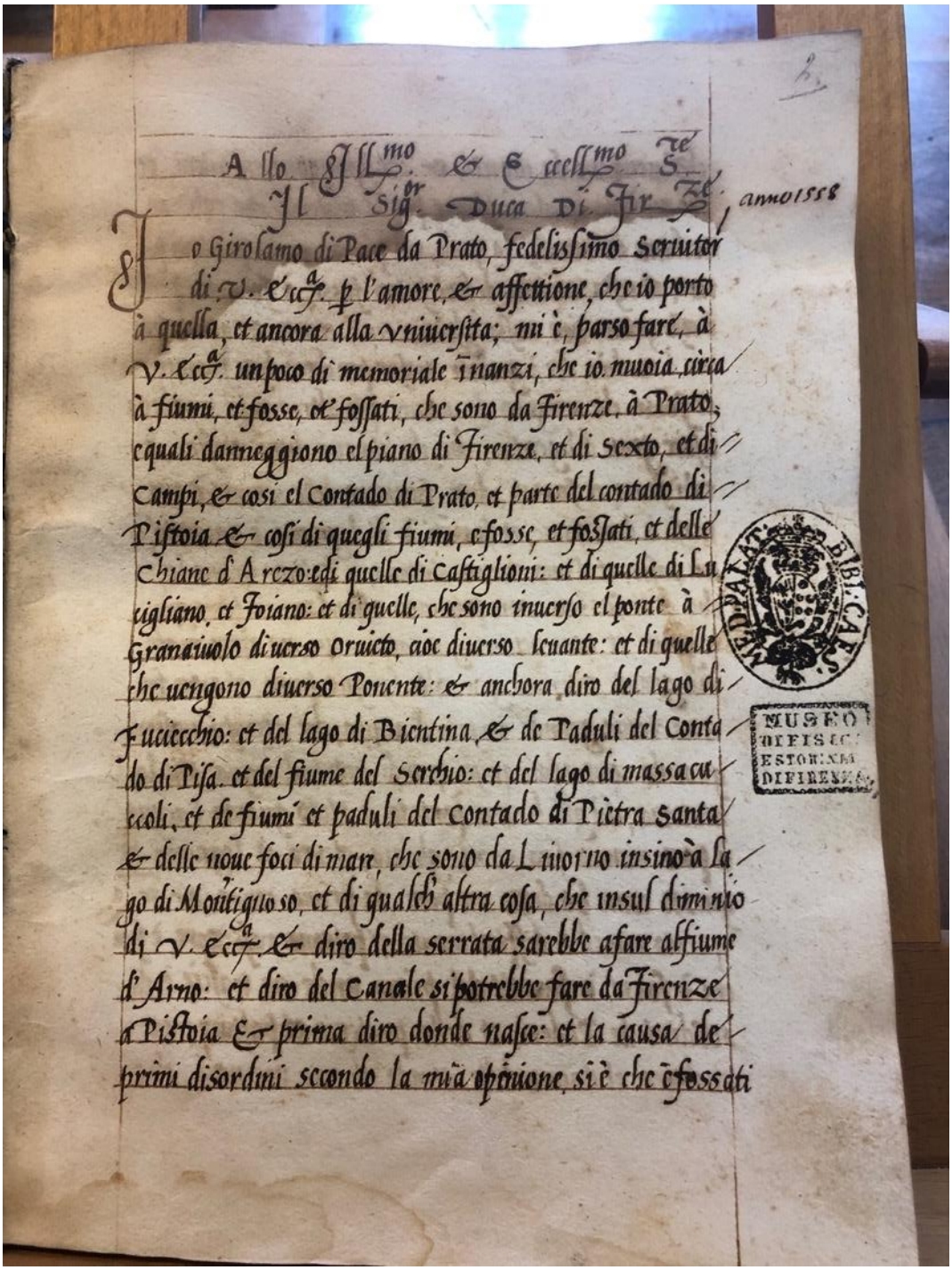

Figure 18: Girolamo di Pace da Prato, *Memoriale sopra la natura, il corso, ed i ripari di quasi tutti i fiumi e fossi dello Stato Vecchio, e sopra i regolamenti, che vi erano stato fatti fino all'anno 1558, e che si sarebbero dovuti fare nell'avvenire*, 1558, BNCF, Manoscritti Palatini 788, fol. 2r

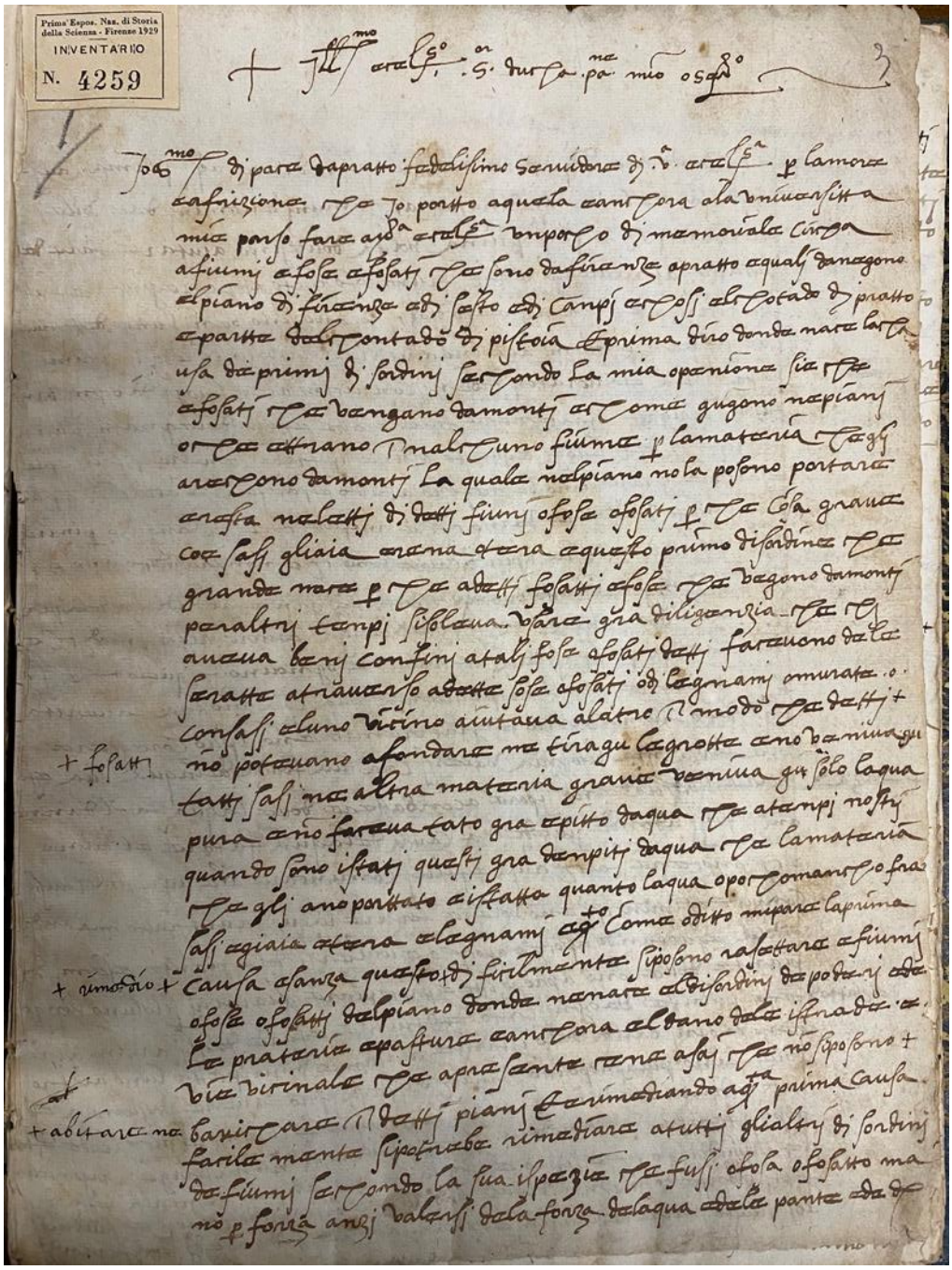

Figure 19: Girolamo di Pace da Prato, *Memoriale sopra la natura, il corso, ed i ripari di quasi tutti i fiumi e fossi dello Stato Vecchio, e sopra i regolamenti, che vi erano stato fatti fino all'anno 1558, e che si sarebbero dovuti fare nell'avvenire*, 1558, BRP, Carteggi di Cesare Guasti, 194, fol. 2r

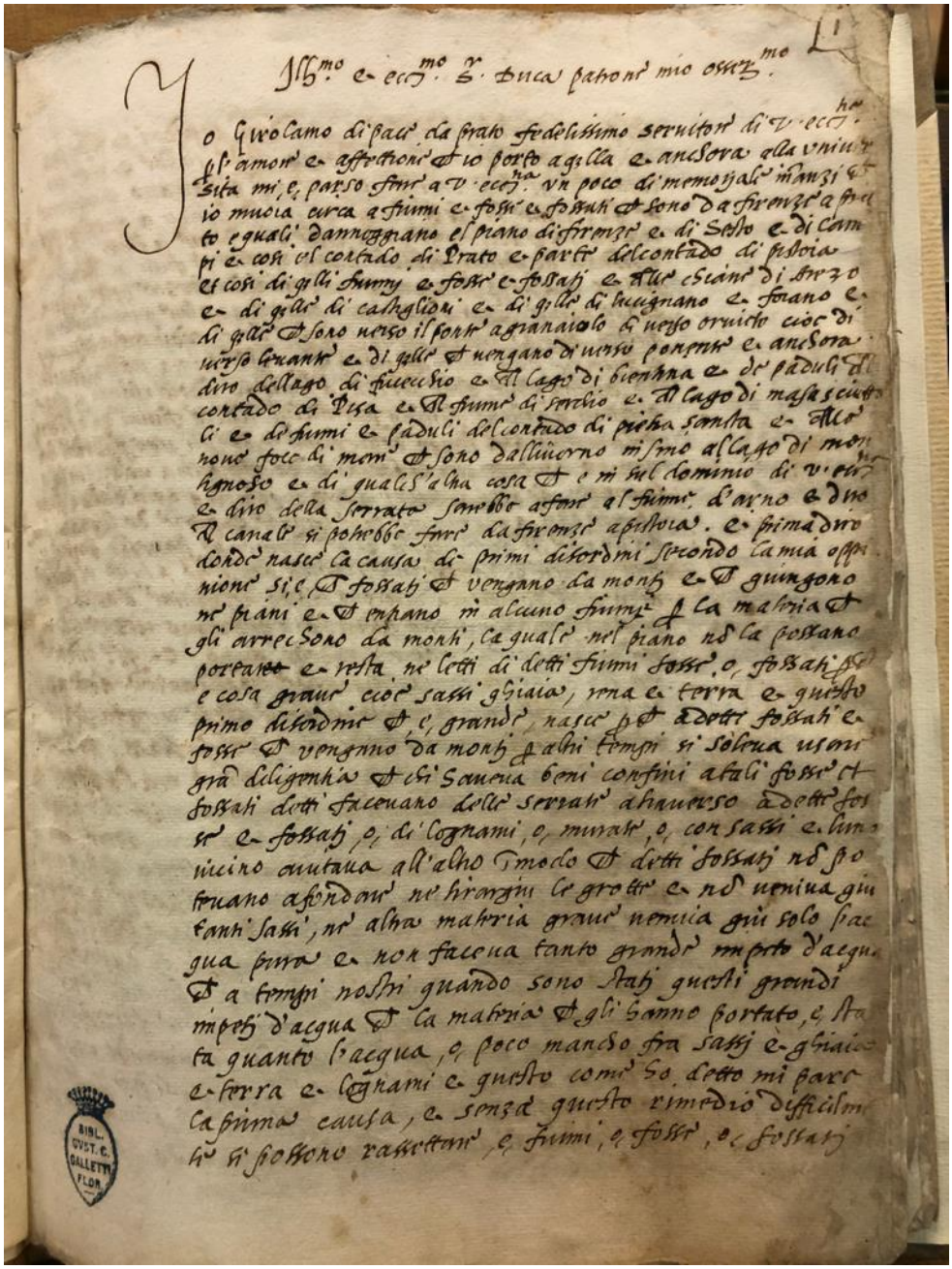

Figure 20: Girolamo di Pace da Prato, *Memoriale sopra la natura, il corso, ed i ripari di quasi tutti i fiumi e fossi dello Stato Vecchio, e sopra i regolamenti, che vi erano stato fatti fino all'anno 1558, e che si sarebbero dovuti fare nell'avvenire*, 1558, BNCF, Landau Finaly 97, fol. 1r

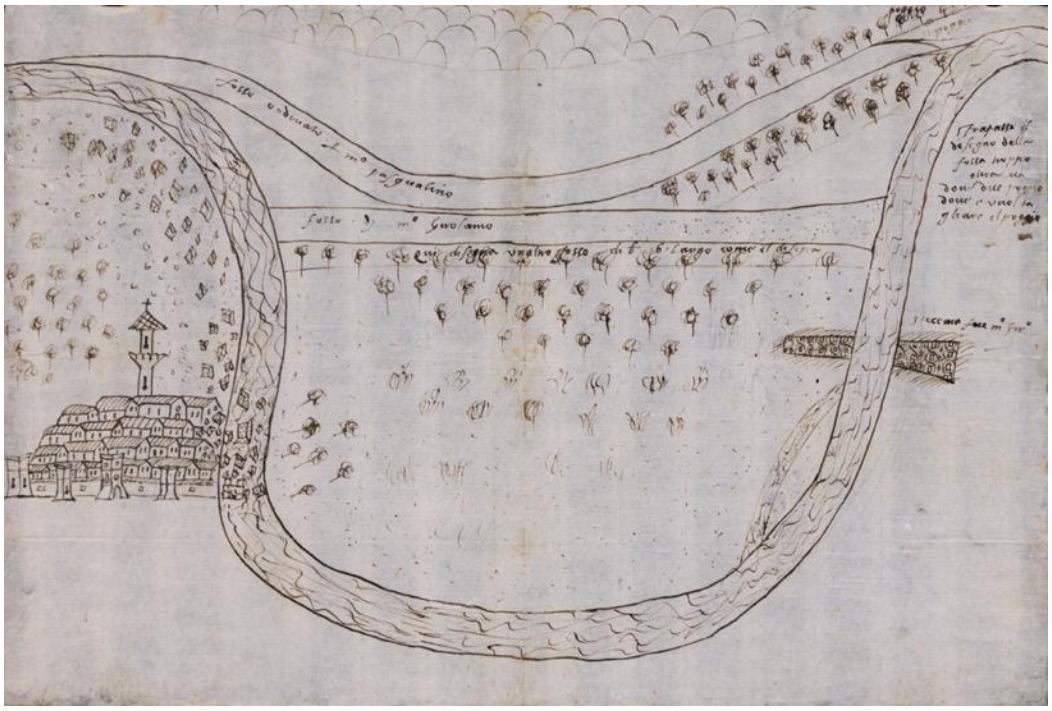

Figure 21: Anonymous, map-design of two projected cuts (*tagli*) of the Arno River by Pasqualino d'Ancona and Girolamo di Pace da Prato, near Montevarchi, 16th century, ASF, Miscellanea Medicea, 93/III, 93

Figure 22: Stefano Buonsignori, *Florentini Dominii*, 1588, with Girolamo's geographical coverage shaded approximately in blue

Figure 23: Leonardo da Vinci, map-design of the Arno valley with the route of a proposed canal, ca. 1503–04, RCT, RCIN 912279

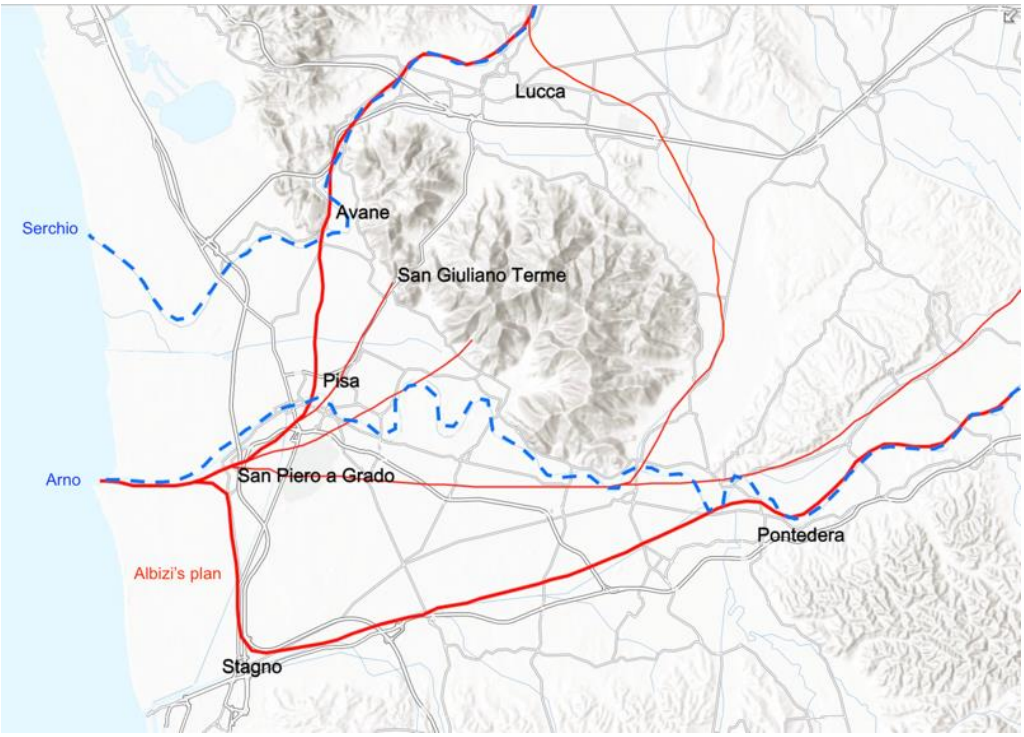

Figure 24: Albizi's project mapped over western Tuscany, showing his proposed new riverbeds and channels contrasted with the approximate 16th-century courses of the Arno and Serchio rivers

Figure 25: Giuseppe Zocchi, *The Countryside along the Arno in the Gonfolina Gorge*, 1744, PML, 1952.30:41, showing men (*bardotti* or *redaroli*) tugging a boat (*navicello*) along the river

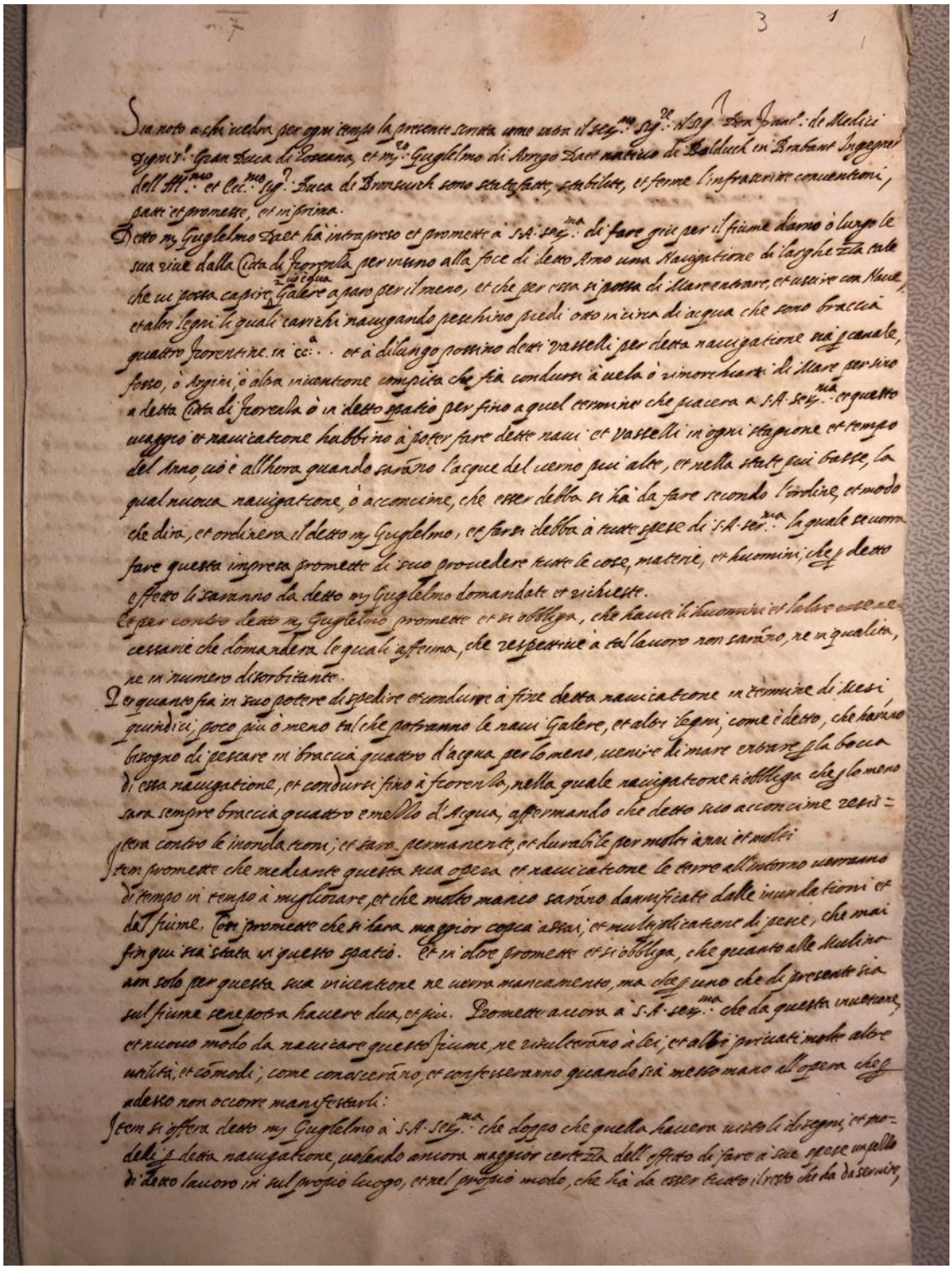

Figure 26: Agreement between Wilhelm de Raet and Francesco I on making the Arno navigable, 1557, ASF, Miscellanea Medicea 28/7, copy 1, fol. 3r

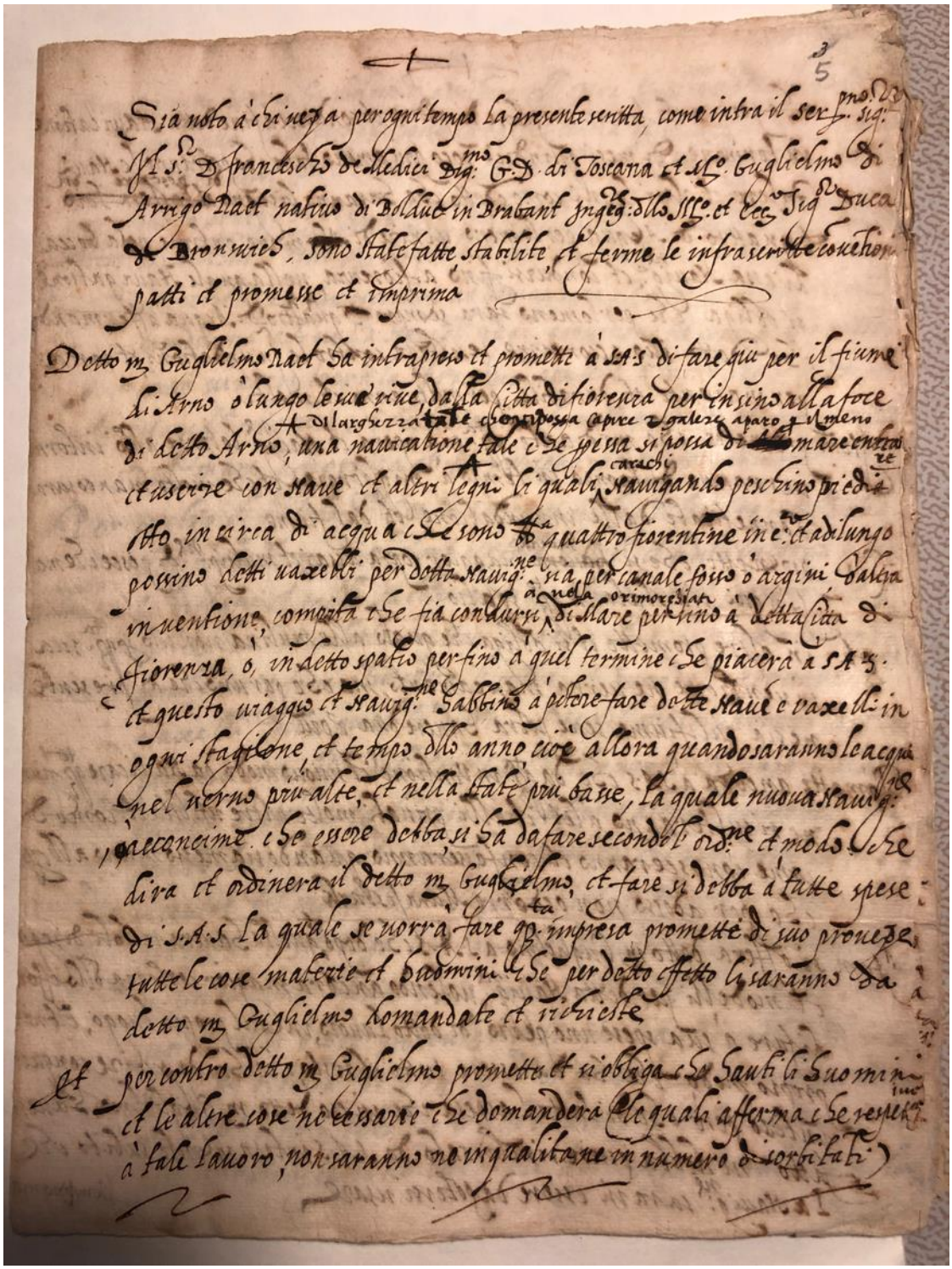

Figure 27: Agreement between Wilhelm de Raet and Francesco I on making the Arno navigable, 1557, ASF, Miscellanea Medicea 28/7, copy 2, fol. 5r

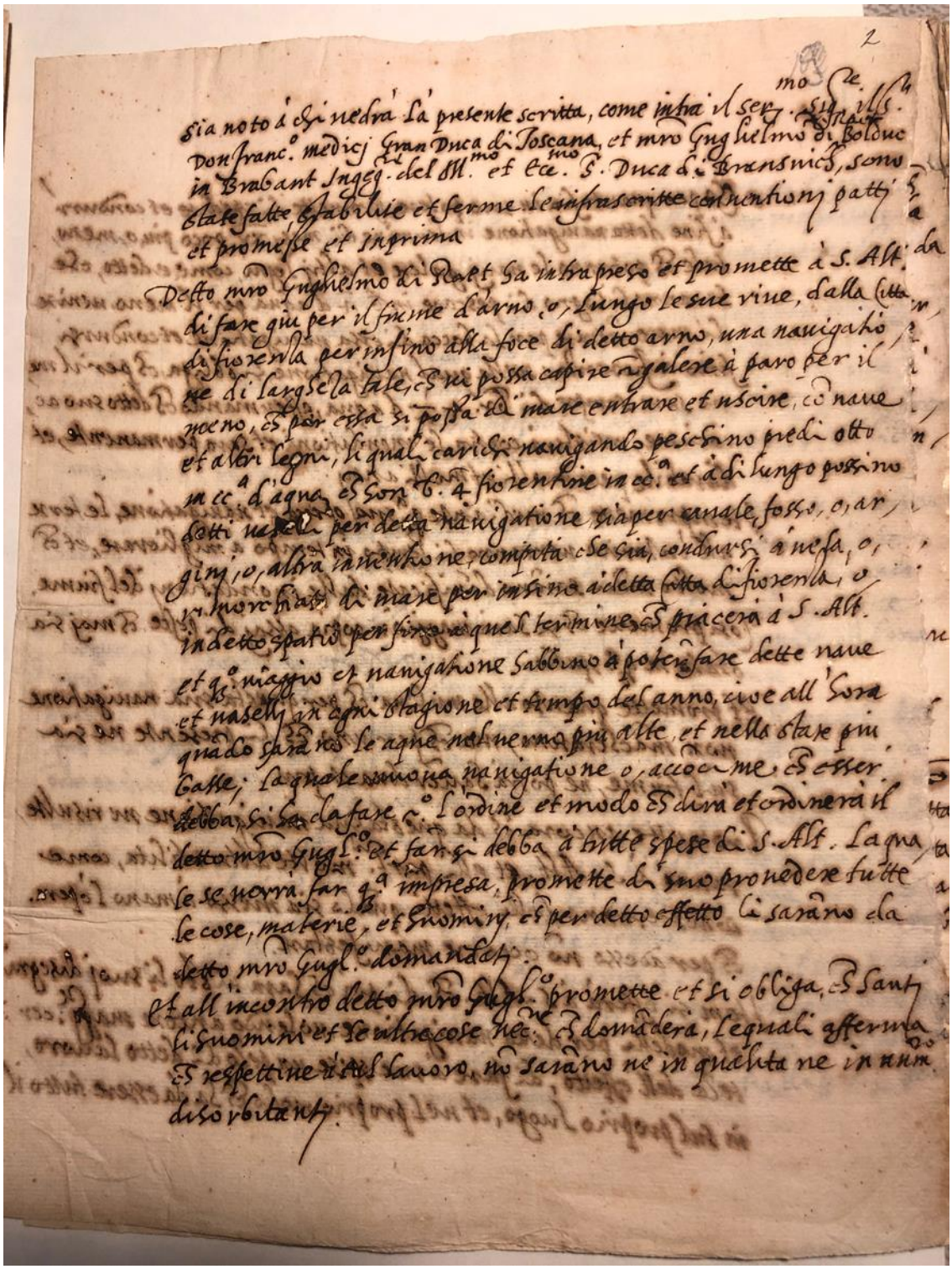

Figure 28: Agreement between Wilhelm de Raet and Francesco I on making the Arno navigable, 1557, ASF, Miscellanea Medicea 28/7, copy 3, fol. 9r

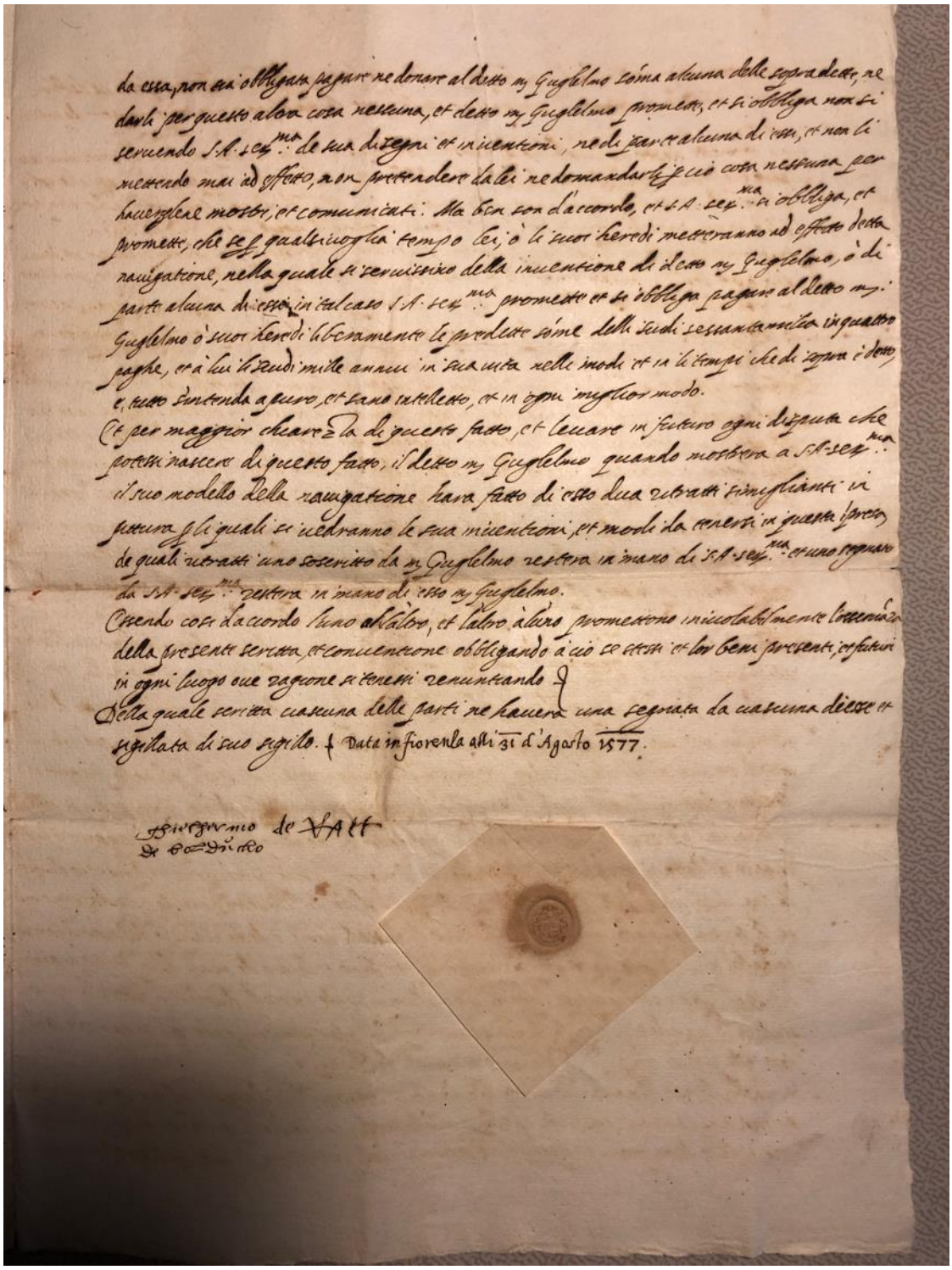

Figure 29: Agreement between Wilhelm de Raet and Francesco I on making the Arno navigable, 1557, ASF, Miscellanea Medicea 28/7, copy 1, fol. 4r