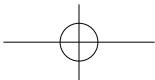
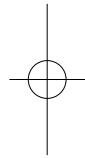
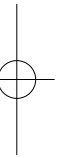

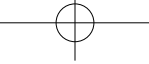


Along the water:  
urban natural crises  
between Italy and Japan

# 危 機 と 都 市

左右社  
Sayusha


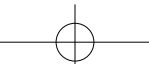




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## The crisis of Padua territory water system from its origins to the nineteenth century

Pietro CASETTA

### The birth of Padua as a water city

History of Padua is closely related to its waters, rivers, lagoons and distresses caused by the major floods that the city and its region have had to suffer.

There is a long history of crises also thanks to Padua's long history itself. Legend says that the city was founded in bc 1118 (other sources mention the dates of bc 1182 or 1183)<sup>1</sup> thanks to the presence of water. To celebrate this relationship, during the Venetian period in the sixteenth century, the foundation date has been engraved on the river's bank, at the base of Porta Portello, the most important Padua gate.

Archaeological discoveries confirm the presence of human settlements only two centuries later, between eighth and fourth century bc.

In the bc 302, Paduans fought a hard war against Cleonymus, a Greek General that came from Sparta across the Adriatic Sea.<sup>2</sup> Paduans won the war because of their knowledge of the peculiar waters of this region, which has no clear boundaries between lagoon and sea, as well as their expertise on building boats designed for such an environment. These boats are still built for the pleasure of sailing within some Paduan clubs, and their shape has spread to other nearby regions. [Fig.1]

War against Cleonymus was one of the few occasions in Padua history where the water has helped the inhabitants to face a warring crisis.

Since then, water itself has represented a recurrent crisis element. The great flood of AD 589 – also called *Rotta della Cucca* – was the first natural

The crisis of Padua territory water system from its origins to the nineteenth century | Pietro CASETTA

disaster on Paduan territory described by historians. The effects were comparable to a tsunami: farms, roads, and most of the other manmade constructions were destroyed all over Padua territory and nearby regions. Nearly all the cultivated fields became swamps. Moreover, the rivers changed their courses. In many places Bacchiglione River moved into the bed created by Brenta River. Brenta also created the great meander we can see in the historic center of Padua, although it is now a branch of Bacchiglione. [Fig.2]

Other more recent studies asserted that Brenta has produced this large meander in a period between two to six millennia bc and during the second millennium the Bacchiglione replaced it. The bridges would be so long because they were probably built on the path left by the Brenta.<sup>3</sup>

An evidence of this event can still be observed today through the roman bridges saved and restored after the destructions perpetrated by the Longobards



Fig.1 アミッシ・デル・ピオヴェーゴ「ヴェネト州の伝統的なレース用ボート（「マスカレータ」）、バッキリオーネ川にて」、2012年  
Amissi del Piovego, *Traditional Veneto rowing boats, called "Mascareta" on the Bacchiglione River, 2012.*



and the flood.

Since the flow rate of Bacchiglione is lower than the Brenta, these bridges are longer, compared to the actual width of the river. For example, nowadays the river runs below three arches, although the bridge has five. [Fig.3]

### **Venice and Padua: the struggle for Veneto supremacy and the war for water**

Rotta della Cucca disaster was possible due to inhabitants lack of rivers management: there were no embankments nor other artificial defenses. The first measure applied in Veneto to manage the water system is perhaps the *Venetian Act* of 811.<sup>4</sup> On this occasion, three advisors were appointed and commissioned to strengthen the Venice Lagoon system and improve the condition of Venice itself. This act did not concern only Venice and its Lagoon but, indirectly, all the nearby territories that, in the following centuries, would be called *Mainland Domains* or shortly *Mainland*.<sup>5</sup>

In fact, as we will see, Venetians did not know, and therefore did not consider that, in order to save Venice from the floods, they condemned the Mainland to the same destiny. In 811, Venetians were not aware of these circumstances, and also they did not care, since those territories did not belong to Venice. In the following centuries, when those territories were acquired by Venice, Venetians continued not to improve Mainland, instead focusing mainly on the Lagoon system. It is possible to state that the Venetian Act began Venice's political intervention on the Mainland water system, a policy that was never abandoned, not even when the Venetians conquered the whole territory and lasted until the empire disappeared at the end of eighteenth century.

Since the Venetian Act, the fate of Padua's water system has been closely related to the management of Venice's waters. It's also important to underline that between the ninth to the fourteenth century there weren't enough technical competences to understand the link existing between Lagoon, Mainland and open sea environments. For this reason, Venetians realized many dreadful works that damaged both Mainland and Lagoon environments. One example is the realization of the *Argine di Intestadura* during the fourteenth century. This embankment, built along the border of Lagoon, was not parallel to the rivers but

perpendicular to it, as to create a wall between Venice and the Lagoon mouths. The aim was to divert the rivers flow, slipping it along this wall, to finally lead it in the lagoon to a place far away from Venice. The result was a disaster. The silting of Lagoon continued, and manifested other problems for cargo traffic and for Mainland drainage, while the problems caused by the canals dug by other Veneto inhabitants between the twelfth and fourteenth centuries continued on.<sup>6</sup>

The challenge between Venetians and Paduans (and all other Mainland people) continued until Venice conquered Padua and its territory, in 1405. Although many historians write that Venice had a good relationship with the conquered territories, this statement is not totally true. Venetians had a good relationship mainly with their sea territories, conquered before the occupation of the Mainland. This last territory has always been considered a potential danger rather than an ally.

This terrible relationship is clear when we examine the water system management under Venice rule.

As stated before, main fear of Paduans has always been the flooding. The floods were mainly due to the slope of the rivers, which was (and still is) too small. A small slope is such an obstacle to the water flow that it causes floods. The Paduan solution was to shorten the rivers, in order to increase the slope. In order to shorten the rivers it would have been necessary to bring the outlets of the rivers near Padua, i.e. in the Lagoon. On the other hand, Venetians did not want the outlets to be nearby, since the rivers carried a lot of mud silting the Lagoon. The issue of Lagoon silting was essential, since the silt hindered the navigation and Venice was an empire solely based on that, while Mainland economy was primarily based on agriculture.<sup>7</sup>

### **Venice and Padua water contest: from the battlefields to the scientific theories**

The fifteenth century is significant to understand the relationship between Venice and Padua to the present day because of two occurrences: the conquest of Padua by Venice, and some substantial advancement in hydraulic science.

Although it was too early to talk of, hydraulic science as for its modern definition, the link between floods in the Mainland and silting in the Lagoon



was finally understood, and the issue became a political problem soon after Padua conquest.

One of the most important hydraulic experts of that century, Giovanni Giocondo da Verona – also named Fra' Giocondo – criticized the works begun under the political pressure of Venice interests, represented by the noble Marco Cornaro. Cornaro decided to bring the outlets of all the rivers out of the Lagoon, i.e. in the sea, to save Venice from silting. Fra' Giocondo demonstrated, on a scientific basis, that bringing the Brenta out of the lagoon was a mistake because of the issue related to the slopes.

Fra' Giocondo's group lost the struggle for the future development of Veneto water system. It was the first victory of politics against science, a victory of Venice with no discussion about the consequences of this decision on the Mainland.<sup>8</sup>

This occurrence brought a strong disagreement between Padua and Venice and, in the following century, gave birth to two parties with two leaders: one for Venice's side, led by the hydraulic planner Cristoforo Sabbadino, and one for Mainland's one, Alvise Cornaro.<sup>9</sup>

Sabbadino was a great hydraulic expert, aware of the link existing between Mainland and Lagoon, but he chose the reasons of Venice, i.e. the run out of the Lagoon of both Brenta and Bacchiglione.<sup>10</sup> Cornaro, as we would say today, was a dissident of Venice. He chose to live in Padua, in a house designed for him by one of the most important architect of Veneto, Giovan Maria Falconetto.<sup>11</sup>

Close to the house he built a theatre, the first open air theatre of Europe in the modern era. This complex, named *Loggia e Odeo Cornaro*, was the stage for the comedies of the famous author Ruzzante,<sup>12</sup> and hostel for the major artists of Veneto's Renaissance. Cornaro was a dissident, but also an intellectual, patron, and landowner. He chose Padua side because he perceived that the future of Venice have been in the Mainland rather than on the sea; agriculture rather than commerce.<sup>13</sup>

Foscari family followed Alvise Cornaro example and, in the sixteenth century, hired Andrea Palladio to design Villa La Malcontenta. This Villa is about 25 kilometers far from Padua. It is not surrounded by any wall in order to be adjacent to the surrounding fields; it is higher than it is wide, to see the

meadows from an elevated position; finally it is very small, to leave more space as possible to the fields.

More than the villa, fields are the main design element of the complex since, to obtain the cultivated area, a large work of drainage was necessary to transform the swampy grounds and protect them from floods. Villa La Malcontenta represents a correct response to a water problem: use of drainage.

Alvise Cornaro well represents the small group of Venetians that have always been very careful of their territory, along with Foscari family.

Therefore, although Venetian domination also had positive aspects in terms of reducing the environmental impacts, Padua's existence could not be threatened since its rivers could not completely be abandoned. Venice was an island, without food, wood, stones or other construction materials. For this reason a little branch of Brenta was left to arrive into the Lagoon. It is now called Naviglio-Brenta canal and it flows out just in front of Venice. Venetians used this river to connect Venice to Padua, recognizing that the latter had an important role, being at the economic center of many important resources for Venice: the Euganei Hills, the Berici Hills, and many cultivated areas. Moreover, many Venetians finally decided to build farms on the Mainland and, since they were accustomed to sail, they wanted to reach their farms by boat just along the little branch of Naviglio-Brenta. So, along its shores, many Venetian farms were built. In the following centuries these farms were transformed into country houses, and then into holiday villas as we can see today.

Therefore, to save their environment from silting, Venetians modified the Brenta more and more until its complete abandonment of the Lagoon. By the end of the eighteenth century, all the rivers surrounded the lagoon, except for very small watercourses and the Brenta canal that later became known as Riviera del Brenta.

### New technologies and final decay of Serenissima water system

The fragile equilibrium of Veneto water system encountered a new issue from

a cultural modification. Most of the Venetian families that firstly demonstrated their interest in agriculture, in the following centuries slowly left the cultivated fields to decay, transforming, as stated before, their country houses into holiday villas. This process reached its peak in the eighteenth century, and is well represented by Villa Pisani, about 15 kilometers east of Padua. Villa Pisani is the biggest and most beautiful Villa of the Riviera del Brenta, and likely of all Venetian villas. Nevertheless its beauty is only appearance: Villa Pisani was designed as an amusement park, a place dedicated to enjoy life without any will to improve the territory. However, during the eighteenth century the rising Mainland aristocracy started to ask Venice to solve the frequent water crises.<sup>14</sup> Moreover, a strong advance in hydraulic science technology throughout Europe came in help of Veneto's decayed water system.<sup>15</sup>

A first result of technology improvement in Veneto was an important hydraulic structures system, realized in Limena, in the near northwest of Padua. Those water control buildings, named *Colmelloni*, were among the first constructions created in Europe to adjust the amount of water crossing through a river and were realized where Brentella Canal begins. Brentella is a watercourse dug for war reasons at the beginning of fourteenth century to link the waters of Brenta with the ones of Bacchiglione, upstream of Padua. The Colmelloni became necessary to create a device to adjust the water flow of Brentella, often out of control.<sup>16</sup> Results of this engineering innovation were necessary for providing cultivation sustainability also for the furthest fields, since Colmelloni improved flow control of the two most important rivers in Padua territory. These structures were rebuilt several times until 1649 when they crumbled down transforming the fields into swamps and causing serious damages to Padua's agriculture and creating chaos in the whole local water system. Venetians rebuilt them only in 1775, improving the reconstruction with a greater program that interested the whole territory. This plan, conceived by Giuseppe Antonio Rossi, was designed to carry out hydraulic buildings also far from Limena, like the bridge at Dolo (about thirty kilometers distance), and several tens of kilometers of embankments.<sup>17</sup>

The approach to environmental issues began to change and the experts started to understand that, in order to solve the hydraulic concerns, it was

necessary to consider either the whole territory or at least a great part of it. It was too early to talk about a modern "system" but still a wider vision of the problem, previously absent, began to be conceived.<sup>18</sup>

Anton Maria Lorgna and later Angelo Maria Artico were the most important hydraulic experts of this period, though it can be stated that by the end of eighteenth century every local technician proposed a project. However, though there was an ongoing process of general improving of the Mainland territory hydraulic condition, still Venice was reluctant to start a whole rethinking of the entire water system. As a consequence of this indeterminacy, Padua's territory was devastated again. In 1776, one year before Lorgna's project, there were eleven broken levees on the stretch of Brenta close to Padua, five on Brentella, and a lot of damages to the bed of Bacchiglione that resulted in the flooding of the entire territory.<sup>19</sup>

#### **Fossombroni-Paleocapa project: attempts to find an established solution**

The revolution, both scientific and political, arrived with the beginning of the nineteenth century after the Republic of Venice finally fell in 1797. Following the brief presence of Napoleon, the Austro-Hungarian Empire occupied Veneto and Venice. Padua territory was so devastated that Austrian authorities were forced to face the problem, opening a new approach to hydraulic issues through the creation of a team of experts. Army general Camillo Vacani was chosen to gather, compare and synthesize all the ten main hydraulic projects submitted to the authorities;<sup>20</sup> Grand Duchy of Tuscany minister Vittorio Fossombroni, known in whole Europe as one of the main hydraulic science experts, was appointed to draw up the restoration project of Veneto rivers; young Venice engineer Pietro Paleocapa was appointed to assist Fossombroni.

The first one to publish his work was Vacani with a big report titled "Della Laguna di Venezia e dei fiumi delle attigue provincie" ("On Venice Lagoon and nearby districts rivers"). He divided the report in three chapters: "Lagoon", "Rivers" and "Sea". The layout of the report was clear since a "Lagoon problem" did not exist, as opposed to the "territory problem" which was in a

critical state. After reading Vacani's Report, Fossombroni titled his project: "Considerazioni sopra il sistema idraulico dei paesi veneti" ("Considerations on Veneto lands hydraulic system"). The gap had been filled: the concept of *hydraulic system* was born, and nobody was going to abandon it anymore.

Fossombroni grew too old to continue the task and Paleocapa replaced him in conceiving and drawing the executive plan.

He proposed to reach the following targets:

- The organization of Brenta system;
- A redesign of Bacchiglione system;
- A coordination plan for rivers navigation, industries and road networks within the new Brenta and Bacchiglione administration;
- A coordinated plan for the improvement of drainage channels.

This idea was to create an innovative project of hydraulic system that could open the path to more modern and topical concepts. We can now study the whole project, rediscovered twenty years ago and published ten years later, named "Memoria idraulica sulla regolazione dei fiumi Brenta e Bacchiglione" ("Hydraulic memory on the regulation of Brenta and Bacchiglione rivers") although known by the historians as "Fossombroni-Paleocapa Project".<sup>21</sup>

With particular focus on Padua, the project aimed to the realization of the following interventions:

- Excavation of a canal in the south of Padua, connecting the Bacchiglione to the Roncagette canal, in order to avoid flood waters to enter in Padua;
- The shortening of the Brenta on the downstream of Padua, from Stra to its outlet, digging another canal, to save the fields from the floods;
- The relocation of Brenta outlet into the Lagoon, although far from Venice.

As usual, the main problem that Paleocapa had to face was in the political arena since Austrian authorities didn't want to realize the project due to its high cost. Providentially Paleocapa knew how to deal with politicians, since

he himself later became Minister of the King Vittorio Emanuele II of Italy. He decided to achieve the project distributing the works and the expenses on a ten years program. Moreover, he took advantage of the flood of 1839 to convince Austrian viceroy Ranieri to begin the works.<sup>22</sup>

The excavation of the new canal, named Scaricatore (basically a "Venting Canal"), was a good idea although its water-flow was too low; the shortening of the Brenta, (named "Cunetta") was another good idea, which allowed to solve the problems caused by the floods on the fields; on the other hand, the outlet of Brenta in Lagoon was a terrible error, since the amount of mud that the river brought into the Lagoon was so abundant that, in a few years, an out-and-out delta was formed. [Fig.4]

The choice to lead the Brenta into the Lagoon, decided by one of the cleverest hydraulics engineer of his time (Paleocapa had solved the silting problem in Suez Canal), has amazed the historians. In fact Paleocapa defended this choice up to the end of his life, despite silting being noticeable. Requests for a solution were considered, only fifty years later, when the outlet was brought out of the Lagoon again, near Brondolo. However the Fossombroni-Paleocapa plan still remains a great and important project since its hydraulic structures never needed to be changed but just improved in the following years.

## Conclusions

Padua water system saw many enhancement projects realized in the last one hundred and an half years but still many new floods affect the area, demonstrating once more the difficulties of maintaining the balance between human environmental modifications and natural occurrences. The example of Veneto east area is also paradigmatic of the enduring contrast between two artificial landscape contexts such as the lagoon one, necessary to the life of Venice, and the Brenta/Bacchiglione canal system, often source and threat to Padua richness and safety. The lessons from the past teach us that an excessively radical debate on such a delicate issue is inadequate without a complete understanding and respect for the harmonious coexistence of development and natural territorial evolution.



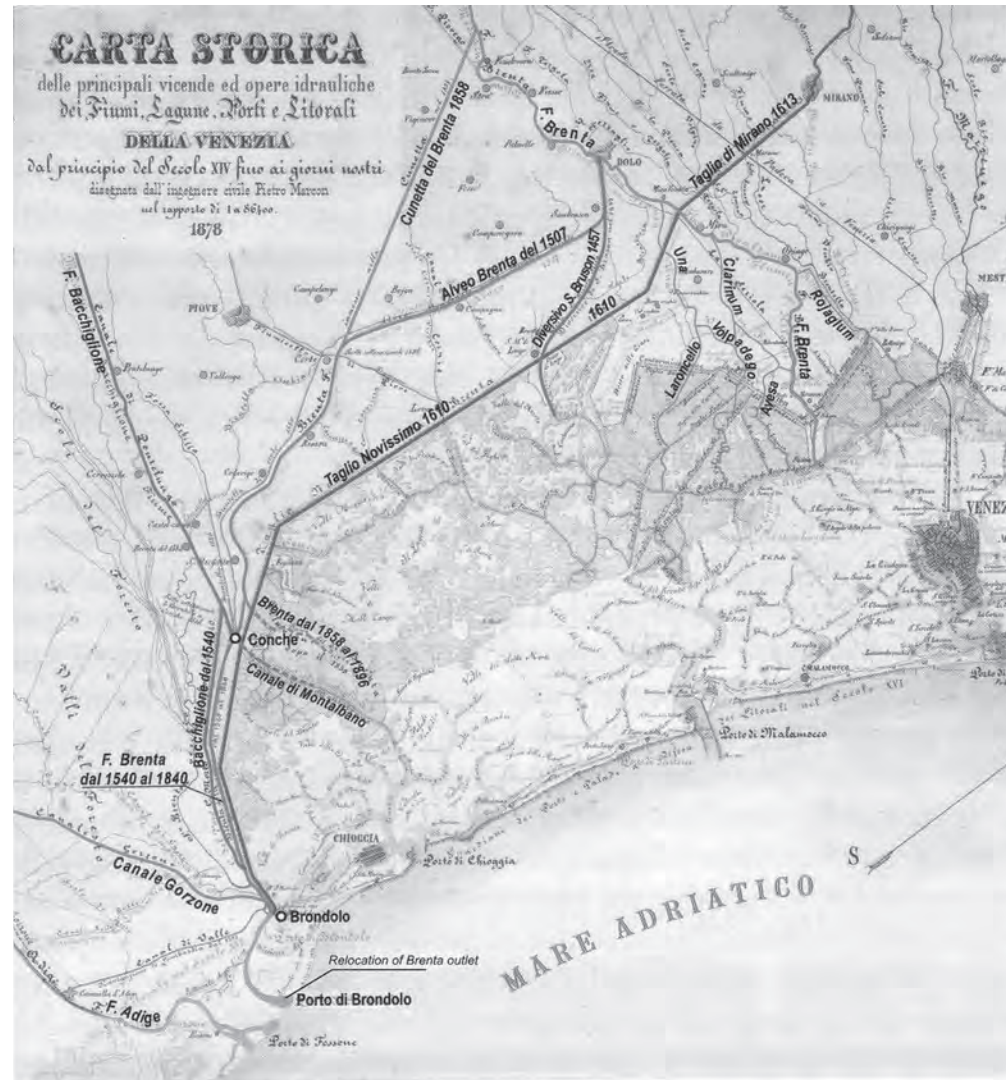


Fig.4 ピエトロ・マルコン「14～15世紀におけるヴェネト州東部の水路の変容」、1878年(レイジー・アルパオスによる改変、2010年)  
Pietro Marcon, *Modifications of East Veneto waterways between the fourteenth and nineteenth centuries*, 1878.  
Modified by Luigi D'Alpaos, 2010.

## Notes

- 1 L. Braccesi, *La leggenda di Antenore dalla Troade al Veneto*, (Venezia: Marsilio, 1997).
- 2 Marta Sordi, 'Cleonimo nella Laguna Veneta. Un frammento di Catone?', in L. Braccesi (ed.), *Hesperia 10 - Studi sulla grecità di occidente*, (Roma: L'Herma di Bretschneider, 2010), p. 255.
- 3 Paolo Mozzi, Silvia Piovani, Sandro Rossato, Maurizio Cucato, Tiziano Abbà and Alessandro Fontana, 'Palaeohydrography and early settlements in Padua (Italy)', *Il Quaternario - Italian Journal of Quaternary Sciences* 23 (2bis), (2010), pp. 387-400. (On line: [http://www.aiqua.it/images/directory/130863974913SP09\\_Mozzi.pdf](http://www.aiqua.it/images/directory/130863974913SP09_Mozzi.pdf))
- 4 Pietro Marcon, 'Cenni cronologici delle principali vicende cui andarono soggetti i fiumi del Veneto... 1878', in G. B. Stefinlongo (ed.), (Venezia: Ufficio Idrografico e Mareografico, 1995), p. 60.
- 5 「本土」は、イタリア語の「ドミーニ・ディ・テッラフェルマ (*Domini di Terraferma*)」あるいはヴェネツィア方言の「スタト・ダ・テラ (*Stato da Tera*)」「ドミーニ・デ・テラフェルマ (*Domini de teraferma*)」の訳語である。本土は、3つに区分されるヴェネツィア共和国領のひとつであり、残るの2つは「ドガド (*Dogado*: 首都ヴェネツィアとその周辺領域)」と「スタート・ダ・マール (*Stato da Màr*: 海洋州)」である。Mainland is the translation of *Domini di Terraferma* in Italian language and *Stato da Tera* or *Domini de teraferma* in Venetian one. Mainland was one of the three subdivisions of the Republic's possessions, the other two being *Dogado* (*Duchy*) and *Stato de Màr* (*Sea State*).
- 6 L. D'Alpaos, *Fatti e misfatti di idraulica lagunare: la Laguna di Venezia dalla diversione dei fiumi alle nuove opere alle bocche di porto*, (Venezia: Istituto veneto di scienze, lettere ed arti, 2010), pp. 32-7.
- 7 こうした問題に関する詳細な説明については次を参照せよ。A complete explanation of these problems can be found in: V. Fossombroni, *Considerazioni sopra il sistema idraulico dei paesi veneti*, (Firenze: Tipografia Galileiana, 1847) and P. Paleocapa, *Memoria idraulica sulla regolazione dei fiumi Brenta e Bacchiglione - 1843*, P. Casetta (ed.), (Roma: Istituto poligrafico e Zecca dello Stato, 2002).
- 8 D'Alpaos, *Fatti e misfatti di idraulica lagunare*, pp. 37-9.
- 9 Luigi D'Alpaos, 'I rischi di inondazione nella Provincia di Padova', *Padova e il suo territorio* 119, (2006), p. 7.
- 10 D'Alpaos, *Fatti e misfatti di idraulica lagunare*, pp. 40-2.
- 11 Camillo Semenzato, 'Gian Maria Falconetto', *Bollettino del Centro Internazionale di Studi di Architettura di Andrea Palladio* 3 (1961), pp. 70-7.
- 12 「イル・ルツァンテ (ヴェネト地方ではエル・ルツァンテ)」のあだ名でも知られるアンジェロ・ベオルコ (1502-1542) はイタリア人俳優・喜劇作家であり、その代表作は「ルツァンテ」という名の百姓を主人公とするヴェネツィアが舞台の喜劇である。これらの喜劇は16世紀のパドヴァの農村生活を生き生きと描いている。Angelo Beolco (1502-1542), also known by his nickname *Il Ruzzante* or *el Ruzante* (in Venetian language) was an Italian actor and playwright, mostly famous for his Veneto located comedies, featuring a peasant called "Ruzzante". Those plays show a vivid picture of sixteenth century Paduan country life. L. Puppi, *Alvise Cornaro e il suo tempo*, (Padova: Comune di Padova, 2014), p. 332.
- 13 アルヴィーゼ・コルナロ (ルイージ・コルナロ) は独特かつ近代的な個性の持ち主であった。彼は豪華や浪費を嫌った。その風変わりな著作『無病法』(中倉玄喜訳、PHP研究所、2012年)において彼は、長寿健康のために節食を規則として課している。節食は同時に身体・精神・環境への敬意や市民・パトロンとしての善行の重視などのメタファーでもあった。Alvise Cornaro had an original and modern personality. He despised luxury and wastage. He wrote an eccentric book titled "Trattato della vita sobria" ("Essay on sober life"), on which he set rules to get older and healthier through a correct diet. Diet was also metaphor of the respect for body, mind, and environment, respect for good behavior as citizens and patrons. P. Sambin, *Restauri di archivio rivisti e aggiornati da Francesco Piovani*, (Padova: Esedra editrice, 2002); Alvise Cornaro, *Scritti sulla vita sobria, elogio e lettere*, Marisa Milani (ed.), (Venezia: Corbo e Fiore editori, 1983); Comune di Padova, *Alvise Cornaro e il suo tempo, catalogo della mostra*. (Padova: Comune di Padova, 1980).
- 14 18世紀から19世紀における災害・事業・プロジェクトなどについては次を参照せよ。For a list of damages, works and projects achieved between eighteenth and nineteenth centuries: C. Vacani for Forteolivo, *Della laguna di Venezia e dei fiumi nelle attigue provincie*, (Firenze: Tip. e lit. degli Ingegneri, 1867), pp. 459-61.
- 15 D'Alpaos, *Fatti e misfatti di idraulica lagunare*, pp. 46-7.
- 16 R. Martinello, *Limena - Un territorio e le vicende storiche dei suoi abitanti*, (Padova: La Garangola, 1981); Renato Martinello, 'I colmelloni di Limena', *Padova e il suo territorio* 16, (1988); Elio Franzin, 'I colmelloni di Limena e le inondazioni nelle campagne e nella città di Padova', *Padova e il suo territorio* 83, (2000).
- 17 Elio Franzin, 'Giuseppe Antonio Rossi', in S. Casellato and L. Sitran Rea (eds.), *Centro per la storia dell'Università di Padova, "Professori e scienziati a Padova nel Settecento"*, (Treviso: Antilia, 2002) pp. 413-20.
- 18 Pietro Casetta, 'Il colmellone di Limena in un'osella settecentesca e la sistemazione idraulica dell'Alta Padovana', *Alta Padovana - Storia, cultura, società* 2, (2003).
- 19 Fossombroni, *Considerazioni sopra il sistema idraulico*, p. XXIX.
- 20 Introduction by Pietro Paleocapa to Vacani, *Della laguna di Venezia e dei fiumi*, p. 4.
- 21 イタリア統一の動きが始まる以前のパドヴァの水文系の状況については次を参照せよ。For a map of the hydrographic situation of Padua before Italian Unification process see P. Peri and A. Rizzoli, *Carta idrografica della città di Padova*,

1843–1866 ca. P. Casetta (ed.), (Padova: La Garangola, 2002).

- 22 Paleocapa, *Memoria idraulica sulla regolazione dei fiumi*, p.14 paragraph 261, and attached VII p.195.

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- 3 Image property of the author.
- 4 Pietro Marcon, '*Carta storica delle principali vicende ed opera idrauliche dei Fiumi, Lagune, Porti e Litorali della Venezia dal principio del secolo XIV fino ai giorni nostri, 1878*', in L. D'Alpaos, *Fatti e misfatti di idraulica lagunare: la Laguna di Venezia dalla diversione dei fiumi alle nuove opere alle bocche di porto*, (Venezia: Istituto veneto di scienze, lettere ed arti, 2010). Copyright already obtained by the author.

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