Twenty-six Centuries of Reclamation & Agricultural Improvement on the Pontine Marshes*

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Summary

The Pontine Marshes cover a plain of about 80,000 hectares, located in Lazio to the south-east of Rome, hemmed in by a chain of hills and the sea. The coastal dune system made it difficult for the many watercourses to reach the sea, and their resultant flooding turned the area into marshland, with the consequent spread of malaria.

During the seventh and sixth centuries BCE, the Latins and Volscians founded numerous settlements in the area, consequently managing to control the waters (even partially), but with Roman occupation, the area declined. The sole important structure realised by the Romans was the Appian Way, flanked by several canals to avoid flooding.

Reclamation works were carried out by the Popes from the end of the thirteenth century, including Boniface VIII, Eugenius IV, Leo X, Pius IV and Pius V, but only with the last (who died in 1590 of malaria caught while

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inspecting the works) was a start made on any organic plan to dispose of the stagnant waters.

Despite several projects during the following centuries, every initiative came to a standstill, until Pius VI (eighteenth century) started on a complex work plan, subsequently interrupted by the Napoleonic invasion and in actual fact never resumed.

With the coming of the Kingdom of Italy, major studies were carried out on the reclamation works to be undertaken, but it was only in 1924 – following the promulgation of important laws concerning integral land reclamation, culminating in Consolidation Act n° 215 of 1933 – that a start was made on the sanitary, drainage and land improvements in the region, with important results, partly wiped out by the war events of 1943-44.

With the damage to infrastructure repaired after the war, the reclamation area – whose population prior to 1924 was less than one thousand - is today inhabited by over 315 thousand persons, its highly important production specialising in the agro-zootechnical and industrial sectors.

1. Physical Conditions

The Pontine Marshes form a vast plain covering about 80,000 hectares, located in Lazio to the southeast of Rome. The area is roughly 45 km long with a width varying between 15 and 25 km, hemmed in by a chain of hills – the Lepini and the Ausoni – to the northeast and the Tyrrhenian Sea to the southwest, the Circeo promontory southwards, and again the Tyrrhenian Sea to the southeast. To the north and northwest it borders the Roman Campagna, with rather vague limits that could be taken as coinciding with the lower and middle course of the River Astura and then with a line drawn in a north-easterly direction towards the town of Cori on a spur of the Lepini Hills.

The depression, which has existed since far-off geological times[1], between the mountain chains of the Lower Eocene and the Cretaceous periods and the coastal dunes of the Quaternary, had filled up – thanks to the solid matter carried by its dense hydrographic network – with silt (peaty alluvium). At the same time conspicuous dunes were formed, often impeding discharge to the sea of rainwater and the natural run-off from the hills, as well as of the numerous and abundant springs existing at the foot of the extremely permeable calcareous formations of the *Monti Lepini* and *Ausoni*, thus giving rise to widespread and extensive swamplands[2]. The waters of this hydrographic basin are gathered by the River Amaseno (and related tributaries) and by the River Sisto. Over the centuries, the latter, draining the lower-lying area, has met with great difficulty in discharging the rain and spring water from its basin into the sea, owing also to the barrage formed by a chain of dunes between Terracina and Circeo.

The Quaternary dune separating the depression from the sea reaches a height of 30-40 m a.s.l. Among its altimetric – irregularities, it used to include here and there – prior to the reclamation works carried out between 1930-40 - marshy spots and stag nant pools (*piscine*) in the midst of thick scrub.

[1] Between 430,000 and 400,000 years ago, the Tiber crossed a much longer stretch of plain than it does now, running at the foot of the Lepini Hills. The mouth of this paleo-river bed, its *talweg* cut into a Calabrian-Pliocene bed whose traces have been identified at an elevation of –90 m a.s.l., was located between Monte Circeo and Terracina, its course coinciding, or parallel upstream, with the present River Sisto. The Tiber's current river bed was formed at a geological era dating back 360,000 years ago, owing to the blockage of its previous bed by the volcanic activity of the Alban Hills "Manfredini 1990".

[2] The many springs rising at the foot of these calcareous formations, covering a distance of about 20 km, have a total flow rate that can even reach twenty cubic metres per second.

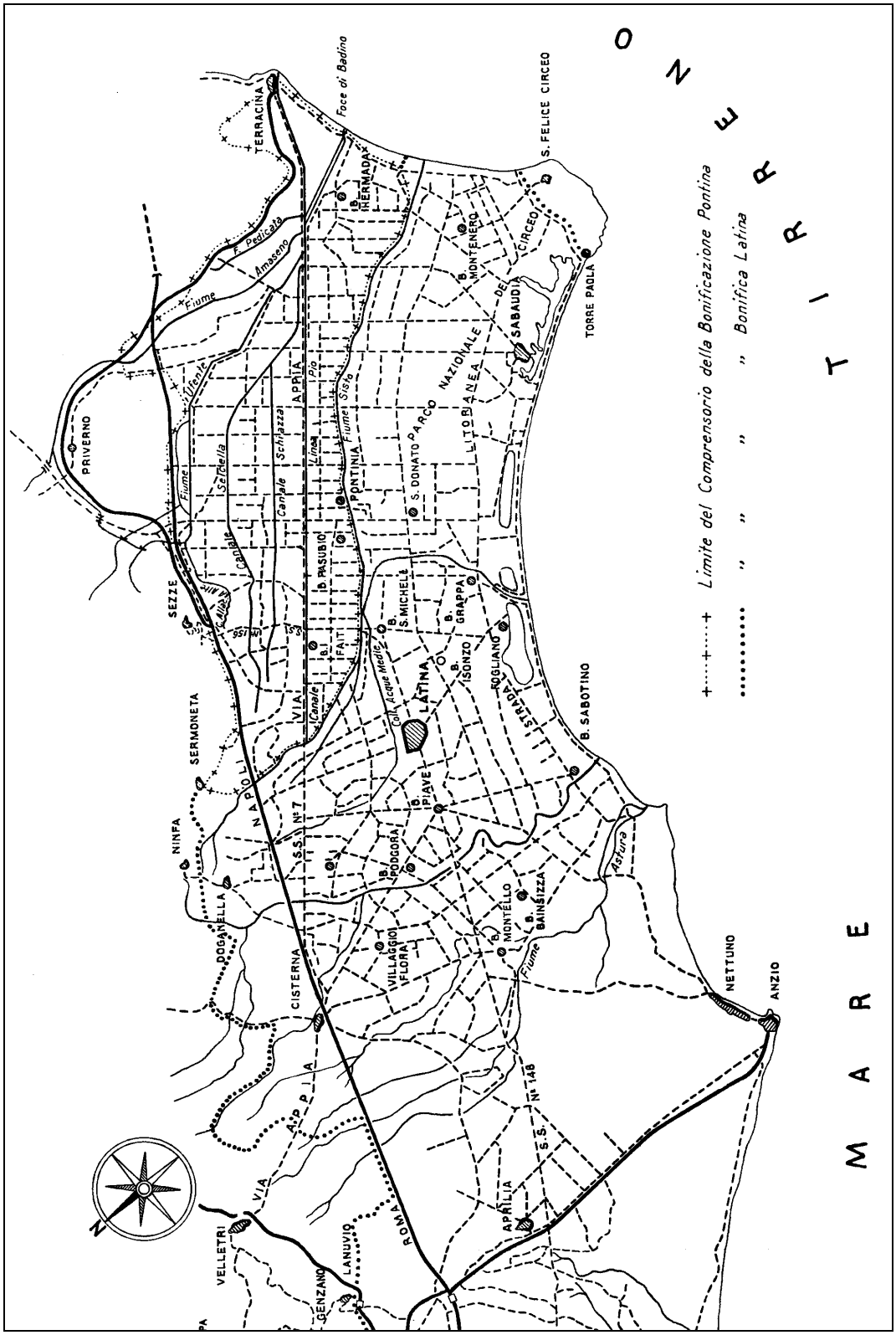

Fig. 1: Map of the Pontine Zone.

To the southwest of this dune, a modest coastal dune has recently been formed, giving rise to a series of coastal lakes – *Fogliano, dei Monaci, Caprolace* and *Paola* (nowadays *Sabaudia*) – between the Circeo promontory and the mouth of the River Astura.

2. Land Reclamation & Agricultural Improvements up to the Unification of Italy

2.1. The Pre-Roman and Roman Period

Initially the area was inhabited by the Latins and then by Latin-Etruscan colonies, subsequently defeated by the Volsci[3], who planted numerous settlements, some of which have disappeared over the centuries, such as *Suessa Pomezia*, while others still survive, including Artena, Anzio (*Antium*), Terracina (*Anxur*), Sezze (*Setia*), Segni (*Signia*), Norma (*Norba*), Sermoneta (*Sirmio*), Cori (*Cora*), San Felice Circeo (*Circellum*) and others[4].

The Volsci were the first to undertake drainage works in the Pontine areas they inhabited, and to exploit the fertile lands for farming purposes, to the extent that according to the historian Dionysius of Halicarnassus[5], 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.

The agricultural wealth of the area clearly stimulated the interest of the Romans, who several times attempted to occupy the territory, but were regularly repulsed by the Volsci until, in 328 BCE, with the conquest of Priverno and the founding of new colonies, the Romans managed to subjugate and Romanise the local population.

First the wars of conquest with their devastation, and subsequently the incapacity of the new colonists to manage the existing drainage works endangered the regular run-off to the sea, causing vast areas of the plain to become marshland, with the concomitant spread of malaria, so that Roman authors called the area the "*Pomptinae Paludes*".

In his *"Geography"*[6], written during the last years of his life, in speaking of the Roman countryside, Strabo says "*The whole territory is fertile and produces everything, except for a few places along the coast that are marshy and unhealthy, such as the land of the Ardeati, the one between Antium and Lanuvium as far as the Pomentina plain and some lands in the region of Setia (Sezze), and the one near Tarracina*".

In his work "*De Architectura*", Marcus Vitruvius Pollio[7], illustrating whether or not to build houses in marshy areas[8], notes that "*where marshes have no possibility of outlet through canals or rivers, as in the case of the Pontine Marshes, the water stagnates and a putrefaction process sets in, causing nauseous and pestilential exhalations*".

Some interventions however – although not for agricultural purposes – were undertaken to facilitate water drainage. In 312 BCE, the Censor Appius Claudius Caecus began build-

[3] The Volsci were a people of Umbrian origin (central Italy) who, in the second half of the sixth century BCE moved southwards, settling in the middle valley of the River Liri and in the area between the Alban Hills (southeast of Rome), the Tyrrhenian Sea and the River Sacco, which also included the Pontine Marshes.

[4] Some of these settlements had, however, been founded prior to the Volscian invasion, by the Latin and Latin-Etruscan peoples.

[5] Dionysius of Halicarnassus (60BCE-8CE) wrote various works including *Roman Antiquities*, an historical work narrating the events of Rome from its foundation to the First Punic War.

[6] Strabo was born in 64 BCE and died in 24 CE, and wrote a weighty work on geography. The passage cited is from Book V, chap. 3, para. 4.

[7] The only Roman writer on architecture whose work has come down to us. His *De Architectura* in 10 books was written between 27 and 23 BCE.

[8] Book I, chap. IV, para. 12.

ing the carriage road, named the *Via Appia* in his honour, connecting Rome with Brindisi. The Rome-Terracina (*Anxur*) stretch is perfectly straight, but at the end of the section is forced to pass between the foot of a rocky spur – on which the temple of Jove Anxur rises) – and the sea, having crossed the whole length of the Pontine plain (or more precisely the Pontine marshes). The intervention thus aimed at preventing the road – entirely cobble-stoned[9] – from flooding, also in view of the fact that the only alternative route was the *Via Setina*, a tiring connecting road climbing over the heights between Sezze and Terracina.

Another intervention, cited by Livy[10], was carried out around 162 BCE by the Consul M. Cornelius Cethegus for the sole purpose of safeguarding the practicability of the Via Appia. It appears that it consisted of excavating a stretch of a major canal, subsequently denominated Rio Martino, cutting transversally through the great Quaternary dune and running southwest towards the sea. The Consul may have wished to create a proper collecting drain, but the work – limited to the space and time of his consulship – did not produce relevant benefits.

Caius Julius Caesar also studied a plan – never carried out owing to his assassination – to divert the course of the Tiber, which, according to Mommsen[11], foresaw the "*deviation of the whole lower course of the Tiber and, instead of allowing it to run from the present-day Ponte Molle, between the Campo Vaticano and the Field of Mars towards Ostia, directing it around the Campo Vaticano and the Janiculum in a straight line through the Pontine Marshes to the Gulf of Terracina*". According to this plan, "*the Pontine Marshes would be drained and the Latin coastline generally, and the Capital would be provided with a safe seaport, which had been desired for so long*".

Once again, Strabo's *Geography* states "*At 290 stadii* (about 43 km) *from Antium lies Monte Circeo, which rises like an island out of sea and marshes…. Inland lies the Pomentina plain… After Circeo, at 100 stadii* (about 15 km)*, lies Terracina, earlier called Trachine owing to its actual configuration. Before it stands a great marsh formed by two rivers, the greater being called the Ufente. There, for the first time, the Via Appia, which runs from Rome to Brentesion (Brindisi), and which is the route most utilised, reaches the sea…. Near Terracina, for those going towards Rome, the Via Appia is flanked by a canal fed in many places by stagnant waters and rivers: it is used for navigation especially at night, so that travellers journey from evening to early morning and proceed the rest of the way by road, but also by day. A mule pulls the boat*."[12]

Indeed, in order to overcome the discomfort of travelling along the Via Appia at times when it was flooded by water, the Romans dug a canal, the *Decennovium*, parallel to the road, also for the purpose of facilitating run-off towards the sea. The name alludes to the

[9] Procopius, who lived in the first half of the sixth century CE, described the Via Appia as follows: "*It is truly one of the most wonderful works in the world. All the paving stones, which are very hard millstone, Appius Claudius had transported there, quarrying them elsewhere, because they were not to be found in that region. He then had the stones dressed until the surfaces were smooth and had them cut with square corners, so they would fit together without mortar or other cohesive and they fit so firmly together that the onlooker cannot believe that they were laid out artificially, but that they form a single whole. And despite the passing of time* [author's note: 9 centuries!] *and although they are travelled on every day backwards and forwards by multitudes of vehicles and animals of all kinds, their structure has in no way been disjointed, nor have they lost anything of their smoothness.*"

[10] Livy (Titus Livius), Latin historian 59 BCE – 17 CE, *History of Rome* – Book XLVI.

[11] T. Mommsen, *Roman History*, Book V, chap. XI.

[12] In his *Satires* (V, 3-23), Horace also recounts an episode of his nocturnal journey by boat on the *Decennovium*, discovering at dawn that he was still at the point of departure, because the boatman, having got drunk, had fallen asleep!

19 miles (about 28 km) along which the road was at its most impracticable[13].

Other works were carried out by the emperors Nerva and Trajan (end of first century CE), also for the purpose of making the Via Appia practicable, since it was often flooded when the rivers Amaseno, Ufente, Astura, Ninfa and Teppia burst their banks.

In actual fact, however, although on conquering the territory, the Romans were initially interested in its agricultural production, with the progressive extension of Rome's borders - first within the peninsula and the major Italian islands, then to Europe, Asia and Mediterranean Africa -, their interest moved to the immediate exploitation of the vaster and richer areas they had subjugated. They avoided any commitment to an expensive reclamation of the Pontine area and limited their interventions to ensuring the practicability of the Via Appia, the essential route for communications with Greece.

A further timid attempt at reclamation by a Roman patrician, Caecina, of the Decii family took place under the dominion of Theodoric (495-520 AD), King of the Ostrogoths. Indeed, Caecina petitioned the sovereign for authorisation to carry out personally the reclamation works for the area, requesting in return ownership of the reclaimed lands. An inscription discovered at Terracina[14] records that the intervention was brought to successful completion over an area extending for 35 km upstream from Terracina. Subsequently, however, probably owing to lack of maintenance, wars, exceptional floodwaters, or whatever, the whole area reclaimed by Caecina became marsh again.

2.2. Early Papal Interventions

In any case, in the following centuries, the barbarian invasions, pestilence, Saracen raids, struggles among the Roman patricians (both in and outside Rome), the incapacity of the Papal government which has an at least formal control over the Pontine plain[15], all contributed to the abandon and degradation of the area.

Only in 1298 was an initial intervention carried out by Boniface VIII (who belonged to the Caetani family). A canal was dug to free the waters on the Pontine lands of the Dukedom of Sermoneta, acquired shortly before by his nephews. These very modest and short-lived works nearly unleashed a civil war among the local gentry, since their purpose was to discharge the waters of the Ninfa river into the River Cavata, which – owing to its modest capacity – gave rise to tremendous flooding in the territory of Sezze.

The attempt was taken up a century later by Pope Eugenius IV, who proposed to create a new canal to collect the waters of the rivers Ninfa, San Nicola, Falcone and Acquapuzza, with the double aim of forming a geographical boundary between the Dukedom of Sermoneta and the territory of Sezze and, above all, of not damaging the latter. The work came to a halt at the Pope's death in 1447.

The next was Leo X, of the Medici family (1475-1521), who "*in the face of private inertia and following the great Medici tradition, always aimed at exalting the arts and developing their own dominions*"[16], intended to reclaim the areas, encountering however the opposition of the Duke of Sermoneta, who feared he might lose his benefits from granting fishing rights in his territory. Leo X, by

[13] At the same time, the Romans liked to go to the Circeo promontory, which was already at this period a residential area *par excellence,* as documented by the remains of the Acropolis, the piscine of Lucullus and Domitian's villa.

[14] And on view in the main square, beside the cathedral, once the temple of Apollo.

[15] Indeed, in 774 CE, the Emperor Charlemagne confirmed to the Papacy the so-called "*donation of Pipino*", which comprised possession of the whole of Lazio and consequently also of the Pontine marshes.

[16] "Starnazzi, 2003".

motu proprio dated 14 December 1514, assigned to his brother Giuliano, the commander of the papal army, the task of eliminating the marshy areas along the Terracina coastal strip, carrying out the operations at his own risk and expense, but taking in exchange – by way of donation – all the lands reclaimed from the waters.

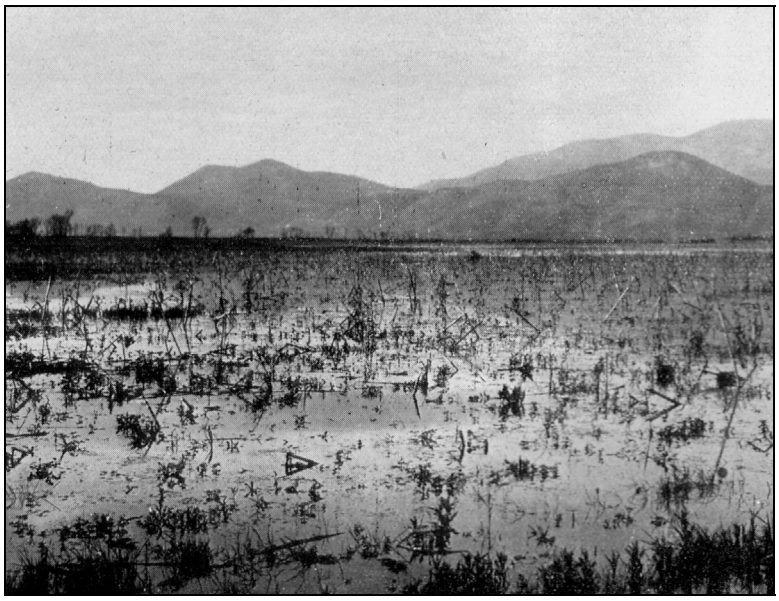

Fig. 2: Overflows in the Pontine Zone.

Fig. 3: A flood in the Piscinara Zone.

In the spring of 1515, Giuliano de' Medici sent Leonardo da Vinci to the area, with the task of drawing up a project for draining off the water, of which the general plans – in practice the widening and improvement of the Rio Martino and the creation of a new drainage canal – are shown on the map, full of details, drawn by the scientist and artist (Windsor, RL 12684). Giuliano then went into partnership with one Domenico de Iuvenibus and entrusted the supervision of the works to the surveyor Giovanni Scotti. The works began in the same year with the digging of the drainage canal – which took the name of *Canale Giuliano*, and subsequently, of *Canale Portatore* (or *Portatore di Badino*) – by means of which the waters of the River Ufente, up to then flooding and stagnating on the plain, could at last find an outlet to the sea.

Giuliano de' Medici died in 1516 and the Pope handed over the reclaimed property to his nephew Lorenzo, with the task of continuing the reclamation. At this point, the inhabitants of Terracina rose in opposition. To begin with, they had been willing to hand over ownership of the flooded lands to the Papacy, but once they had seen how easily the reclamation had been carried out, they opposed any further works so as not to lose their property rights. The opposition of the landowners of Sermoneta and Sezze and then the death of Leo X (1521) resulted in the definitive suspension of the works, without even any intervention on the Rio Martino, despite attempts made by Pius IV and Pius V.

Sixtus V (1520-1590), a man of great energy, having succeeded to the Papacy (1585), gave charge to the architect Ascanio Fenizi of Urbino – in exchange for the usual grant of ownership of the reclaimed lands – to proceed at his own expense with the reclamation of the upper part of the Pontine plain, imposing a deadline for the start of works (May 1586). Having gone into partnership with others in order to dispose of sufficient capital, Fenizi abandoned any work on the Rio Martino, in view of local socio-political precedents, but he extended and deepened the *Fiume Antico*, creating an outlet to the sea close to Torre Olevola (Monte Circello), so as to drain the waters from the lands of Sezze and Priverno.

The enterprise was crowned with great success, and on 11 October 1589 the Pontiff visited the area, staying there for a fortnight. On 29 August 1590, however, Sixtus V died of malaria, contracted during his survey of the Pontine Marshes, and his death put yet another stop to any intervention. Owing to lack of maintenance and the destruction brought about by fish poachers, who were unhappy with any works intended to reclaim the area, the marshes grew once more.

2.3. The Dutch Projects

A few decades went by and in 1637, Nicolò Cornelius Witt, a Dutch specialist in flood protection, presented Pope Urban VIII with a project to be carried out together with his partners. The project envisaged the creation of a major navigable canal, about 45 km long, which, starting from Ninfa – hence the name *Canale Ninfeo* – would cross the whole marsh. This plan never got off the ground owing to Witt's death.

In 1659, under Alexander VII, a Fleming – Nicolò Wan der Pellens –petitioned for a concession to reclaim the marshes, but the excessively hard conditions imposed by the papal government rapidly dissuaded him from pursuing the initiative.

This was followed, under Innocent XI, by a request from another Dutchman – Cornelis Meijer (Italianised as Meyer) – a hydraulic engineer known for his works in Holland, but – after drafting a plan of the Pontine Marshes in 1678 – this attempt was also abandoned owing to the impossible conditions imposed by the pontifical authorities.

When Innocent XII was elected pope in 1691, Meyer put forward another request. The Pontiff arrogated to himself ownership of all the marshy lands so as to transfer them to him as well as to those persons he had deemed appropriate to take on as partners. The sole important condition was that the reclamation works had to be terminated within 20 years. Meyer then came to an agreement with Don Livio Odescalchi, Duke of Bracciano, who decided to carry out the work at his own expense, hiring Meyer as supervisor of the works. Immediate opposition came from the inhabitants of Sezze, Priverno and Terracina, so that Innocent XII's successor, Clement X, desirous of bringing the works to a conclusion, issued a decree in March 1702, transferring ownership of the marshlands to the Duke of Bracciano. Meyer having died, the works – begun in 1702 – were carried out by his son Otto, who started by cleaning the bed of the River Ninfa and embanking the River Acquapuzza. Once again however those who saw their interests being sacrificed opposed the works, and Baldassare Odescalchi, who had succeeded Don Livio, abandoned the work after seeing his family spend more than 30,000 scudi, a very considerable sum for the time.

In the years that followed, no important attempts were made, although the popes always mooted the idea, and Clement XIII ordered Enrico Bolognini and the surveyor Giacomo Sani to carry out a study. They proposed using the Rio Martino as a collector drain to the sea for the Teppia, Ninfa, Acquapuzza, Portatore di Bassiano and S. Nicola rivers. The Pope presented the project for review by other specialists from Ferrara, who gave a favourable

opinion, but no one was found to finance the enterprise. Since the resources of the Papal States were insufficient to take over the burden directly, the whole project came to a standstill until Pius VI.

2.4. The Project and Works of Pius VI

On 5 February 1775, Giovanni Angelo Braschi of Cesena was elected pope and took the name of Pius VI. In that same year, two companies – one French and one Lombard – offered to reclaim the Pontine Marshes, but before taking a decision, the Pope wished to review the whole enterprise. At a government meeting on 28 May 1775, everyone agreed to the expediency of the intervention, but that the burden of the reclamation should be shouldered by the private sector, thus dispensing the Apostolic Camera[17] from all expenses. It was also decided, prior to commencing the works, to review any existing property rights over the lands to be reclaimed and, if there were any, to assess the contribution that the owners should make in exchange for the advantages of the reclamation.

The Pope summoned to Rome two distinguished hydraulic experts from Bologna, Gaetano Rappini and Ludovico Benelli, who visited the marshes to ascertain the causes of flooding, study the most suitable means of preventing the same and assess the cost of the works. Together with the jurist Giulio Sperandini, the notary Gaspare Torriani, the surveyor Angelo Sani and the specialist Benedetto Talani, they considered it best to divide the reclamation area into two zones:

- The inner district, including the territories of Terracina, Sezze, Piperno, Sermoneta and Bassiano, i.e. the lower-lying areas which would profit most from the reclamation.
- The outer district, including the lands surrounding the former, which would profit from the drainage canals, but not to the same extent as the inner district.

They also differentiated the contributions to be made by landowners in the inner and outer districts.

Once Rappini's project had received the approval of a further two hydraulic engineers from Bologna, and desiring to start the works as soon as possible, Pius VI decided – contrary to what had been established initially – that the work would be funded by the Apostolic Camera.

The first works started, under Rappini's supervision, in the autumn of 1777, with the demolition of the fishponds at Canso, Capo Sele and others, which would otherwise have impeded the works. The site of the future outlet canal parallel to the Via Appia – which was to take the name of *Linea Pio*, after the Pope's name – was cleaned and excavation works were started. In order to facilitate this work and the cleaning of the beds of rivers, torrents and ditches, huts were built to house the workers (up to 3,500 were employed), with ovens for baking bread and warehouses for storing victuals. The cutting down of high trunks, growing at the edges of the marshes, was contracted for payment. Furthermore, in order to avoid problems with landowners, who were allowed to farm the lands so long as they did not impede the execution of the works, the Pontifical Commissioner, the lawyer Giulio Sperandini, received from the Pope the widest powers, including the extremely rare power of proceeding even against ecclesiastics.

The year 1779 saw very little rainfall and facilitated the implementation of the works. In the following year, Pius VI wished to check work progress on the ground and was satisfied to note that much land had already been reclaimed. He made the mistake of leasing the

[17] The Court dealing with the Church's financial affairs (N.E.U. Rizzoli-Larousse).

reclaimed lands to Rappini, the works supervisor, who then became more interested in exploiting the lands received than in pursuing the works.

Pius VI repeated his visits in 1781, 1782, 1783 and 1784 and, seeing that the works were proceeding slowly, did not renew Rappini's lease, ordering that the lands should be leased on a share-tenancy basis[18] as small allotments to local peasants, since he was convinced that only by means of agricultural exploitation could the reclamation of the Pontine Plain be achieved and consolidated.

Continuing his annual visits, in 1791 the Pope decided to transform the share-tenancy leases into long leases[19], but this initiative aimed at assisting small farmers failed miserably owing to speculators, including the Pope's own nephew, Duke Braschi-Onesti (who managed to secure over 5,000 ha), the works supervisor – the engineer Rappini - (who was content with a mere 2,000 ha), plus a few others, out of a reclaimed area of about 30,000 ha.

In order to separate high and low waters, two independent collector drains were created:

- The waters of the Ninfa and Teppia rivers and from the Cisterna canal and other minor water courses were collected by the River Sisto, appropriately cleaned and graded, and through the new *Canale delle Mole* or *di Ninfa*, a tributary of the Sisto and, through the Fiume delle Volte, into which the Sisto discharges, were conveyed to the sea;
- The waters of the Ufente, the Rio Brivalgo and others were – as far as possible – conveyed away from the Pontine area by a diversion of the Ufente and discharged, together with the waters of the Amaseno, into the so-called *Pantano dell'Inferno*, whence they poured into the *Linea Pio* which carried them to the sea through the *Portatore di Badino*.

In order to draw the waters off the plain, minor drainage canals were also dug, called "*Fosse Miliari*", because they were spaced one mile apart, to facilitate the run-off of rainwater towards the *Linea Pio*.

In short, the key to Pius VI's reclamation is the *Linea Pio*, which was begun in 1778 and required three-and-a-half years of work. It crosses the marsh parallel to the Via Appia for 21.5 km, joining the two villages known as *Le Macerie* and *Foro d'Appio*. Navigable at all seasons, it was completed with a road on the right bank and with numerous drinking troughs for cattle, with the aim of preventing the cattle from ruining the embankments by going down to the canal. In 1786, the *Linea Pio* was extended upstream for 5.6 km, from *Foro Appio* reaching the village of *Tre Ponti*.

In 1798, as a consequence of the French invasion, the works were halted. Furthermore, the Pope died the following year, having spent, in twenty years, over 10 times the amount originally estimated by Rappini[20], without completing the reclamation of the Pontine Plain.

2.5. The Napoleonic Studies

With the Napoleonic occupation, a commission was appointed by Bonaparte to assess the effectiveness of the works performed and to draw up appropriate proposals to complete the reclamation. The said commission included the Engineer Inspector General the Baron de

[18] Share-tenancy: an agricultural lease on a profit-sharing basis, by the lessor and one or more tenants, to farm land and exercise related activities with the aim of sharing produce and profits.

[19] Long leases (*emphyteusis*): the right to enjoy the land belonging to another party in perpetuity or temporarily, with the obligation of improving it and of paying certain annual services in cash or kind.

[20] "Orsolini Cencelli 1997".

Prony, Count Fossombroni of Florence[21], Messrs Irvard and Rigard de l'Isle and M. Desfongères, but the political events of the next few years, culminating in Napoleon's fall, blocked every initiative.

However, in 1822, de Prony published in Paris the volume "*Description Hydrographique et Historique des Marais Pontins*", in which[22], concerning the works performed by Pius VI, he wrote:

"*…. as a rule, from a hydraulic point of view , they are only very approximate, some quite unfinished. Indeed, among the works not even roughed out are some of the greatest importance, as for example, those relating to surface waters, without which the complete reclamation of the Pontine lands cannot even be hoped for*".

He then advanced several proposals, of which the main one, concerning high water control, was the canalisation and revamping of the River Sisto, so as to avoid the silting up of the mouth at Badino by the greater flow rate conveyed.

Fossombroni, on the other hand, with his experience at Valdichiana behind him, foretold that reclamation would take place "*by alluvion*", followed by the immediate cultivation of the reclaimed lands and the setting up of settlements on the plain[23].

[21] Famous for the studies and works he carried out on the reclamation of Valdichiana.
[22] The following passages from de Prony are taken from "Riva, 1983".
[23] *Ibid*.

2.6. The Post-Napoleonic Era

In the decades following the fall of Napoleon, very little was done by Pius VII on his return from imprisonment - or by his successors - to settle the Pontine Plain and maintain the works already carried out. In 1845, under the pontificate of Gregory XVI, the intention was to hand over the reclamation works to private hands, after completing some essential works, estimated at about 30,000 scudi, to relieve the papal administration of the heavy burden of maintenance. The initiative was not followed up, owing to the death of the Pope in 1846.

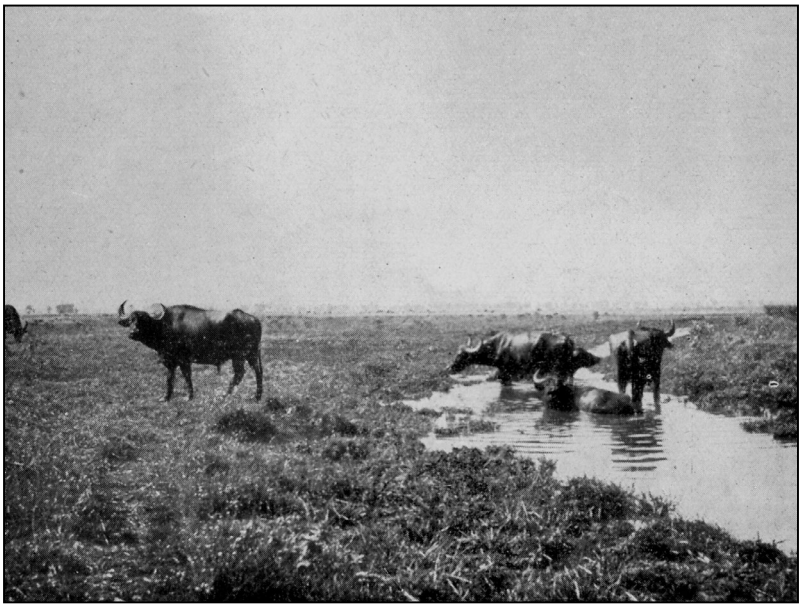

Fig. 4: Permanent marshes in the Piscinara Zone.

It was only in 1861 that Pius IX, by means of a "*notificazione*", summoned a general meeting of the Pontine lease-holders (*emphyteutas*), so that they could set up a Consortium and appoint an assembly or association to represent them and see to the maintenance and completion of the reclamation works at the expense of the lease-holders. There was widespread opposition to this measure, but Pius IX did not give way, except to recognise that the Papal State should contribute 25% to maintenance costs, and the provinces of Frosinone

and Velletri 15%, in consideration of the social importance of the reclamation.

The end of Papal government was, however, nigh.

Fig. 5: Overflows in the Terracina Woods.

3. From the Unification of Italy to the Serpieri Act

On 20 September 1870, Italian troops entered Rome and the Papal States ceased to exist.

Taking over from the Apostolic Camera, the Italian Government undertook to contribute to maintenance costs for the works implemented up to then, but could do very little to complete them, owing to difficulties of all kinds (economic in particular) resulting from the transfer of political power and the unification of the country.

In the meantime, at national level, after various attempts, the "*Baccarini*" Act on reclamation was approved in 1882. It did not however provide the expected results for various reasons (mostly economic).

In any case, up to 1891, the area involved in the Pontine reclamation covered roughly 19,600 ha, of which about 1,100 ha were canals, roads and embankments. Of the remaining 18,500 ha, 10,000 had been permanently reclaimed, while a further 7000 ha remained dry only during the summer (from June to October), the final 1,500 ha being almost perennially flooded.

At territorial level, however, up to the end of the nineteenth century the Pontine Plain covered about 89,000 ha, of which 22,200 ha ordinary sowable land (mostly located in the reclaimed area), 36,800 ha of permanent meadow and pasture, while woods of various kinds accounted for about 30,000 ha.

With State intervention, besides clearing the silting up of the drainage network and the rivers Amaseno, Ufente, Ninfa, Sisto, etc., the most important of the few works carried out was the digging of a new canal, called the *Diversivo di Linea*, almost 5 km long, running from the right of the *Collettore di Linea* to the confluence with the Amaseno, and reaching the *Portatore* at Badino. The works lasted from 1891 to 1895. In short, at the end of the nineteenth century, the whole drainage network consisted of a main canal, four longitudinal canals, two perimeter canals, one river-torrent, one collector drain and one canal naturally divided into two.

The works carried had, however, improved - although not solved - the area's health problem. Indeed, malaria, which held sway in its

most serious forms, inexorably striking any who ventured "into the marshes", decreased, facilitating the demographic growth of some towns on its borders, such as Terracina. The 1901 census numbered a little over 39,000 inhabitants, two-thirds living in built-up areas on the edges of the territory and the remainder scattered around the Pontine Plain.

In 1900, with the issue of the Consolidation Act on Land Reclamation by Drainage, the Pontine Plain was classified as first category marshland, and its reclamation works were thus at the charge of the State. Numerous projects and studies were consequently taken up again for the complete drainage of the area, both by the Civil Engineers [24] and by the *Consorzio Pontino*, but the outbreak of the First World War cancelled every initiative.

In 1918, an engineer named Marchi of the Rome Civil Engineers was given the task of drawing up a framework-project to complete the reclamation of the Pontine Marshes. Marchi proposed separating high and low waters by digging canals with different outlets to the sea and suggested dividing the whole area into two zones, one belonging to the then *Consorzio della Bonificazione Pontina*, on the left of the River Sisto, and the other belonging to the *Consorzio di Bonifica di Piscinara*, then being set up, which would manage the lands on the right bank of the River Sisto. This subdivision reflected the different nature of the soils and their morphology.

On the basis of these new guidelines, the engineers Pancini and Prampolini went on to define the final project, with a few variations on Marchi's framework-project, and the first works started in 1922 on the lands belonging to the *Consorzio della Bonificazione Pontina* and in 1927 on those of the *Consorzio di Bonifica di Piscinara*. Besides the need for sufficient funding to carry out the works, Prampolini, focusing on the two consortia's representative powers [25], was concerned with the need for agricultural exploitation of the lands reclaimed, in view of the local landowners' aversion to making investments for improvement purposes. At this point, the Government decided to expropriate unfarmed land and an initial lot of 18,000 ha was expropriated by decree published in the Gazette on 28 September 1931.

In the meantime, the Government had issued a series of measures concerning integral land reclamation, culminating in the Consolidation Act n° 215/1933 on Integral Land Reclamation (known as the Serpieri Act).

4. From the Serpieri Act to the Second World War

The Serpieri Act established major guidelines on the subject of "*integral reclamation*", i.e. land reclamation by drainage and land improvement for agricultural purposes, defining which interventions were at State expense and which (obligatory) at the expense of private parties, who would however have the advantage of State facilitations, such as low interest rate mortgages.

Thus, with the promulgation of the Serpieri Act, the reclamation works begun in previous years saw major development.

4.1. Territorial Status at the Outset of the Intervention

Out of an area of about 80,000 ha, in July 1924 (the year before reclamation began), the resident population did not even number one

[24] A technical structure belonging to the Public Works Administration, dealing with public works generally and related projects and rulings. With the appearance of the Regions, State competence has now been handed over to the Regional Governments.

[25] The engineer Natale Prampolini was appointed Chairman of the *Consorzio di Piscinara* starting from 1926 and from 1927 Commissary of the *Consorzio della Bonificazione Pontina.*

Fig. 6: Overflows in the Terracina Woods.

thousand, whereas the floating population (mostly shepherds and charcoal burners) – found largely in winter when the risk of contracting malaria[26] was considerably less – numbered around 4800, decreasing in summer to about 1800. The territory, covered largely by scrub, was indeed a source of malaria and abandon, suitable – to a large extent – for hunting and fishing, raising cattle of modest quality in the wild (mostly buffalos[27]) and for producing wood charcoal.

To provide the reader with more detailed information on the environment at the outset of the works, a few passages are given below from Prampolini's article "*La vittoria idraulica*", published in "*La conquista della terra*", a. VIII, n. 10-11, ottobre-novembre 1937.

"*The part on the right bank of the ancient River Ninfa-Sisto*[28] *(reclamation district belonging to the former Consorzio di Piscinara*[29]*) comprises lands with an elevation of between 8 and 60 m a.s.l., fluctuating considerably between these limits*." In this area, the hydraulic disorder

Fig. 7: Shanty used as a dwelling prior to reclamation.

was essentially a matter of flooding, some permanent and some only periodic, owing to the absence of any natural passages for discharge. Indeed, the ridge constituted by the ancient Quaternary dune impeded any free discharge of waters to the sea. Even the vast areas covered by the dune itself were not im-

[26] Dr. Vincenzo Rossetti, *Note informative sulla malaria nella palude pontina* in "Nostra terra pontina", Fratelli Palombi Editori, 1985: *The impenetrable forests, the marshy jungle, the ill-smelling bogs, the impenetrable cane-brakes, the everlasting watery mess, created an environment of vegetation and damp which, together with the steamy heat, maintained an impressive level of anophelism throughout the Pontine Marshes, linked to the abundant perniciousness of the most serious type of malaria in the whole of Italy, which – in the period immediately before the reclamation – in thirty percent of cases was synonymous with death. This malignant tertian fever took on a variety of clinical symptoms: comatose (with the patient falling into a coma until he died); meningeal (with symptoms very similar to various kinds of meningitis); bilious (with very serious icteric conditions throughout the body); dysenteric (sometimes choleric owing to very numerous diarrhoeic discharges); pneumonic (with symptoms that a layman would consider as those of ordinary pneumonia); algid (always lethal, in which body temperature, instead of rising to 104°F, descends to levels not compatible with life).*

[27] In the first quarter of the twentieth century, herds of buffalo were driven into the drainage canals owing to their extraordinary capacity for uprooting water-weeds by trampling them, thus facilitating water flow. The employment of buffalos ceased in 1924, and was replaced by mechanically-driven weed removing machines.

[28] Mainly comprising the great Quaternary dune and the coastal strip.

[29] As the works progressed, the Consortium changed its name to *Littoria* and then, after 1945, to *Latina*.

mune from hydraulic disorder, in this case characterised by the so-called "*piscine*", i.e. closed, deep depressions. This marshy area was flanked by another, between the Quaternary dune and the present-day marine dunes.

"*The part on the left bank of the River Ninfa-Sisto (reclamation district belonging to the Consorzio di Bonificazione Pontina), unlike the area previously examined, has almost everywhere the nature of a uniform plain: the lands, however, are very low-lying and vast areas of them are lower than the river. Yearlong watercourses, coming from springs at the foot of the hills, cross the plain. In many parts the soil is peaty and reclamation works consequently have serious difficulties with foundations and conservation*."

According to the delimitation carried out in 1918 by the Civil Engineers, the Reclamation Area of the *Bonificazione Pontina* covered 27,000 ha, and the *Piscina* Reclamation Area covered 46,000 ha. In May 1934, a vast area of about 57,000 ha – also needing reclamation, belonging to the Roman Plain - was united with the latter.

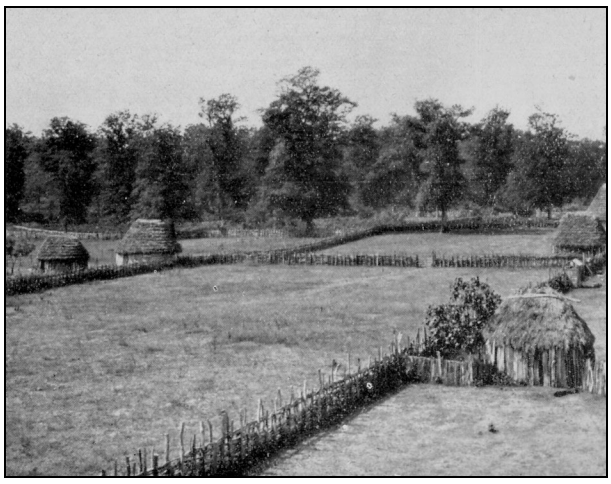

Fig. 8: Examples of shanties Used as dwellings prior to reclamation.

Fig. 9: The road from the "Via Appia" to the "Quadrato" (present-day Latina) during floods.

4.2. Institutions in Charge of Integral Reclamation

In order to proceed with agricultural improvements in the two reclamation districts, the following activities had to be performed:

- sanitary reclamation, initially given in charge of the *Istituto Antimalarico Pontino*[30] and – subsequently – to the Italian Red Cross;
- land reclamation by drainage, entrusted to the two Consortia mentioned above;
- land improvement, entrusted to the *Opera Nazionale Combattenti* (ONC)[31].

[30] Or, more precisely, *Istituto per il Risanamento Antimalarico dell'Agro Pontino.*

[31] The *Opera Nazionale per I Combattenti* was a government-controlled entity with juridical personality and autonomous management, founded in 1917 in view of the end of the current war and consequent demobilisation of the army. Placed under the direct control of the Prime Minister's Office, its chief task was to assist ex-servicemen in their return to civilian activities. From this viewpoint, the Institution (abolished in 1978) operated particularly in the land improvement sectors, including reclamation, extending small and medium peasant

4.2.1. Sanitary Reclamation

Health care for the local population started initially with a couple of health centres, operating as early as 1922. However, with the beginning of works in 1927 and consequent influx of labourers, particularly in the summer months when the risk of contracting malaria was higher, health care was revamped to include 13 health centres.

Great emphasis was laid on prevention, entrusted initially to the *Istituto Antimalarico Pontino* and subsequently to the Italian Red Cross, since the workers came mainly from northern Italy, where the incidence of malaria was minimal and even the most elementary preventive measures unknown.

Lodgings were therefore built for the workers, provided with every construction device to prevent mosquitoes from entering and with daily disinfestation of the dormitories. Health operators also ensured the distribution of quinine and its regular assumption by the workers, also ensuring that the lodging doors were shut and that workers should not go out at night, with surveillance up to 11 p.m. The labourers' nutrition was particularly looked after.

Results were not late in arriving, considering the very few deaths from malaria among the workers on the *Consorzio di Piscinara* reclamation.

Year	Deaths (n°)
1929	5
1930	17
1931	5
1932	71
1933	33
1934	24
1935	5
Total	**160**

ownership and assisting the assignees technically and financially, thus carrying out a fundamental role in the country's economic development and social order.

4.2.2. Land Reclamation by Drainage

This was in the hands of the two consortia operating on the said territory: the *Consorzio di Piscinara* and the *Consorzio della Bonifica Pontina*.

The technical scheme adopted for the intervention was the Pancini-Prampolini project, which in turn was based on the guidelines of Marchi's framework project, i.e. on separating the waters into three distinct categories, according to their origin:

- **Floodwaters or surface waters**: such waters come from the hills and are full of silt. They can be discharged by gravity, conveying them through special collector drains, either excavated or aboveground, to the sea or into the rivers.
- **Mean waters**: mostly clear waters found in peripheral areas in the form of springs or streams, which cannot always be discharged by gravity. If any mechanical lifting is required, it is usually of modest proportions.
- **Low or phreatic waters**: these waters stagnate on the surface of the land in the reclamation area after rainfall, flooding and seepage, and their evacuation often requires mechanical means.

Based on these criteria, two major canals were dug, connecting waters outside the reclamation area:

- the first, originally named *Canale Mussolini* and currently "*Collettore delle Acque Alte*", starts at Abbadia, cutting through the Pontine Plain in a N.E.-S.W. direction to its outlet in the sea at Torre di Foce Verde, about 3 km east from the mouth of the River Astura. Along its route, it intercepts several canals (Teppia, Cisterna, and others). Later on, when a vast area formerly belonging to the Roman

Plain was included in the Pontine Plain, the "*Canale allacciante Astura*" was dug and connected to the *Collettore delle Acque Alte*. The route of the Astura Canal runs parallel to the coast at a distance of about 10 km, intercepting all the waters coming from the hills, including those of the River Astura. Downstream from the Astura Canal inlet, the *Collettore delle Acque Alte* has a flowrate of 760 m^3/s;

- the second, for the purpose of protecting the area between Sezze and Terracina, consists of a revamping of the River Amaseno, with its outlet at Porto Badino.

Inside the reclamation area, two systems were implemented to collect mean waters (by gravity) and low waters (by pumping).

The "*mean water*" canal network largely comprises existing watercourses and canals, appropriately revamped, the main drainage canals being the Rio Martino, the River Sisto, the Linea Pio and the River Ufente.

At the same time, for almost all the area covering the townships of Priverno and Sezze located between the Via Appia and the Rome-Naples railway line, as well as part of the territory between the Appia and the River Sisto, a network of drains was created to convey the "*low waters*" to the numerous pumping stations built, which – in turn – discharge into the mean water canal network, mainly into the Linea Pio. Other more modest areas drained by pumping include the coastal strip between Sabaudia and the mouth of the Astura.

The works were carried out as a concession by the two Reclamation Consortia and, besides the excavation of collectors and drainage canals and the construction of pumping stations, weirs and diversion works, comprised:

- the building of main and secondary road networks, with related structures and roadmen's houses[32];
- back-filling and levelling works;
- several irrigation systems.

Fig. 10: Canal Excavated Manually.

The coastal lakes behind the coastal dunes were also improved. The lakes of Fogliano, Monaci and Caprolace were deepened to avoid the development and proliferation of marsh vegetation, while only the coastal areas of the Lake of Paola (nowadays Sabaudia) were dredged, as being the only marshy areas.

[32] The *casa cantoniera* (roadman's house) takes its name from the "*cantoniere*", the agent of the public administration charged with the supervision and maintenance of a given stretch of road outside the town and – in the past – with providing assistance to any travellers in need. *Case cantoniere* were consequently located at more or less regular intervals along the more important arterial roads, and were immediately identifiable owing to their colour and typology.

The banks of the lakes of Fogliano and Monaci were lined with broken stones, and the other two lakes were provided with plantations and mattresses. The *Consorzio di Piscinara* (later called *Littoria*, after the town inaugurated on 18 December 1932, and – after the end of World War II – *Latina*, after the new name taken by the town) also built eight villages, initially utilised by the reclamation workforce and subsequently transformed into rural centres.

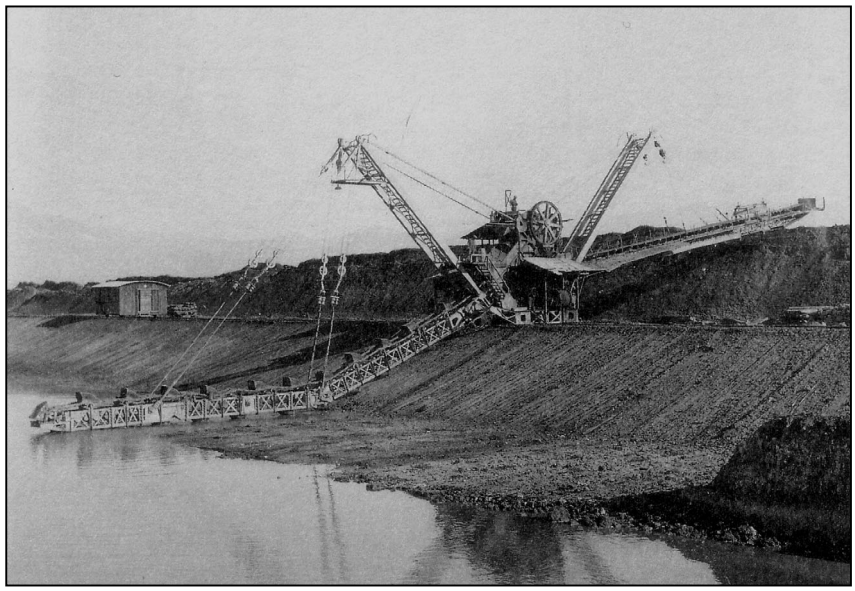

Fig. 11: Canal Excavated Mechanically.

In the period 1926-37, the two Consortia carried out the following works:

Major pumping stations	n°	2
Other pumping stations	n°	12
High water drains	km	164
Mean water drains	km	364
Low water drains	km	2,122
Road drains	km	13,515
Road network	km	1,380
Back-fill & embanking lands	m^3	10,000,000
Stone, broken stone, pozzolana, tufa	m^3	4,000,000
Reforesting of reclaimed area (trees)	n°	3,500,000
Reforesting of upstream catchment basin	ha	31,000
Irrigation canals	km	1,280
Driven and artesian wells	n°	4,538
Water pumping plants	n°	38
Drinking water reservoirs	n°	33
Farmhouses	n°	4,198

In view of the previous failures over the centuries, the effort required for the total transformation of the area was enormous.

Although mechanical means available at the time were widely used (dredgers, excavators of various kinds, narrow-gauge tracks with locomotives and wagons of different types, trucks, etc.), the commitment in human resources was exceptionally high, requiring manpower to be sent from all over Italy[33]. To give an idea of the effort sustained, during the period 1926-37, the two Consortia utilised a total of more than 18 million man-days, as shown in the following table:

[33] In actual fact, with the long-term reclamation plan, not only of the Pontine Plain, but of all the marshy and unhealthy areas throughout Italy, the Government intended to combat unemployment which, out of a population of 38-40 million, reached – according to the official statistics of the time – particularly high levels: **1926**: 181,493; **1927**: 414.283; **1928**: 439,211; **1929**: 489,347; **1930**: 642,169; **1931**: 982,321; **1932**: 1,147,945; **1933**: 1,229,387; **1934**: 1,158,418; **1935**: 1.011,711 (first nine months).

Year	Man-days (n°)
1926	132,000
1927	244,000
1928	432,000
1929	595,000
1930	1,090,000
1931	940,000
1932	2,100,000
1933	3,500,000
1934	4,966,000
1935	3,021,000
1936	932,000
1937	712,000
Total	**18,664,000**

Clearly, too, this was accompanied by a considerable economic commitment in Lire:

Year	Cons. bonif. Littoria	Cons. bonif. Piscinara	Total (Lire)
1922		391,380	391,380
1923		1,974,390	1,974,390
1924		4,069,350	4,069,350
1925		7,965,570	7,965,570
1926		8,049,530	8,049,530
1927	17,652,480	8,297,840	25,950,320
1928	4,684,000	8,900,020	13,584,020
1929	49,806,370	9,399,200	59,205,570
1930	42,139,105	14,455,560	56,594,665
1931	24,685,555	13,069,080	37,754,635
1932	55,432,185	16,079,460	71,511,645
1933	63,303,935	20,019,020	83,322,955
1934	108,380,990	41,401,730	149,782,720
1935	118,883,370	39,263,280	158,146,650
1936	21,167,000	31,828,600	52,995,600
1937	15,763,325	38,643,270	54,406,595
1938	14,533,600	36,809,300	51,342,900
1939	14,490,660	27,026,200	41,516,860
1940	51,988,880	31,874,850	83,863,730
Total	**602,911,455**	**359,517,630**	**962,429,085**

Except for a few works that were totally at State expense, for most of the works 87.5% of the cost was paid for by the State, the remaining 12.5% being at the charge of the consortium property owners, paid for by mortgages.

With the outbreak of the Second World War, reclamation activities were held up for lack of human and financial resources. Despite this fact, the result achieved up to that point was considerable, succeeding not only in controlling the rainwater and surface waters in the area, but in completely transforming the whole region from an agrarian-socio-economic point of view.

4.2.3. Agrarian-Improvement

As reclamation by water drainage progressed, it became necessary not only to clean and make the land ready for ordinary farming purposes, but also to create farm units and assign them to farming families, together – and above all – with a whole set of infrastructures to make it possible for them to live in an area lacking all services.

As the same time, most of the land was either public property or belonged to major landed proprietors, as can be seen in the following table:

Property	N°	Surface Area (ha)
- municipal	2	13,840
- farming co-operatives[34]	3	8,120
- financial-agric. companies	7	25,698
- private (over 100 ha)	27	35,143
- private (under 100 ha)	3,100	17,199
Total	**3,139**	**100,000**

Since the landowners were, if not unwilling, at least perplexed about following government directives concerning land improvement and the changeover from more or less extensive farming to a modern agricultural economy, owing to the high costs to be shouldered (even if tempered by the financial aid envisaged by the legislation of the period), the Government decided to expropriate the lands to be reclaimed (except for those lands whose owners undertook by a certain date to carry out the

[34] Farming co-operatives are a form of association, as a rule among the inhabitants of a given area, for promiscuous exploitation of the land.

transformation and improvement works required by the Reclamation Master Plan) and to assign to the *Opera Nazionale Combattenti* the task of land improvement and settlement with a farming population.

The first expropriation decree was published in the Gazette on 28 September 1931, and in the following month of November, the ONC took over the first lot of 18,000 ha to be parcelled out, formerly belonging to the *Società Fondi Rustici* and the *Società Bonifica di Fogliano*, to be followed by further expropriations in quick succession.

The first intervention concerned the deforestation, uprooting and grubbing up of wooded areas, followed by ploughing, which was also extended to all unfarmed land, and related shaping of the ground surface to facilitate rainwater run-off.

To make the land fit for cultivation, the ground was broken to depths of 40-50 and 70-90 cm, according to the type of soil, employing batteries of heavy tractors. Rainwater run-off was ensured by constructing drainage ditches, spaced every 40 m.

To protect crops from violent gusts of wind resulting from the cutting down of woods and forests, a major system of windbreaks was created, with several rows of trees set on a chequerboard pattern, planted both parallel and at right angles to main wind directions. The main barriers, some 30 to 60 m wide, comprised 8-16 parallel rows of trees.

Experimental farms were then created to identify the most appropriate crops for the various kinds of soil, which - owing to their very nature – could give rise to problems. Indeed, the studies performed showed that land was either:

- fertile and relatively high yields,
- of marsh origin,
- sterile, with low yields,
- clay soil,

necessitating considerable scientific research to find the most suitable fertilizers to improve the fertility of unproductive land. Besides improving land fertility, however, studies concentrated on the crops to be grown, both with and without irrigation. These farms, distributed over the area, facilitated experiments on different strains of wheat, maize, turnips, cotton, etc.

Average farm size was established at 20 ha, but in actual fact, unit size depended on many factors, such as family composition[35], the fertility of the land, the quality of the reclamation by drainage, possibilities of irrigation, accessibility, etc. In practice, farm size, with rare exceptions, ranged from 10-12 ha for farms close to the Via Appia, which included the most fertile lands, to 24-25 ha for the poorer soils close to the coast.

After much study and debate, it was decided to provide each farm with a farmhouse and annexes, avoiding any formation of large rural centres. It was felt necessary however to ensure that farm dwellings were only a short distance (20-25 m) from the roads dividing the farms and, by converting the workers' villages set up to carry out the reclamation works, 17 small "*borghi*" – or villages - were created, provided with basic civil services (town hall, church and presbytery, crèche and elementary school, *carabinieri* barracks, post office, chemist and dispensary, ONC office and dwellings for its employees, warehouses, mechanical workshop, shops, cinema, inn, etc.).

Farmhouse design took into account the composition of the farming families, mostly from densely populated areas such as the Veneto and Emilia. For health reasons, the buildings

[35] On the assumption that each hectare required a minimum of 0.25 manpower units, the work capacity of a farming family was assessed as follows: men between 18 and 65 years old = 1, women between 18 and 65 = 0.55, children (boys and girls) from 8 to 13 = 0.25, boys between 14 and 17 = 0.50, girls between 14 and 17 = 0.25: persons over sixty-five = 0.20.

Fig. 12: Examples of Division into Farms after Reclamation.

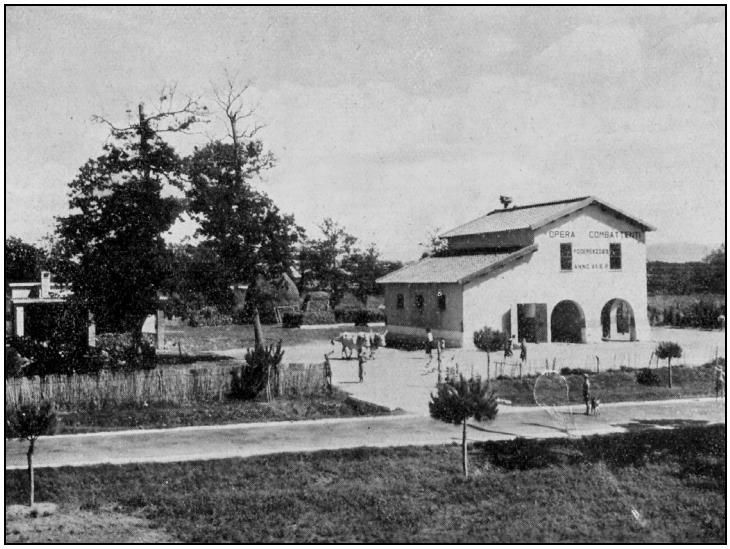

Fig. 13: Example of Farm-house Built after the Reclamation Works.

were set on two floors, with warehouse, cattle-shed, etc. on the ground floor, and the dwelling proper on the first floor[36]. Every farmhouse was provided with a stable for at least 8 head of cattle (16 m^2 per head), a manure pit (6 m^2 per head), a well, a water trough for the cattle, an oven for bread, a chicken run and a pigsty.

Each farm was provided with cattle (4 yoke oxen, chickens and pigs), agricultural machinery and equipment (including a plough and a harrow) and the necessary stocks (seed, fertilizer, straw, hay, vine and mulberry cuttings, fruit trees, etc.), besides advances in provisions and money up to the first harvest for the farming families, who started arriving in 1932.

On economic grounds, however, the initial model was subsequently modified, reducing the number of rooms and stable capacity, and eliminating momentarily the chicken run and pigsty, etc. Indeed, the first farmers did not even manage to amortise 62% of plant cost[37], bearing in mind that in the early years land yield was often poor[38].

[36] Repeating a typology already tested out in Valdichiana at the time of the "*Leopoldina*" reclamation.

[37] 38% of the cost was borne by the State.

[38] It should be added that some of the "farmers", mostly from the northern provinces, were unemployed persons with little or no knowledge of farming practices, so that it was necessary to provide the men and women of the families with detailed instructions on how to perform and deal with the most common-place farming activities (with courses on cattle-raising, how to yoke oxen, ploughing, for farmers' wives, and even how to use a wood-fired oven), as shown by a memorandum dated 22 March 1935, sent by the O.N.C. Government Commissioner, the Hon. Orsolini Cencelli, to the Under-Secretary at the Prime Minister's Office. Furthermore, the provincial offices of the Commission for Domestic Mobility [*Commissariato per le Migrazioni Interne*] attempted to rid themselves of the more unruly elements of their populations by sending them to the Pontine Plain.

Progress in dividing the land into farms was as follows:

Year	Parcelled farmland (ha)	Farmhouses (n.)	Average Farm Area (ha)
1932	10,000	480	20.8
1933	11,000	750	14.7
1934	12,000	470	25.5
1935	3,000	380	7.9
1936	4,000	160	25.5
1937	4,400	334	13.2
1938	1,200	50	24.0
1939	8,666	329	26.3
Total	**54,666**	**2,953**	**18.5**

The above figures show the considerable contraction in reclamation activities from 1935 to 1938, owing to the diversion of means, interest and political will as a consequence of the war action undertaken by Italy in Ethiopia and Spain. After a new start in 1939, the Pontine Marsh reclamation scheme again came to a standstill due to the Second World War.

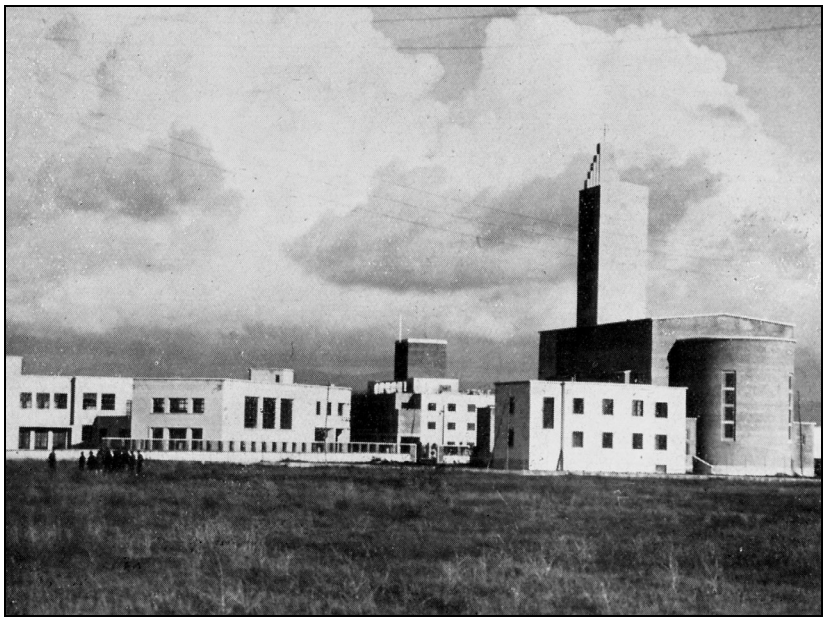

Fig. 14: View of Pontinia (1934).

Besides the small rural centres mentioned above, the Government, again through the ONC, built five villages that - for propaganda reasons - were called towns (and in the following decades and particularly in the second half of the twentieth century, towns they did become): Littoria founded in 1932, which became provincial capital in 1934, Sabaudia (founded in 1933), Pontinia (1934), Aprilia (1936) and Pomezia (1938).

The ONC also integrated the main and secondary road systems, implemented by the two *Consortia della Bonificazione Pontina* and *di Piscinara* (which, with the foundation of Littoria took the name of *Consorzio di Bonifica di Littoria*), supplemented by a network of minor roads between the various farms.

Health care for the farmers was provided by the Italian Red Cross, which – among many other activities – took particular care with the prevention of malaria, to such an extent that, even with the considerable increase in the labouring and farm population, the years rate of deaths from malaria decreased progressively from 30-35% in 1924 to 0.8% in 1936.

Lastly, in order to make it possible for the farmers to utilise mechanised processes, the ONC set up the ASM (*Azienda Servizi Motorizzati*), with its own repair workshop.

During the early stages (i.e. up to and after the Second World War), contractual relations between ONC and the farmers were based on sharecropping[39]. The ONC

[39] With the institution of share-cropping (now abolished in Italy, but in force up to a few decades ago), the farm constituted a productive territorial unit of a size that could guarantee the self-sufficiency of the farming fam-

was thus responsible for managing the single farm properties and therefore decided on the methods for tilling the ground, the types of crops, crop rotation, as well as giving binding instructions for all economic activities. The ONC also chose the seeds, cattle and any necessary ancillary material.

It should be added, however, that, in view of the poor yields of the early years, the rigid sharecropping clauses were modified, with the ONC guaranteeing a "*minimum annual income*", with supplements to farmers whose income fell short. Although the farmers' economic situation progressively improved (in 1935-36 only 2% of the farmers achieved an income higher than the guaranteed minimum, while in 1937-38, the percentage had risen to 15%), the Government decided on gradual disengagement by letting the farmers buy the farms, with various forms of redemption[40].

The development of the land improvement effort with State intervention was enormous for the time, and can be summarised by a few figures:

- 55,000 ha broken up
- 20,000 ha of wood and thicket cleared and stumps pulled
- 64,666 ha farm-parcels
- 2,953 farmhouses
- 143 km reclamation area roads
- 487 km roads between farms
- 205 km irrigation canals
- 15,000 km drainage ditches,

besides the construction of water supply mains (21 km), high voltage power lines (640 km), telephone lines (1,080 km) and sewers.

To the above can be added the farm parcelling carried out by the agricultural co-operatives (350 units) on the lands they managed, and by the private sector (1,700 units) on lands that had not been expropriated owing to the owners' undertaking to convert their estates into farms.

In conclusion, by 31 December 1939, 5,003 farm units had been created, of which:

- 2,662 ONC farms, assigned to families mostly from the northeastern provinces of Italy and, to a much lesser extent, from central Italy;

- 291 ONC farms, 350 agricultural association farms and 680 farms belonging to private parties were assigned to families from the nearby *Monti Lepini* and the Province of Latina.

The 5,003 farm units gave shelter to the same number of families, comprising a total of 52,956 persons.

ily, whose composition had – at the same time – to be sufficient to cultivate the farm. The farmer was provided by the owner with a farmhouse of a suitable size for his family, a stable for his cattle, sheds for equipment and carts, proper access roads, water and a provision of livestock and other stock to operate the farm. Duties existed for both parties. The lessor – the farm-owner or landholder under whatever title (perpetual lease, usufruct or lease) – was responsible for putting and keeping the farmer in a position to fulfil his own duties in turn and consequently all investments needed for deforestation, ground-breaking, installing drainage or irrigation systems, planting tree plantations, etc. were at his charge. The lessor was also responsible for managing the farm, either directly or through a person familiar with farming practice. The tenant farmer had to look after and cultivate the farm according to the directions of the lessor or his representative, as well as reside in the farmhouse made available. Expenses and products were shared according to criteria that varied from place to place, or according to arrangements that changed over time.

[40] Three models were foreseen: Model A was a conditional sale with payment over 30 years in constant half-yearly rates, including capital and 4.5% interest, with the possibility of advancing redemption, but not earlier than 1951. Model B was similar to Model A, except that for the first five years payment covered only interest, the payments over the following 30 years covering capital and interest, with the possibility of advancing redemption, but not earlier than 1946. Model C was a five-year lease with promise to sell.

5. The War and Post-War Years

The works planned were interrupted owing to war breaking out in 1940 (which also drew many men from working the fields, making it difficult for the farming families to survive). One project never implemented – by way of example – was the major canal connecting up the waters outside the area of the *Bonificazione Pontina*, left until last, not because it was less important, but for political and social reasons, which preferred to give priority to the reclamation of the marshes.

Between September 1943 and May 1944, the war itself directly involved the Pontine Plain: the German occupation forces requisitioned the mechanical workshop of the *Consorzio di Latina* and seized the topographic maps of the reclamation area. They then proceeded systematically to blow up the embankments and remove or vandalise the pumps at the pumping stations, damming the sea outlets of rivers and canals in order to flood the Pontine Plain and impede the advance of the Allied troops.

The Allied landings at Anzio and Nettuno involved the reclamation area between Borgo Podgora and the town of Aprilia, with serious damage to dwellings and rural infrastructure.

In the post-War years, with aid from the E.R.P.[41], State allocations through the *Cassa del Mezzogiorno* and the contributions of Consortium members made it possible to repair war damage, complete the remaining works and improve the drainage system in view of the progressive compaction of the land which had reduced the "*franco di bonifica*"[42].

The following table provide an overview of the total costs – in Lire at that time – borne for supplementary and maintenance works in the period 1941-63 by the two reclamation consortia.

The ONC also did its part, paying out contributions for the repair of damaged buildings, varying according to the amount of damage. At a cost of about 350 million Lire at that period, over 500 dwellings were repaired, while the State contributed 60% for the repair of farm annexes, for an overall amount of 200 million Lire of the time.

Year	Reclamation Consortium		
	Pontina	Latina	Total
1941	40,508,080	15,056,785	55,564,865
1942	26,686,060	14,303,525	40,989,585
1943	16,585,950	3,891,395	20,477,345
1944	21,140,230	2,138,000	23,278,230
1945	40,396,190	53,107,780	93,503,970
1946	116,734,650	66,835,625	183,570,275
1947	234,648,320	360,967,745	595,616,065
1948	573,725,380	343,329,710	917,055,090
1949	558,741,630	137,812,000	696,553,630
1950	599,925,540	181,524,940	781,450,480
1951	518,043,250	845,778,895	1,363,822,145
1952	916,442,280	635,492,610	1,551,934,890
1953	1,135,928,630	255,095,560	1,391,024,190
1954	1,206,849,580	74,983,760	1,281,833,340
1955	1,044,404,840	378,931,760	1,423,336,600
1956	827,044,140	600,955,805	1,427,999,945
1957	1,102,885,700	787,254,460	1,890,140,160
1958	1,151,173,700	264,480,800	1,415,654,500
1959	893,919,100	246,108,655	1,140,027,755
1960	1,000,068,720	484,830,750	1,484,899,470
1961	937,685,100	423,560,580	1,361,245,680
1962	943,953,210	280,365,500	1,224,318,710
1963	968,567,830	176,302,490	1,144,870,320
Total	**14,876,058,110**	**6,633,109,130**	**21,509,167,240**

To rehabilitate the roads of the reclamation area. State intervention amounted to 100%, and 60% for roads between farms, the difference being shared by the two Consortia and the OCC. The latter also took part in refurbishing farm machinery (tractors, etc,) and farm livestock (which had diminished owing to the war from 36,000 to 2,500 head).

[41] European Recovery Programme.

[42] "*franco di bonifica*" means the difference in level between the land elevation and the normal level of the waters in the canals belonging to the drainage network.

During the war, malaria had once more spread throughout the area, owing both to the decreased maintenance of the works due to lack of manpower, and to the scarcity of fuel for operating the pumping stations, as well as to the flooding caused by the German Army. Malaria was definitively defeated not only by restoring the works, but more especially to widespread use of DDT[43].

6. Status of the Pontine Plain at the Threshold of the Twenty-First Century – Final Considerations

In view of the fact that the reclamation works, which during the first half of the twentieth century had marked the two areas managed by the Consortia *di Bonifica di Latina* and *della Bonificazione Pontina*, had now come to an end, in 1990 the Lazio Region – responsible, like the other regions, for agricultural activities with the coming of decentralisation – passed a resolution uniting them in a single consortium, subsequently (1996) named "*Consorzio di Bonifica dell'Agro Pontino*", with headquarters at Latina.

The Consortium operates over an area of about 170 thousand hectares, mostly belonging to the Province of Latina, the rest lying in the provinces of Frosinone and Rome. The entire area numbers 25 municipalities, 22 of which lie totally inside the Consortium area.

The reclamation area includes:

Areas with natural drainage	86,395 ha
Areas with mechanical drainage	19,699 ha
Areas to be made operative in future	63,774 ha
Total	**169,968 ha**

The drainage system comprises:

- natural canals for a total length of about 240 km;
- man-made canals for a total length of about 1,820 km;
- 23 pumping stations, totalling 9,650 HP of installed horsepower with an overall maximum flowrate of 114 m^3/s, serving 19,699 ha of mechanically drained land.

The Consortium also manages an irrigation system that covers an area of about 14,000 ha, comprising 6 collective distribution plants. A further 20,000 ha are served by supplemental irrigation with water pumped directly from the canals.

Leaving to one side the areas to be made operative in future, and taking into account only the data referring to the municipalities inside or at the edge of the reclamation carried out in the 'thirties, surprising conclusions can be reached. The resident population – which in 1921 did not even reach 50,000 inhabitants – is now well in excess of 300,000. Whereas the population of Italy has increased by 47% in the past eighty years, the population of the Pontine Plain has leapt to 570%, thanks to the change in environmental and health conditions, as shown by the ISTAT surveys indicated in the following table:

[43] Dichloro-diphenyl-trichloroethane, its use forbidden nowadays in Italy owing to its collateral effects on human beings.

Municipality	Resident Population	
	1921	2001
Aprilia	---	56,028
Cisterna	4,248	32,584
Latina	---	107,898
Norma	3,034	3,792
Pontinia	---	13,027
Priverno	10,930	13,133
Sabaudia	---	16,229
San Felice Circeo	1,782	8,036
Sermoneta	1,611	6,620
Sezze	13,055	21,935
Terracina	12,484	36,633
Pontine Plain	**47,144**	**315,915**
ITALY	**38,769,798**	**56,995,744**

N.B.: Municipalities marked --- did not exist prior to the reclamation

The agricultural conditions of the Pontine Plain have also changed enormously as compared to the post-reclamation period, when farmers were unable to pay their subscriptions to the ONC.

Today, almost all the farmland belongs to the farmers, managing their farms with family manpower and only in exceptional cases making use of permanent or seasonal hired workers (characteristic only of the larger farms).

The following table shows ISTAT agricultural data for 2000. Since the data is indicated per municipality, the table shows those lying wholly inside the Pontine Plain (which are in actual fact those founded as a result of the reclamation, such as Aprilia, Latina, Pontinia and Sabaudia), as well as outlying ones with a considerable portion of territory within the reclamation area (Cisterna, San Felice Circeo and Terracina), leaving aside other municipalities (Norma, Priverno, Sermoneta and Sezze), which have a sizable amount of their territory outside the Pontine Plain.

Municipality	Farms (n°)	Surface Area (ha)	
		total	farm average
Aprilia	1,382	9,304	6.7
Cisterna	1,998	9,021	4.5
Latina	3,634	13,290	3.7
Pontinia	1,741	8,431	4.8
Sabaudia	904	10,305	11.4
S. Felice Circeo	333	1,482	4.5
Terracina	2,123	7,690	3.6
Total	**12,115**	**59,523**	**4.9**

Data ISTAT 2000 survey

About 60% of the territory's area is covered by farms with a net prevalence of sowable land, as shown in the following table:

Surface Area in Hectares

Municipality	Geograph. Area	Exploited Farmland				Arboricult. for Timber	Woods	Other Areas	Total
		Sowing	Ligneous Crops	Permanent Meadows & Pasture	Total				
Aprilia	17,770	3,998	3,263	636	7,897	33	531	843	9,304
Cisterna	14,282	3,478	3,220	747	7,445	20	303	1,253	9,021
Latina	27,779	8,464	1,845	1,143	11,452	322	56	1,460	13,290
Pontinia	11,224	7,266	184	162	7,612	2	13	804	8,431
Sabaudia	14,429	4,181	156	937	5,274	19	3,533	1,479	10,305
S. Felice Circeo	3,139	1,270	22	16	1,308	0	9	165	1,482
Terracina	13,703	3,804	557	1,503	5,864	1	1,151	674	7,690
Total	**102,326**	**32,461**	**9,247**	**5,144**	**46,852**	**397**	**5,596**	**6,678**	**59,523**

Data ISTAT 2000 survey

The next table shows the main crops grown by local farmers. Among the sown crops, forage plants dominate, followed by cereals and vegetables, although vines and fruit production are of great importance.

Surface Area in Hectares

Municipality	Cereals	Vegetab. crops	Rotated Forage crops	Vines	Olives	Citrus	Fruit	Total
Aprilia	1,371	208	1,196	1,922	243	41	1,037	6,018
Cisterna	1,286	164	873	1,011	267	20	1,901	5,522
Latina	2,197	915	2,737	1,017	74	3	713	7,656
Pontinia	1,788	386	3,585	7	132	2	38	5,938
Sabaudia	334	1,472	1,532	117	9	1	29	3,494
S. Felice Circeo	74	1,009	77	1	11	1	9	1,182
Terracina	583	285	1,007	95	378	22	35	2,405
Total	**7,633**	**4,439**	**11,007**	**4,170**	**1,114**	**90**	**3,762**	**32,215**

Data ISTAT 2000 survey

The importance of permanent meadowland and pasture and of rotated forage crops (totalling about one third of the arable land area) is due to the high numbers of cattle raised on the Pontine Plain, as shown in the following table:

Head of Cattle

Municipality	Bovines	Buffalos	Swine	Sheep	Goats	Horses	Birds
Aprilia	2,529	1	773	9,515	157	105	55,334
Cisterna	2,967	500	47	113	13	174	35,286
Latina	8,446	829	159	2,463	698	105	29,030
Pontinia	14,660	8,170	10,480	1,447	74	57	9,501
Sabaudia	5,601	631	103	247	30	30	6,027
San Felice Circeo	105	---	10	400	59	---	---
Terracina	7,229	520	4	565	40	15	1,383
Total	**41,537**	**10,651**	**11,576**	**14,750**	**1,071**	**486**	**136,561**

Data ISTAT 2000 survey

Territorial reclamation and improvement have also encourage the development of industry, the processing of farm produce, trade, the service sector and institutional structures, with flourishing companies and employment, as shown by the figures given in the following table:

ISTAT Survey 2000

Municipality	LOCAL UNITS									
	FIRMS						INSTITUTIONS		TOTAL	
	Industry		Trade		Other Services					
	(n°)	workforce	(n°)	workforce	(n°)	workforce	(n°)	workforce	(n°)	workforce
Aprilia	434	8,595	1,065	2,582	1,508	4,230	191	1,829	3,198	17,236
Cisterna	602	5,756	745	1,481	447	1,622	79	1,406	1,873	10,265
Latina	2,072	12,027	3,116	6,954	3,387	12,409	419	6,393	8,994	37,783
Norma	37	120	66	114	54	176	23	352	180	762
Pontinia	181	1,230	240	473	204	649	41	603	666	2,955
Priverno	133	725	344	759	447	1,338	53	67	977	2,889
Sabaudia	63	1,332	389	1,097	455	1,282	60	389	967	4,100
S. Felice Circeo	47	142	291	568	297	862	14	206	649	1,778
Sermoneta	34	1,974	109	207	103	213	24	156	270	2,550
Sezze	308	1,169	365	744	289	870	89	838	1,051	3,621
Terracina	535	1,521	889	2,094	844	2,553	99	1,467	2,367	7,635
Pontine Plain	**4,446**	**34,591**	**7,619**	**17,073**	**8,035**	**26,204**	**1,092**	**13,706**	**21,192**	**91,574**

At this point, we may ask the question "If the usual profitability estimates had been carried out by the World Bank and other international funding organisms for the investments made between 1922 and 1940, taking into account farm production and profitability as it was then (subsequent developments could certainly not have been foreseen), would the Pontine Marshes have been reclaimed and malaria overcome?"

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