

ITALY



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General

Italy - officially the Italian Republic - is located in the heart of the Mediterranean Sea, Italy shares land borders with France, Switzerland, Austria, Slovenia, San Marino, and Vatican City. The country has an area of 30.1 Mha (million hectares) with in 2020 a population of 60.5 million, or 1.99 persons per ha (Wikipedia and United Nations, 2019).

Climate and geography

Italy has a largely temperate seasonal and Mediterranean climate. Because of the great longitudinal extension of the peninsula and the mostly mountainous internal conformation, the climate of Italy is highly diverse. In particular, the climate of the Po Valley geographical region is mostly continental, with harsh winters and hot summers. The coastal areas of Liguria, Tuscany and most of the South generally fit the Mediterranean climate stereotype. Conditions on peninsular coastal areas can be very different from the interior's higher ground and valleys, particularly during the winter months. The coastal regions have mild winters and warm and generally dry summers, although lowland valleys can be quite hot in summer (source: Wikipedia).

Italy is roughly delimited by the Alpine watershed, enclosing the Po Valley and the Venetian Plain. In the South, it consists of the Italian Peninsula and the two Mediterranean islands of Sicily and Sardinia, in addition to many smaller islands. The Apennine Mountains form the peninsula's backbone and the Alps form most of its northern boundary. The Po, Italy's longest river, flows from the Alps on the western border with France and crosses the Padan Plain on its way to the Adriatic Sea.

Arcieri and Ghinassi (2020) mention that in the history of Italian rice growing, the contribution by Leonardo da Vinci to conceiving and realization of gates and canals in order to drain the marshlands of the Po river plains during the 15th century is considered as priceless. Ciriaco (2005) states that during the course of the 16th century about 100,000 ha were reclaimed in the Po Valley.

Linoli (2005) gave a detailed description of the development of the reclamation works in the Pontine marshes and shows a map of the area (Figure 1). It started with the Volsci who undertook drainage works in the Pontine areas they inhabited to exploit the fertile lands for farming, to the extent that, according to the historian Dionysius of Halicarnassus, the lands dominated by Circeo *were the greatest of all the fields bordering on the Latin Plain and the adjacent sea*. At that time therefore, the marshes - thanks to the works carried out by the Volsci - must have been limited to localised areas lying lower than sea level. In fact this implies that it should have been polders. Linoli also describes that after several attempts in 328 BCE (before the common era) the Romans were able to subjugate the Volsci. However, they did not maintain the reclaimed areas well and it became swamps again. A new reclamation attempt took place in the period 495-520. However, probably owing to lack of maintenance, wars, exceptional floodwaters the whole reclaimed area became marsh again. Since then several works have been initiated to reclaim the marshes without real success as for example described by Ciriaco (2005) who stated that from the times of the Roman Emperors numerous attempts have been made to drain the Pontine Marshes. Linoli (2005) mentions, for example, that in the spring of 1515 Giuliano de Medici did sent Leonardo da Vinci to the area, with the task of drawing up a project for discharging the excess water to the sea. Due to opposition of local landowners the works were not completed. Also in the period 1585-1590 works have been implemented to reclaim the marshes, but also in this case with only temporary success. In 1629-1637 Nicolaes Cornelisz. de Witt and Gilles van den Houten from the Netherlands worked on the reclamation. However, with limited success. In 1648 the Belgian Nicolaes van der Pellen and then Cornelis Meyer tried to reclaim the marshes (Schouwenaars, 2019). Over the next decades many attempts were made to reclaim the marshes. Since the 1930th significant impoldering projects have been carried out, resulting in the present day impoldered area of 120,000 ha.

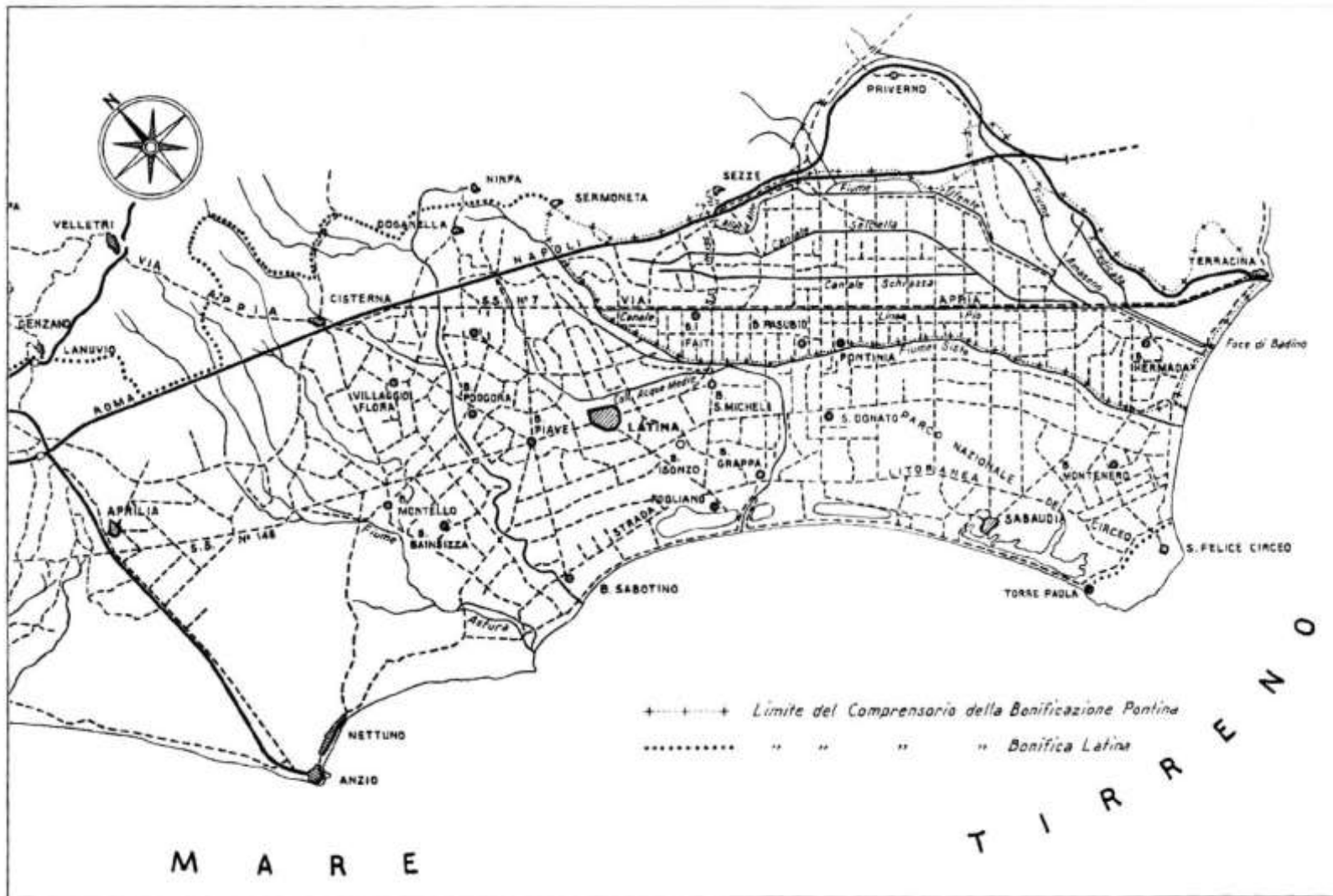


Figure 1. The area of the Pontine Marshes (Linoli, 2005)

Korthals Altes (1928) mentions that in 1576 Di Bentivoglio started with impoldering projects near Modena. After his death the works were successfully completed by his son.

Korthals Altes also describes the reclamation developments in the Polesine di Ferrara, south of the Po River (Figure 2). In this area there is significant subsidence. There seem to have already been impoldering projects around 1000. However, due to the subsidence the area became a swamp again later on. In the Polesine di Ferrara there was also the Comacchio at 5 m-MSL (mean sea level). In 1559 new plans for impoldering of the Polesine di Ferrara were initiated. Implementation took place from 1564-1580.

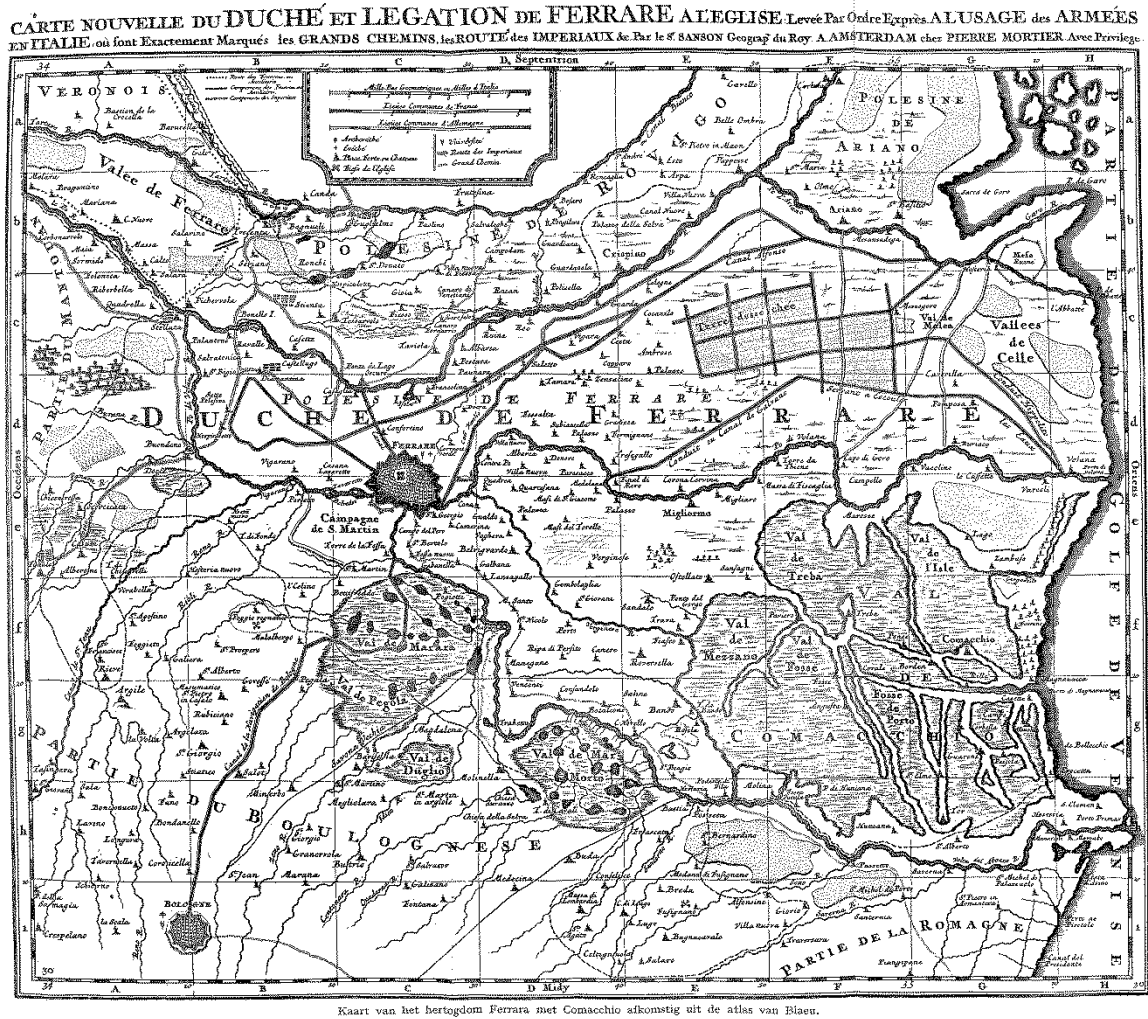


Figure 2. Map of the Ferrara area with the Polesine de Ferrara, as published in the Atlas van Blaeu (Korthals Altes, 1928)

Korthals Altes (1928) describes in detail the activities of Dutch specialists in impoldering projects in Italy. There has been a significant involvement in the reclamation of the Pontine Marshes. In other areas there has been a certain involvement. Mention can be made of a plan by Gilles van den Houte to reclaim an area near Ferrara at the beginning of the 16th century. Meyer has made a plan to improve the Arno River. In this plan also some impoldering projects were included (Figure 3). Both plans have not been implemented.

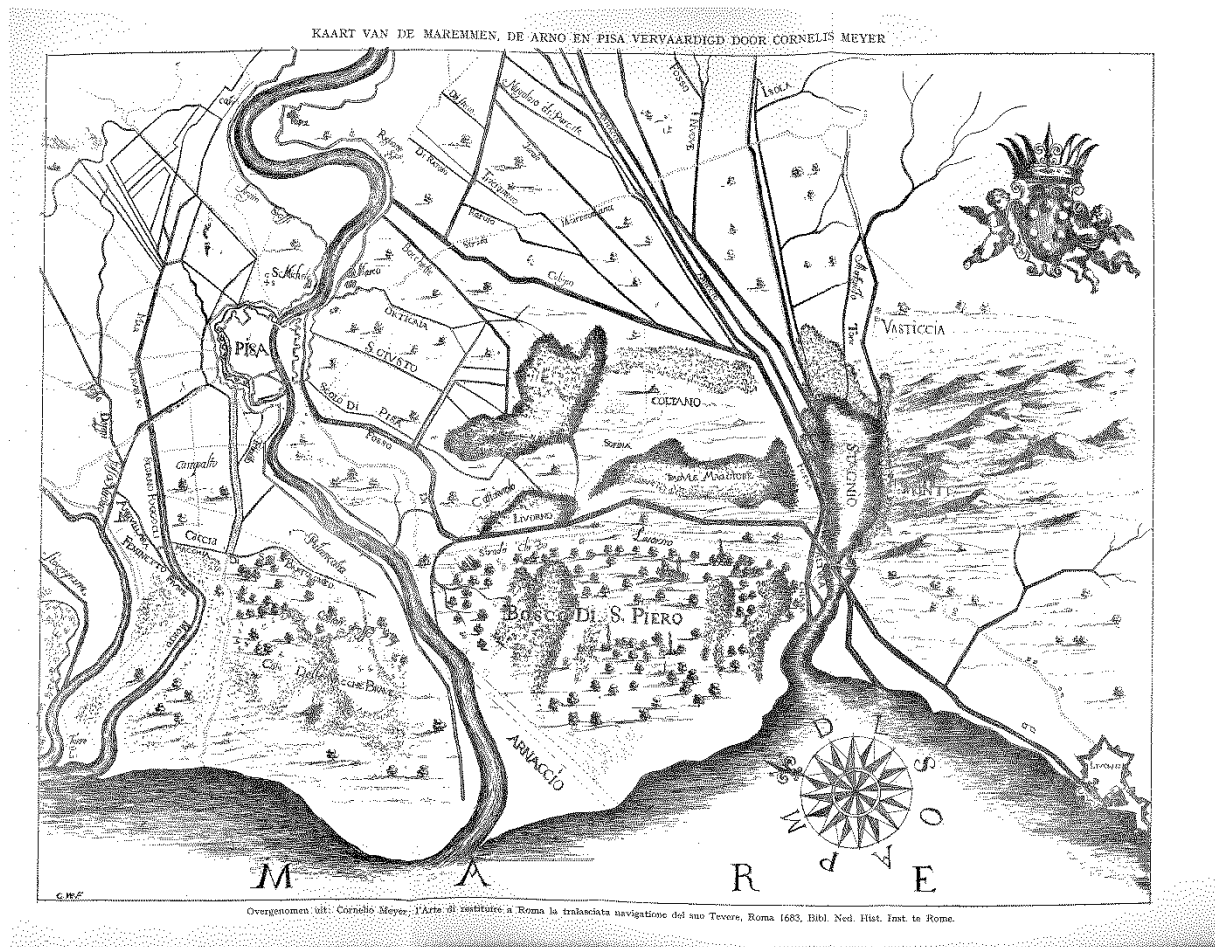


Figure 3. Plan of 1683 by Cornelis Meyer to improve the course of the Arno River and to reclaim some marshes (Korthals Altes, 1928)

Existing polders

Brisse and Rotrou (1876) describe that Lake Fucino was located on average at 668 m+MSL (mean sea level) and that originally it had a fluctuating area of about 140 km², which at the initiative of Claudia may have been reduced to about 90 km². They give a detailed description of the ancient works to drain the Lake. A 4.5 km collecting canal was extended and deepened by Hadrian, which reduced the area of the lake to about 57 km². However, all undertakings to drain the lake had been unsuccessful. Between 1852 and 1862 the larger tunnel was along the same route as the Roman tunnel and destroyed most of the archaeology of the Roman tunnel, which is why the success of the earlier Claudian Scheme by Claudia is so uncertain (Brisse and Rotrou, 1876 and Korthals Altes, 1928). Korthals Altes shows the cross sections of both tunnels (Figure 4). The deeper Hadrianic Canal destroyed the archaeology of the Claudian Canal. The final Roman Canal has left clear archaeology, showing that 1 km from the Lake, the tunnel was 7.5 m deep, 19.5 m wide at the top, and 4.5 m wide at the base. It sloped to the tunnel at 0.05%. The lake appears to have returned to its uncontrolled pre-Claudian area by the end of the 5th century and certainly by the end of the 6th century (source: Wikipedia). From 1854 – 1876 works to drain the lake were successfully implemented by Prince Alexandro Torlonia (Brisse and Rotrou, 1876). They also mention that the actual draining of the Lake provisionally started at 9 August 1862 and give a very detailed description of the lay out of the drainage and road systems. In 1870 the new tunnel was completed and the improvement works were ready (Korthals Altes, 1928). A satellite image of the reclaimed Lake Fucino is shown in Figure 5.

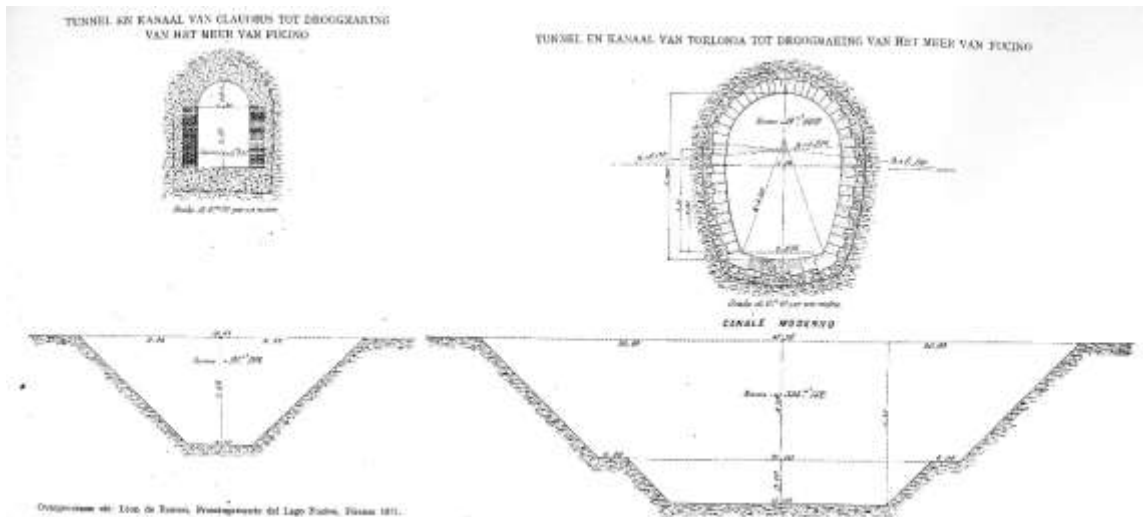


Figure 4. Tunnels and canals to drain lake Fucino (Korthals Altes, 1928, after De Rotron, 1871)



Figure 5. Reclaimed Lake Fucino

The Group Polder Development (1982) identified seven polder areas, which are included in Table I. In addition, Volker (pictures) mentioned the Bacinetto Polder.

General characteristics of the polders in Italy are shown in Table I.

Proposed polders

No proposed polders have been identified.

Pictures of polders

The pictures by Prof. Adriaan Volker are shown in Table II. The pictures by Prof. Bart Schultz are shown in Table III.

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Bart Schultz













Lelystad, May 2022

Table I. General characteristics of existing polders in Italy

Name	Reclamation	Area in ha	Type *)	Latitudes	Longitudes	Elevation in m+MSL	Land use
Polders in the Po Delta	Since 1000	200,000	RLL	44° 57' N	12° 28' E	-3	Agriculture
Sacca Sessola	1870	16	RLL	45° 24' N	12° 19' E	1	Urban
Lake Fucino	1854-1876	15,000	DL	41° 60' N	13° 33' E	650	Agriculture
Pontine Marshes	1928	120,000	RLL	41° 25' N	13° 3' E	0	Rural area
Bonifica Valle del Mezzano	1962	18,863	RLL	44° 40' N	11° 59' E	-4	Agriculture
Arborea			RLL	39° 47' N	8° 36' E	-1	Agriculture
Bacinetto Polder							
Banco d'Orio		500	LGS	45° 42' N	13° 19' E	0	Agriculture
Maccarese District			RLL	41° 53' N	12° 13' E	2	Agriculture
Vallesina Polder			RLL	45° 39' N	13° 0' E	-1	Agriculture
Valli di Comacchio			RLL	44° 43' N	12° 10' E	-2	Agriculture
Polders near Modena			RLL				
Total		354,379					

*) RLL = reclaimed low-lying land; LGS = land gained on the sea; DL = drained lake

Table II. Pictures of polders and lowlands in Italy by Prof. Adriaan Volker

			
A5 2 082/A.5.2.82*) Bacinetto Polder	A5 2 083/A.5.2.83 Bacinetto Polder	A5 2 084/A.5.2.84 Bacinetto Polder	A5 2 085/A.5.2.85 Bacinetto Polder
			
A5 2 086/A.5.2.86 Bacinetto Polder	B1 5 001/B.1.5.1 Urban area with canals in Venetia	B1 5 002/B.1.5.2 Urban area with canals in Venetia	B1 5 003/B.1.5.3 Laguna of Venetia
			
B1 5 004/B.1.5.4 Urban area with canals in Venetia	B1 5 005/B.1.5.5 Urban area with canals in Venetia	B1 5 006/B.1.5.6 Urban area with canals in Venetia	B1 5 007/B.1.5.7 Urban area with canals in Venetia

*) Batavialand/original

Table II. Pictures of polders and lowlands in Italy by Prof. Adriaan Volker (continued)

			
B1 5 008/B.1.5.8 Urban area with canals in Venetia	B1 5 009/B.1.5.9 Urban area with canals in Venetia	B1 5 010/B.1.5.10 Urban area with canals in Venetia	B1 5 011/B.1.5.11 Urban area with canals in Venetia
			
B1 5 012/B.1.5.12 Urban area with canals in Venetia	B1 5 013/B.1.5.13 Urban area with canals in Venetia	B1 5 014/B.1.5.14 Urban area with canals in Venetia	B1 5 015/B.1.5.15 Urban area with canals in Venetia
			
B1 5 016/B.1.5.16 Urban area with canals in Venetia	B1 5 017/B.1.5.17 Urban area with canals in Venetia	B1 5 018/B.1.5.18 Laguna of Venetia	B1 5 019/B.1.5.19 Probably urban area with canals in Venetia

Table II. Pictures of polders and lowlands in Italy by Prof. Adriaan Volker (continued)



			
B1 5 020/B.1.5.20 Probably urban area with canals in Venetia	B1 5 021/B.1.5.21 Probably urban area with canals in Venetia	B1 5 022/B.1.5.22 Probably urban area with canals in Venetia	B1 5 023/B.1.5.23 Probably urban area with canals in Venetia
			
B1 5 024/B.1.5.24 Probably urban area with canals in Venetia	B1 5 025/B.1.5.25 Probably urban area with canals in Venetia	B1 5 026/B.1.5.26 Probably urban area with canals in Venetia	B1 5 027/B.1.5.27 Probably urban area with canals in Venetia
			
B1 5 028/B.1.5.28 Probably urban area with canals in Venetia	B1 5 029/B.1.5.29 Probably urban area with canals in Venetia	B1 5 030/B.1.5.30 Probably urban area with canals in Venetia	

Table III. Pictures of polders and lowlands in Italy by Prof. Bart Schultz


















			
106_0638 Canal and buildings in Venetia	106_0639 Canal and buildings in Venetia	106_0640 Canal and buildings in Venetia	106_0641 Canal and buildings in Venetia
			
106_0642 Canal and buildings in Venetia	106_0643 Canal and buildings in Venetia	106_0644 Canal and buildings in Venetia	106_0645 Canal and buildings in Venetia
			
106_0646 Canal and buildings in Venetia	106_0647 Canal and buildings in Venetia	106_0648 Canal and buildings in Venetia	106_0650 Canal and buildings in Venetia

Table III. Pictures of polders and lowlands in Italy by Prof. Bart Schultz (continued)

			
106_0651 Canal and buildings in Venetia	106_0652 Canal and buildings in Venetia	106_0653 San Marco square in Venetia	106_0654 San Marco square in Venetia
			
106_0655 San Marco square in Venetia	106_0656 San Marco square in Venetia	106_0657 San Marco square in Venetia	106_0658 Canal and buildings in Venetia
			
106_0659 Canal and buildings in Venetia	106_0661 Canal and buildings in Venetia	106_0662 Building with protection against flooding	106_0663 Canal and buildings in Venetia

Table III. Pictures of polders and lowlands in Italy by Prof. Bart Schultz (continued)

			
<p>106_0664 Canal and buildings in Venetia</p>	<p>106_0665 Canal and buildings in Venetia</p>	<p>106_0666 Canal and buildings in Venetia</p>	<p>106_0667 Canal and buildings in Venetia</p>
			
<p>106_0668 Canal and buildings in Venetia</p>			