

# Reclamation, Migration, and Health: How Southern Italy Defeated Malaria by Transforming the Territory

Francesco Domenico Vitale

Pegaso University, Italy

francescodomenico.vitale@unipegaso.it

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## Abstract

*This research examines the impact of malaria in Southern Italy, emphasizing the role of demographic and urban changes in disease control. It analyzes how environmental, health, socioeconomic, and urban interventions influenced malaria incidence and reshaped affected areas. Key objectives include:*

- *Exploring links between malaria spread and environmental conditions, such as marshlands.*
- *Evaluating land reclamation policies and resettlement programs in reducing endemicity.*
- *Assessing how health policies and internal migrations affected local demographics and development.*
- *Reviewing strategies employed to combat malaria over time.*

*Through an interdisciplinary approach that integrates historical, demographic, and environmental analysis, the study—based on extensive archival research conducted at the State Archives of the city of Brindisi—highlights the efforts to transform marshy areas into productive and habitable lands. The findings show how demographic strategies contributed to overcoming malaria and offer valuable insights for addressing modern health challenges, particularly in the context of climate change and global migration. The limited availability of bibliographic sources makes this work an important and contemporary contribution to the field of research. This analysis contributes to the ongoing debate on health, environment, and public policy in vulnerable regions.*

**Keywords:** Malaria, Socioeconomic Development, Public Health, migration, Reclamation.

## INTRODUCTION

The malarial disease is a condition closely tied to the geographical nature of the territory. In fact, it stimulated, in contemporary times, the creation of maps known as “topo-malarial maps,” which

accompanied the earliest research in the field of geomedicine. These studies aimed to analyze the relationship between the environment and the spread of the disease. The primary intuition - valid for centuries - that suggested a close link between the environment and the development of the disease was correct. However, the theories regarding its causes were flawed: it was believed that the disease developed in marshy environments because harmful gases emanating from such areas intoxicated the inhabitants. From this mistaken theory arose the term “malaria”, meaning “bad air”, which is still used today to refer to the disease otherwise known as “marsh fever”. Although this term originated in the medieval era, even the Etruscans and Romans had already noticed the connection between water stagnation and the spread of the disease, as well as the importance of draining wetlands to combat it (Cosmacini et al., 1996).

Today, however, we know that malaria is, in reality, an infectious and parasitic disease caused by unicellular microorganisms known as plasmodia, which were discovered at the end of the 19<sup>th</sup> century by the French physician Charles Louis Alphonse Laveran (Michele Mainardi, 1998).

### **The Historical and Environmental Impact of Malaria: A Case Study of Brindisi**

For millennia, malaria has been one of humanity’s fiercest enemies, particularly for Mediterranean populations, due to its spread being linked to geographic and environmental factors. It often posed insurmountable obstacles to human presence in certain geographic areas.

An interesting early counter-theory was proposed by Vincenzo Cuoco, a historian and politician from Molise who lived between the 18<sup>th</sup> and 19<sup>th</sup> centuries. In his work *Reforestation and Land Reclamation* (Rossi-Doria & Bevilacqua, 1984), Cuoco criticized contemporary theories that considered water as the main cause of environmental degradation and poor air quality. In his essay, he wrote:

*"It is commonly believed that draining alone is enough to reclaim land. This is a mistake. In most cases, trees must be planted. Trees must be planted because, often, bad air does not come from stagnant water but from the very nature of the soil itself, which, upon contact with water, emits a gas harmful to life [...] We must plant where there is water: plant to reduce it, plant to contain it, plant to conserve it, plant to direct it".*

Although Cuoco’s theory stemmed from an incorrect premise, it was not entirely unfounded. Planting trees effectively absorbs rainwater and soil moisture, thus preventing water stagnation.

Over the centuries, numerous land reclamation efforts were attempted but without achieving effective results, to the point that a popular saying among Southern Italian farmers went: *“Earthquakes pass, plagues pass, but malaria does not pass”* (Tommaso Pedio, 1968).

In Southern Italy, the draining of marshlands, often through the expansion of wooded areas, was consistently hindered by the resistance of the feudal system and the vested interests of large landowners. These landowners were partly responsible for the spread of the disease, as deforestation for agricultural purposes facilitated the creation of stagnant water zones, leading to predictable consequences. However, the South’s predominantly arid climate presented a challenge for landowners who sought to transform their large estates and associated economies.

A revolutionary technique was developed in the early 20<sup>th</sup> century involving the application of chemical fertilizers to enhance soil fertility. However, this innovation proved ineffective, as it was applied to lands

that remained parched. What was needed first was the intensification of soil humidification through the creation of a so-called “water economy”, consisting of the following measures:

1. Expanding forests.
2. Implementing mountain land management.
3. Studying all watercourses.
4. Conducting irrigation work and constructing drainage systems.

These efforts, however, could not fall solely on individual farmers. Unfortunately, communities often remained indifferent to resolving this issue. The chemist Italo Giglioli lamented: *“As long as our mountains continue to lose their forests and fail to gather and slowly distribute the abundant rainfall they receive, it is vain to hope that agriculture in some regions of Italy will permanently flourish”* (I. Giglioli, 1905).

Regarding the mode of disease transmission, malaria is primarily spread by vectors such as Anopheles mosquitoes, which bite most often after sunset. The disease is transmitted because these mosquitoes, when biting healthy individuals, had previously bitten infected individuals. When a mosquito bites a person, before drawing blood, it injects a small amount of its saliva, which serves as an anesthetic. Malaria parasites reside in the mosquito's saliva, having been taken from the blood of an infected person. Once injected into a healthy individual, these parasites develop, resulting in infection.

The disease affected various marshy areas ranging from the Po Valley to the Pontine Marshes, as well as the southern regions of Sardinia, Sicily, and the entirety of Southern Italy.

By its very nature, Italy is characterized by one of the most striking climatic contrasts in the world: on one side lies the end of Europe, while on the other begins Africa. This difference manifests not only in temperature but also in rainfall distribution. In the Po Valley, rainfall is fairly evenly distributed throughout the year, while in Southern Italy, the peak of precipitation coincides with winter, and summers are dry, halting vegetation due to drought.

The flora of the vast Po Valley belongs to the domain of Central European vegetation, with spontaneous plant species almost identical to those found in the German plains. However, upon crossing the Apennines, the flora transforms into a Mediterranean domain, characterized by woody plants with evergreen leaves, featuring species identical or similar to those found on the African coast in Tunisia and Algeria (Rossi-Doria & Bevilacqua, 1984). To quote Bevilacqua and Rossi-Doria: *“In little more than half an hour, one passes from the gray mist of the North into the splendid clear skies of the South: on one side, the German flora ends; on the other, African flora begins!”*. It is in these warm and humid areas that mosquitoes thrive abundantly.

Regarding the impact of malaria on the lives and territories it affected, particular attention will be given to Southern Italy, especially the city of Brindisi, which suffered for centuries under the scourge of malaria. The crisis reached such heights that rulers of the time even considered the possibility of entirely depopulating the city. Geographically, Brindisi boasts a large port shaped like a deer's head. Politically, Brindisi was part of the centuries-old Kingdom of the Two Sicilies until the unification of Italy, while administratively, it was included in the vast province of Terra d'Otranto - which encompassed the modern provinces of Brindisi, Lecce, and Taranto - until the 1920s.

The health of Brindisi's port was directly linked to the health of the city itself. When the mouth of the port was navigable and, consequently, clean - free of mud, debris, and algae - the port experienced periods of splendor since ancient times. It was a key landing point for travelers journeying from Greece to the colonies of Magna Graecia and a safe harbor for Roman fleets participating in the Crusades. In the 19<sup>th</sup> century, Brindisi hosted British ships from the Overland Mail service, which, beginning in 1870, connected London to Bombay.

However, when the mouth of the port became obstructed, either due to natural causes or human negligence, the fortunes of the city changed drastically. Ships could no longer dock, and the port transformed into a foul-smelling swamp, making the city utterly uninhabitable. Marshlands expanded from the docks to the surrounding countryside, encroaching upon inhabited areas.

The first records of malaria in Brindisi date back to Julius Caesar in the opening chapter of *De Bello Civili*, where he recounts that, while waiting in the city to embark for Egypt to confront Pompey, his army was struck by malarial fevers (Lorenzo Cupone, 2007).

### **From 15<sup>th</sup> Century Conflicts to Bourbon Reclamation Efforts**

Malaria continued to plague Brindisi even during the transition to the modern era. The city, under Iberian administration at the time, was caught up in the war between the Aragonese and the Venetians in the mid-15th century. In 1449, after the Venetians burned 47 ships in the port of Syracuse and devastated the coasts of Sicily and Naples, the Aragonese feared that a similar fate might befall the deer-shaped port of Brindisi, which, lacking defensive walls, could easily fall into Venetian hands. To prevent this, the Prince of Taranto, Giovanni Antonio Orsini, ordered a ship filled with stones to be sunk at the mouth of the canal, restricting passage to small boats.

While well-intentioned, this decision turned the inner port into a swamp, exacerbating the spread of malaria and increasing the mortality rate among residents (Ferrando Ascoli, 1981). In 1474, Prince Alfonso of Aragon attempted unsuccessfully to excavate and reopen the canal. The mouth remained blocked, and the port basin continued to silt up as rainwater deposited mud, sand, and algae, which the currents could no longer clear away. The Grande River and Piccolo River became clogged at their mouths, and the canals were blocked by barriers of algae, leaving Brindisi's air unhealthy and causing a sharp population decline until the latter half of the 18th century.

By 1755, the situation had deteriorated to the point where the waters of the inner port were so stagnant that, during an extremely harsh winter, the port's sea completely froze over (Ferrando Ascoli, 1981).

This situation remained unchanged until 1775, when Ferdinand IV of Bourbon finally decided to heed the countless petitions from administrators and citizens, commissioning Cav. Engineer Andrea Pigonati to reopen the port to the natural flow of water. This directive was sent to Pigonati on July 8 of the same year. The engineer traveled to the city with one hundred convicts, who were promptly housed in a building near the fetid swamp of Ponte Grande.

### **The Reclamation Challenges of Ponte Grande and Ponte Piccolo**

Once the port had been addressed, there remained two additional sources of malaria. One was at Ponte Grande, which infested the entire area surrounding the Swabian Castle at the western end of the inlet. The other was at Ponte Piccolo, a breeding ground for infections due to its constant clogging with algae,

mud, and household waste. Briamo and Cavaliere described this swamp as having a “*constantly stagnant, foul-smelling, greenish surface*”. The swamp measured 400 rods in length, 80 rods in width, and 1.5 rods in depth (F. Briamo e G. Cavaliere, 1972).

The widening of the canal required vast human and financial resources, even enlisting the help of women. A total of 200 workers, 100 convicts, and 800 young men and women were involved in the efforts. Finally, on December 30, 1778, all the works were completed, and the benefits were immediately evident. Unfortunately, these improvements lasted only a few years. Pigonati had failed to properly establish the correct direction and depth of the canal, resulting in weak embankments that quickly gave way.

### **From Bourbon Initiatives to Proposals of Abandonment**

Ultimately, Pigonati’s two small breakwaters served no other purpose than to reduce the water capacity of the outer port, as was later confirmed (Ferrando Ascoli, 1981).

Subsequent governments, including the Napoleonic one, attempted to resolve what could be described as an age-old problem for the city of Brindisi but achieved no significant success. The Bourbon Restoration recognized the ports within its kingdom as instruments of civilization and wealth. Particular attention was given to the port of Brindisi, drawing the focus of the Public Works Council.

In 1811, the canal silted up again to the extent that the water depth was only 6-7 feet, making the passage of vessels nearly impossible (Ferrando Ascoli, 1981). The Council tasked Prince Cariati with inspecting the kingdom's ports and proposing the necessary works. After visiting the port, Cariati wrote in his report to the government:

*“Parmi ces ports il faut distinguer celui de Brindisi, que de tout temps a été célèbre surtout du temps des Romain. Placé au milieu de la côte il a le triple avantage d’avoir son entrée bien défendue ; un mouillage sûr a l’abri de tous les vents et une étendue a pouvoir contenir une très grande quantité de bâtiments. Le port aujourd’hui négligé pourroit devenir très conséquent pour le commerce et encore pour la marine militaire”*<sup>1</sup> (Ferrando Ascoli, 1981).

Based on this report, the government assigned several experts the task of designing projects to resolve the swampy conditions of the port of Brindisi once and for all (Ferrando Ascoli, 1981). However, as Ascoli noted, “*all these programs remained mere plans and pious wishes*”.

Due to these failures, the city fell into a severe and profound depression, accompanied by a distressing increase in mortality. Between 1827 and 1830, deaths exceeded births<sup>2</sup>.

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<sup>1</sup> The translation is as follows: "Among these ports, we must distinguish that of Brindisi, which has always been renowned, especially during Roman times. Situated at the center of the coast, it enjoys the triple advantage of having a well-defended entrance, a safe anchorage sheltered from all winds, and a size sufficient to accommodate a very large number of vessels. Today, the neglected port could become very important both for commerce and for the military navy".

<sup>2</sup> F. Ascoli reports that during those years, the number of deaths rose to 2.323 compared to 1.117 births. This is also confirmed by G. Monticelli and B. Marzolla in *Difesa della città e del porto di Brindisi*, Naples, Gabinetto Bibliografico e Tipografico, 1832, p. 15. They warn of the danger that the city could become completely deserted within 15 years.

In May 1828, under the Bourbon regime, responsibility for funding the improvement of the port of Brindisi was transferred from the Ministry of the Navy to the Ministry of the Interior. The works were entrusted to Afan de Rivera, “*General Director of Bridges and Roads, Water and Forests, and Hunting*” (Rossi-Doria & Bevilacqua, 1984).

De Rivera initiated excavation phases to be carried out during the cold seasons, from November to May, to ensure that the fumes from the dredged sludge would not become harmful.

However, after spending only 24 hours in Brindisi, de Rivera was so overwhelmed by the stench - described as “*the smell of rotting eggs*” (Ferrando Ascoli, 1981) so potent that the air was flammable due to the gases (Ferrando Ascoli, 1981) - that he proposed abandoning the city entirely. He suggested filling in the shallows of the inner port to plant trees and redirecting funds allocated to Brindisi toward constructing a new port in Gallipoli (Ferrando Ascoli, 1981).

### **The Revival of Brindisi's Port (1843–1900)**

Upon his death and the succession of Ferdinand II, Brindisi remained in a state of profound depression. A commission tasked with investigating the reasons behind the centuries-long deterioration of the port identified eight causes:

1. Caesar’s construction of the port entrance to control ship traffic.
2. The submerged ship placed by the Prince of Taranto to prevent a possible naval attack at the port’s entrance.
3. Sands carried from the outer sea.
4. The upper valleys at Ponte Piccolo and Ponte Grande.
5. The surrounding hills of the outer port.
6. The waste dumped into the port by the city.
7. The algae transported there and those growing locally.
8. The neglect and abandonment of the port for centuries (Ferrando Ascoli, 1981).

Despite these clear and precise findings, the execution of the necessary works only began in 1843, progressing slowly and at great expense. The activities were halted in 1848 and resumed six years later. Frequent interruptions rendered previous efforts ineffective, and by the time of the Italian unification in 1861, swamps were still present both in the port and around the city.

The new unified government also showed great interest in Brindisi and its port, aiming to make it an important maritime hub for goods and passenger transit.

Work under the unified Italian government began in 1866. This included dredging the seabed, constructing docks adjacent to the city, and filling the internal swamps. There were also significant improvements in infrastructure, such as completing the Ancona-Bari-Foggia-Brindisi railway line in 1865. These developments led to highly appreciable results.

These improvements finally led to the repopulation of the city. While Brindisi had been losing inhabitants in the years before unification, after the reclamation works, its population doubled in just thirty years, rising from 9.105 residents in 1861 to 17.876 in 1891, including both stable and transient populations.

The grim figures described by Ascoli during Brindisi's era of great depression were now a distant memory<sup>3</sup>.

Year	Number of inhabitants
1857	9012
1858	8962
1859	8844
1860	8712
1871	13755
1881	16719
1891	17876

A significant milestone in the fight against malaria came with Law No. 505, enacted on December 23, 1900, introducing the “*State Quinine*”. This law reflected a growing awareness that the adage “*prevention is better than cure*” needed to be applied in the battle against malaria. During a parliamentary debate, the honorable Sidney Sonnino stated:

*“We must treat malarial individuals with the utmost care, particularly during the season when they, and not the malarial mosquitoes, are infected. Healing an individual before or at the start of the malarial season is more effective than treating a hundred during the season”*<sup>4</sup>.

The introduction of the “State Quinine” law brought a wave of optimism to legislators and scientists. Senator Carlo Bizzozero described this measure as:

*“A truly social law”*<sup>5</sup>, which ensured that the cost of distributing the drug would be kept as low as possible and would decrease over time. He elaborated:

*“Quinine will be sold at a low price [...] and its cost can decrease as the price of raw materials falls. It will be provided in excellent quality, controlled by State laboratories, and packaged to ensure stability. It will also be available to consumers throughout the country, not only in pharmacies as is currently the case but also in government-licensed retail outlets. The advantage in this regard can be measured by the fact that, of the 8.262 municipalities in the Kingdom of Italy, perhaps just over 5.000 have pharmacies, while the government-licensed retail outlets number as many as 27.000”*<sup>6</sup>.

From a scientific perspective, quinine administration was not immunizing but rather curative and prophylactic.

The standard treatment became two quinine bisulfate tablets per day for adults, while children were given quinine-infused chocolates (to mask the bitter taste) containing 0,15 grams of quinine daily. This approach represented a practical balance between treatment efficacy and patient compliance, particularly for younger individuals.

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<sup>3</sup> State Archive of Brindisi [Archivio di Stato di Brindisi] (hereafter ASB), Historical Archive of the Municipality of Brindisi [Archivio Storico del Comune di Brindisi] (hereafter ASCB), cat. XII, cl. 12, b.1, fasc. 1.

<sup>4</sup> Ap, Camera dei deputati, legislatura XXI, I sessione, Discussioni, p. 756.

<sup>5</sup> AP, Senato del Regno, Documenti Relazione, cited p. 3.

<sup>6</sup> AP, Senato del Regno, Documenti Relazione, cited p. 3.

## **Malaria Prevention and Land Reclamation**

The process leading to the adoption of “State Quinine” was fairly lengthy. Immediately after national unification, during the construction of the newly established State, it was impossible to ignore the numerous territorial areas then referred to as “*unredeemed lands*”. These areas were unhealthy, desolate, uninhabitable, and economically depressed. Revitalizing these regions required initiating territorial reclamation and literacy campaigns.

The first laws enacted by the Historical Left - led by key figures such as Agostino De Pretis, Francesco Crispi, and Giovanni Giolitti - focused on land reclamation and hydraulic and agricultural improvements. It wasn't until scientific discoveries between 1880 and 1898 identified the true culprits behind the spread of the disease that a more targeted approach emerged. During the Giolittian era, it became evident that combating malaria required the involvement of scientists, doctors, and hygienists among the Members of Parliament.

Legislative efforts in this period followed two main streams:

1. Land reclamation laws, beginning with a law passed in 1882, which focused on transforming the landscape using hydraulic engineering and agronomic techniques.
2. Health legislation, comprising a series of rules and regulations that were eventually consolidated into the Unified Health Code of 1907 (Boccini & Archivio centrale dello Stato (Italy), 2003).

## **From Fascist Efforts to the Post-War Introduction of DDT**

Despite the efforts of the Fascist regime and its administrators in the newly established Province of Brindisi, the definitive eradication of malaria in the area would only be achieved after World War II, when the Americans introduced a powerful and lethal weapon against mosquitoes: para-dichlorodiphenyltrichloroethane, better known as the insecticide “DDT”.

In conclusion, the fight against malaria has represented an enormous challenge for centuries, particularly in the Italian and southern contexts, where the connection between geographical-environmental factors and the disease's spread was evident. Erroneous beliefs of the past, attributing the disease to miasmas from swamps, gradually gave way to fundamental scientific discoveries, such as Charles Louis Alphonse Laveran's identification of the plasmodium as the pathogen and Anopheles mosquitoes as the transmission vectors.

## **Conclusions**

Over time, strategies to combat malaria evolved, from swamp reclamation efforts to health interventions based on quinine use, and later to systematic prevention measures such as protective nets and public awareness campaigns. The city of Brindisi serves as an emblematic example of the struggles associated with malaria, enduring centuries of degradation and incomplete reclamation efforts, culminating in more systematic remediation projects during the 19th and 20th centuries. Despite these efforts, land reclamation alone was insufficient to eradicate malaria entirely, to the point where the municipality faced the risk of total depopulation.



Thanks to the irreplaceable contributions of science, the nature of the disease and its primary transmission vectors were understood, along with the discovery of the curative and prophylactic drug quinine. Legislatively, the introduction of the so-called “State Quinine” marked a decisive step in reducing mortality. However, it was only with the advent of modern technologies, such as DDT after World War II, that a definitive victory over this centuries-old scourge could be claimed.

The story shared here represents a significant example of how scientific progress, public intervention, and collective awareness can transform a reality of suffering and degradation into one of rebirth and hope.

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