



WADI PROJECT



PRESENTATION OF THE ITALIAN SITE

THE GROSSETO PLAIN



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The Grosseto Plain (Tuscany, Italy)

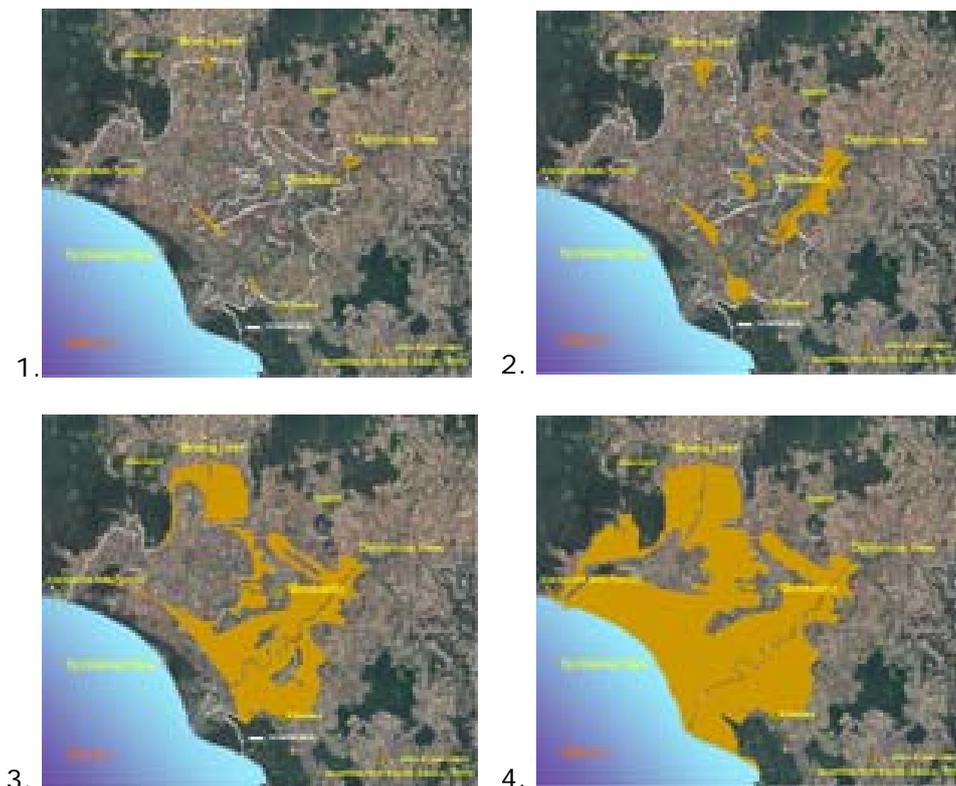
Geographical location

Grosseto (42°46' N 11°6' E) is the capital of the most Southern province of Tuscany. The city (10 m a.s.l.) is located at 12 km from the Tyrrhenian sea, in the middle of an alluvial plain.



Origins of the plain

The Grosseto plain is an area delimited by the hills of Castiglione della Pescaia to the North-west, the hills of Grosseto to the East and by the Uccellina Hills to the South. About 6000 years ago, when sea level stabilised, this area was an enormous marine gulf in which the Bruna and the Ombrone rivers flowed out into sea in its northern and eastern sections respectively. Through the ages, with the progressive buildup of sediments, especially by the Ombrone River, there was a progradation of the land that results in today's alluvial plain. The wetlands of the Diaccia Botrona are what remains of the ancient marine gulf. The Grosseto plain is part of the Ombrone basin (4768 km²), to which the four catchment areas of the Ombrone, Bruna, Albegna and Osa rivers belong.



The Ombrone river

The Ombrone River originates from the Chianti hills near Castelnuovo Berardenga (Siena) and after a relatively complex course of about 165 km it flows out into the Tyrrhenian sea in an area south-west of the city of Grosseto.

The Ombrone River, with a catchment area of 3494 km², is the largest river of Southern Tuscany and has the greatest suspended sediment load as compared to other Tuscan rivers.

Mean monthly flows vary from a minimum of 4 to a maximum of 50 m³/s with a mean of 18000000 tons/year of suspended sediments.

Reforestation carried out along the entire course of the Ombrone river has decreased land erosion. This phenomenon, together with river bed quarrying, has caused severe coastal erosion around the river mouth.



The river near Paganico



The river mouth



The river mouth



A quarry



A quarry

The Bruna river

The Bruna River, which originates from the Accesa lake, after a short course of only 42 km, flows out into the sea at Castiglione della Pescaia. Its catchment area is 350 km². The Bruna River is canalized along almost its entire course but before reaching the sea, it separates in two water courses. One is directly connected to the sea, whereas the other forms a closed loop, which during periods of intensive rains flows out into the sea.



The river near its origin



The river near its origin



The river at its medium distance



Accesa Lake



The river near its mouth



The river mouth

The Diaccia - Botrona wetlands

The wetlands of the Diaccia Botrona are located behind the sandy coastal dunes covered by pinewoods near Castiglione della Pescaia. These wetlands are what remains of ancient Lake Prile that once occupied an area extending about 50 km².

Today, it constitutes a large coastal wetland of about 700 ha, that was originally supplied by freshwater but which now tends to become brackish. The wetlands of the Diaccia Botrona have a mean water depth of 30 – 40 cm and are connected to the sea and to the Bruna River by several canals.



Map of 1795



Panoramic view



The environment



The environment



The environment



The environment

History

Because of its favourable morphological conditions and its richness, in the past, the entire territory of Grosseto was especially suitable for human settlements. Starting from the first millenium BC the Etruscans inhabited the area founding the cities of Vetulonia and Roselle. Both cities had very active ports and important trades were based on the extraction of salt. Roselle prospered also during the Roman domination maintaining its importance until the Middle Ages when it declined politically in favour of the city of Grosseto. When the first idea of making Grosseto a municipality had started to set in among the population, in 1151, Grosseto took its oath of allegiance to Siena. In 1224 Frederic II lived in Grosseto for a while and brought to this town nobles and poets from all over Italy.

After some time, in 1260, Grosseto fought the battle of Monteperti, together with Florence against Siena. However, after several vicissitudes, Grosseto was definitely conquered by Siena. The historical period before 1552 was characterised by pestilences and many attempts of revolts during which, the people of Grosseto drove away the Spaniards, who were in charge of the city at that time. After the treaty of Chateau Cambresis in 1559 and the defeat of Siena against Florence, the Medici family transformed Grosseto in a fortress.



Map of the city of Grosseto in 1823

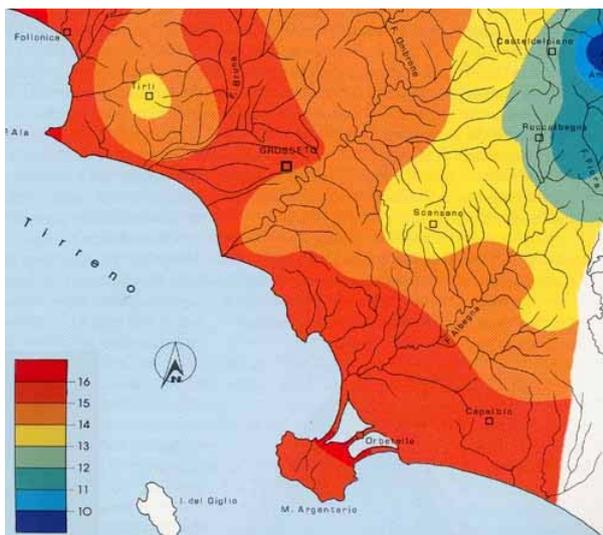
However, the Medici neglected Grosseto and its territory. It was only when Pietro Leopoldo of the Lorraine family took over, that Grosseto was made a Province and separated from that of Siena. The city became independent and new political and economical scenarios emerged. After the Congress of Vienna, Ferdinand III, thanks to the precious support of the minister Fossombroni, made important land reclamations, developed agriculture and cattle farming in the entire Maremma area. Subsequent political events led Grosseto to claiming independence from the Grand Duke and the city actively participated in the Risorgimento. After the departure from Florence of Leopoldo II, the city of Grosseto became one of the many small cities of Italy in search of an identity. In the period between the two World Wars and especially after the Land Reform, the territory of Grosseto evolved and changed a great deal.

Climate

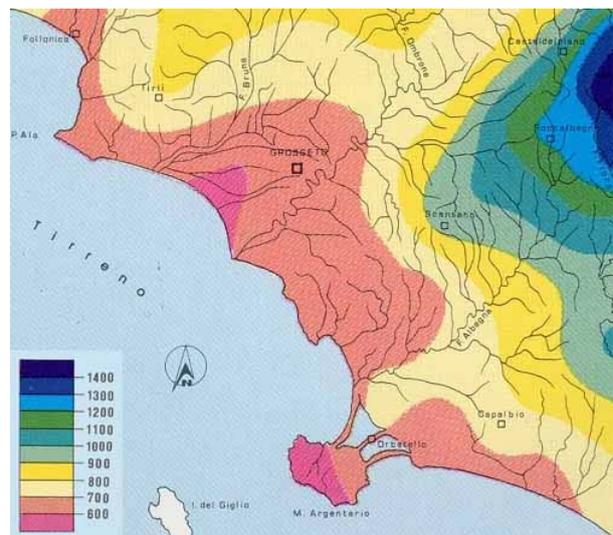
The general climatic conditions of the area refer to the past decades. In the littoral zones of Southern Tuscany the average daily sunshine was calculated at about 3.2 hrs per day in December and 10.9 hrs in July with a mean annual value of about 7 hrs. Consequently, mean global radiation along the coast is one of the highest at the national level.

Also, mean annual temperatures registered along the coast (16 °C) were higher than those of inland areas (<9 °C on the Amiata mountain). The mitigating action of the Tyrrhenian sea not only on coastal areas but also in the mountains (where the lowest values are registered) is evident from the map of the mean annual temperatures of southern Tuscany.

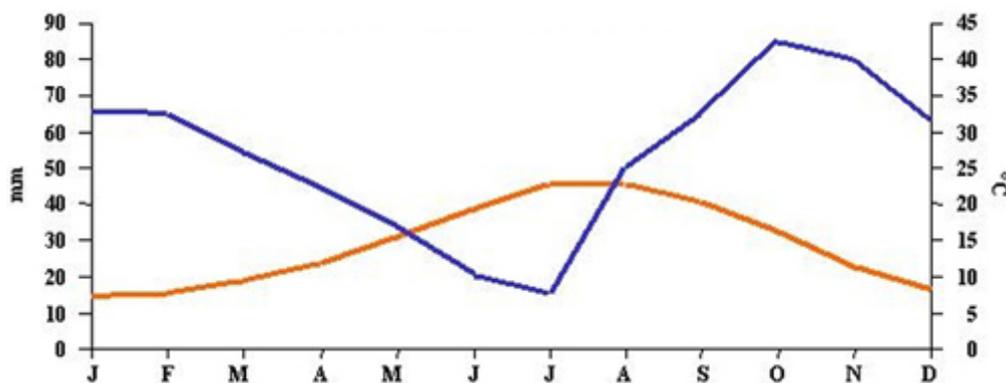
Winds of low-moderate intensity present seasonal patterns with prevalent winds coming from Northwest in January and from Southeast in July. In the Grosseto plain mean annual rainfall was less than 700 mm, with lowest values in July.



Map of mean annual temperature (°C)



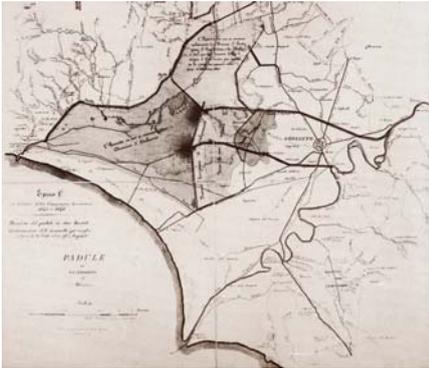
Map of mean annual rainfall (mm)



Climate diagram map of Alberese (province of Grosseto) (1938 – 1988).
Orange: mean temperature(°C); blue: mean rainfall (mm)

Land reclamation

Both during Etruscan-Roman period, the Middle Ages and during the period of occupancy of the Medici and in particular of the Lorraine (1737 - 1860) families, there was always the need of keeping under control the marshlands and of carrying out important operations of land reclamation.



"Colmata" in the territory of Castiglione della Pescaia



Digging of channels

In spite of the many interventions made during the various phases of reclamation and in spite of the some positive results obtained in controlling and reducing the wetlands, the situation remained more or less the same until the Twentieth Century. In this period, first the Fascist then the Republican government reclaimed most of the lands of the Maremma plain carrying out the "total land reclamation" planned many year before by Pietro Leopoldo.

The land reform

After land reclamation, in relatively recent years (1951) the Agency for the Colonization of the Tuscan-Roman Maremma area (Maremma Agency), established the so called "Land Reform" through which labourers and people renting the lands became landlords.

Consequently, new farmhouses and small service centres (with schools, churches, post office etc.) were constructed for the new owners. The Fiora aqueduct was built and small cooperatives were created to buy common farming machines. Before the land reform the entire area was organised in large estates managed by rich landlord families coming from the main Italian cities.



Sabotino locality



The farmers consortium



A farmers house



The school



The church



The cinema



A machine for agriculture



Irrigation channels



A hydraulic pump

Coastal erosion and salinisation

Analysing the evolution of the sandy beaches around the Ombrone River mouth, it is clear that since the second half of the last century a process of erosion has taken place. At that time, the river mouth was more advanced by about 1 km and from then on, there has been a constant erosion rate ranging from 5 to 10 m/year.



Coastal erosion



Inland area submerged from the water



The same area dried in summer



Dried pine trees



Dried pine trees

The constant process of coastal erosion has progressively led to the entrance of salt water in inland areas. This process has also caused the increase in water salinity of the canals built during land reclamation and used to drain flatter areas. Consequently the coastal pinewood, the grazing and farming areas have been severely affected. Another phenomenon is the hydrological degradation of the area due to salt water intrusion in the water table that has lowered its level because of the continuous pumping for agricultural needs.

Protected areas

1. The Maremma Regional Park

The Maremma Regional Park was established by a Tuscan Regional Law in 1975.

Its territory is about 10000 ha, it is delimited landwards by the Livorno - Rome railway and it extends along the Tyrrhenian coast from Principina a Mare to Talamone.

Its most significant geographical elements are:

- the last section of the Ombrone river with a meander course,
- the Uccellina Hills,
- the wetlands of the Trappola, and
- a stretch of coast of 20 km with sandy shores to the North and rocky cliffs to the South.

The territory of the Park belongs to the municipalities of Grosseto, Magliano in Toscana and Orbetello.

It makes up a network of very different environments: farming and grazing areas, Mediterranean maquis, rocky zones, coastal pinewoods, wetlands and sand dunes.

Besides the Ombrone River, the Park presents two hydrographical networks: one made up by the canals built for land reclamation and the other by small streams with torrential regimes that are exclusively found in the hilly areas of the Park.

The Park's territory includes the Azienda Regionale Agricola (the Regional Agricultural Company) of Alberese that extends for 4000 ha.

In recent years it has specialised in cattle-horse breeding and in biological farming systems.



Panoramic view



The coast of the Park



Pine trees inside the Park



Cows inside the Park

2. The Diaccia – Botrona wetlands- A Natural Reserve

The Reserve is located in the municipalities of Grosseto and Castiglione della Pescaia and is made up of public and private lands. The Reserve, established in 1996, extends on a territory of over seven hundred hectares and is considered the most important Italian wetland. This area was acknowledged of international importance ever since 1991. The area has several peculiar ecosystems such as the Salicornietum and Limonietum associations and the typical marshland

habitats. Of the vast forest that once covered most of the Grosseto plain, only relict areas remain. Here ash, elm and tamerix trees can still be found.

The birds of the Reserve are the most interesting and spectacular components of the wetlands. More than 200 species have been counted in the Reserve of which 80 nesting in the area.

In recent years, because the increase in the water salinity, the wetlands of the Diaccia -Botrona have undergone marked changes in their vegetation. Vast areas with reeds of *Phragmites australis* have been replaced by halophilous plants that used to be limited only to the southern and more open areas of the wetlands. The recent evolution of the area, with the loss of certain plant formations and the general "homogenization" of the habitat, caused by natural and human interventions, has brought the wetlands to a high degree of degradation.



The wetlands



The wetlands



The wetlands



Salicornietum

Emerging natural habitats

The Grosseto plain comprises several environments, some of which are of great natural interest. These, however, are extremely vulnerable due to the heavy human impact on the area.

Ephemeral nitro-halophilous vegetation of the sea line deposits (Codice Natura 2000 1210; Codice Corine Biotopes 17.2). This habitat is typical of sandy beach ecosystems where levels of nitrates are high due to the accumulation of beach wrack (littoral of the Maremma Regional Park).

Coastal belt with mobile dunes presenting *Ammophila arenaria* (Codice Natura 2000 2120; Codice Corine Biotopes 16.2122). *A. arenaria* formations are distributed on the dunes far from wave action even during heavy storms (littoral of the Maremma Regional Park).

Calcareous wetlands with *Cladietum* association (Codice Natura 2000 7210; Codice Corine Biotopes 53.3). This habitat is characteristic of lakes with low depths and of retrodunal depressions with calcareous waters (Wetlands of the Trappola)

Besides highly vulnerable areas, the Grosseto plain hosts species at risk of extinction at national and/or regional level: 25 plant species (*Limonium etruscum*, *Centaurea aplolepa*, *Romulea revelieri*, *Ophrys fusca iricolor*, *Puccinellia palustris* etc.), 2 insect species (*Eurynebria complanata*, *Osmoderma eremita*), 3 fish species (*Lampetra fluviatilis*, *Petromyzon marinus*, *Leuciscus lucumonis*), 1 reptile species (*Caretta caretta*), 9 bird species (*Botaurus stellaris*, *Circus aeruginosus*, *Circus pygargus*, *Burhinus oedichnemus*, *Charadrius alexandrinus*, *Coracias garrulus*, *Lanius minor*, *Lanius senator*, *Emberiza hortulana*), and 1 mammal species (*Myotis natterei*).



Ammophila on the coastal dunes



Stranded debris



Trappola Lakes

Water quality

In some areas of Tuscany there is arsenic in the ground water. Its presence can be caused by man-made wastes as in the case of Montieri (ashes and sludges) or can be of natural origin due to geothermal manifestations or to the erodibility of volcanic rocks through which the water filters (Amiata Mount).

Furthermore, Grosseto's water table also undergoes marine water intrusion with consequent problems in supplying good quality drinking water and water for agricultural uses. Marine water intrusion in the water table of the Grosseto plain is a seasonal phenomenon and is progressive in time. Along the entire course of the Ombrone River, its water has moderate levels of pollution or of alteration. This is mainly due to its great water flow that allows it to better withstand possible pollutants which, however, are quite limited thanks to the presence of adequate water treatment systems.



Mud

Human migration

Ever since the past, the Maremma area has always been characterised by temporary or permanent human migrations. People were attracted to the area because of several features, namely, its rich pasture lands, its relatively mild climate and its low population density.

During the Granducato of Tuscany (1737 - 1860), in Maremma population density was low but each year, 3000 farmers were called in for seasonal jobs. However, when the works for land reclamation began about 6000 more workers came into the area. In 1830 the territory of Grosseto supported about 9000 temporary workers against 4200 residents.

From September to May, flocks from most of Tuscany's inland areas were brought to Maremma, always following the same routes. The valleys of the Bruna, Ombrone and Albegna Rivers were the main entrances into the Grosseto plain. This temporary migration, called transhumance, was practiced until the middle of the last century.

Until the mid Twentieth century, at the beginning of the winter, many woodcutters and charcoal-burners from the Tuscan –Romagna Apennines would come down to the Maremma area, bringing, in some cases, their entire families. From the villages of Mount Amiata or from the inland towns of Tuscany and of Upper Lazio all the way to the Apennines of the Marches and Umbria, seasonal farmers were also recruited.

In the years around 1930 several rural areas, like those of Maremma, were the destination of an organised sort of immigration. Between 1930 and 1932, in order to colonise and populate the reclaimed lands of Maremma, the Fascist government favoured the immigration of families from Veneto.

Today, traces of this immigration are still recognisable in the Veneto surnames of many families, in the names of the farms with place-names from Veneto and in the Venetian dialect still spoken by older people. Even today, there is much labour immigration in the territory of Maremma. In fact, many workers from North Africa and Eastern Europe come to work in the area, on a seasonal basis, in the sector of farming and constructions.

After 1960, besides the temporary immigration for labour, also tourism for recreational purposes (sun bathing) has increased population numbers in the area. In 2005, the Grosseto territory registered the presence of 5 million people.



Flock of sheep

Salt

Already during the Etruscans times, Seventh Century B.C., the economy of the city of Roselle was based on its flourishing trading port and on the production of salt. Saline pools were located in the internal areas of the Southern inlet of the ancient marine gulf that once extended between

Castiglione della Pescaia and the Uccellina Hills. Later on, when the Ombrone River had filled up with sediments most of the lagoon, the extraction of salt was moved to the northern section of this salty lagoon, also called Lake Prile. When Roselle lost its political importance the salines of Lake Prile, located in an area to the west of the city of Grosseto, passed under the jurisdiction of this city. These pools remained active until 1386, when they were declared inadequate by the local authorities because of the decrease in the lake's water salinity.



"Saline trapanesi" in 1758

During the Middle Ages there were other saline pools near Giuncarico that sold salt to the cities of Lucca and Chiusi. As the Ombrone River continued its activity in filling up with sediments the Grosseto plain, its river mouth was moved to the southwest. In this period, when the entire territory of Grosseto passed under the administration of Siena, the salines were moved to the Trappola, close to the Ombrone River mouth where they remained active until 1758.

Around this date, in the Le Marze locality, the Lorraine family built 404 pools over an area of 40 ha that produced 40000 quintals of salt/year. This was traded with inland areas and other countries. However, salt yield was only about 2% and costs were very high due to the great number of workers involved and to the distance of the pools from the sea. Sea water was directly pumped to the pools first with machines pulled by oxen and afterwards with a steam-engine. Also these pools worked for just a few years and then were abandoned.



Salt pools in La Diaccia- Botrona wetlands

Malaria

For centuries the Maremma area, due to its environmental characteristics, has been subject to malaria, a real plague for this area.



Concellation stamp saying "Chinino is the principal drug to cure malaria"



Chinino

This disease was an enormous obstacle to the development of the zone and to all the attempts of repopulation made ever since the beginning of the Middle Ages. During the first decades of the Twentieth Century, the government distributed free quinine to contrast this problem. Only after 1950 the problem was definitely solved with the use of DDT and with the end of the works for land reclamation.

Local administration

The local administrations of the Grosseto plain are the municipalities of Grosseto and Castiglione della Pescaia. The municipality of Grosseto has 69899 inhabitants and a surface of 475 km² with a population density of 147.30 inhabitants/km². The municipality of Castiglione della Pescaia has 7244 inhabitants and a surface of 209 km² with a population density of 34.70 inhabitants/km².

Socioeconomics

Until the Lorraine period, end of the Eighteenth beginning of the Nineteenth Century, the few people living in the plain of Grosseto were in direct and often mortal contact with malaria. Cultivation of cereals and grass for livestock was only marginal and agricultural systems were inadequate. Besides pastures, the main resource was fish aquaculture. The main fish farms were the low basins of the Bruna and Ombrone Rivers that supplied the fish-markets of Siena and Florence.

Starting from the Lorraine period until the first decade of the last century, thanks to the restructuring of the lands and to the choices of crops, the Maremma area has radically changed and has gained an image of agricultural fertility and richness. After the Land Reform, during the early Fifties of the past century, traditional agricultural systems were replaced by specialised and intensive agricultures performed by small local farmers. This has given very good results both from a social and an economical point of view.



Modern greenhouses for vegetables



Rice field



Olive trees



Deposit of pine cones for pine seed extraction



Azienda Agricola Regionale of Alberese



Horses



Cows



Aquaculture

Today, the Grosseto plain is quite impacted and has a dense network of highly productive farms. Life standards have increased and the problem of the disequilibrium between city and countryside has been solved. Value has been given to typical local products and a search for foreign and wider markets has been achieved.

Tourism, on the other hand, is very competitive with the agricultural sector and benefits from the presence of natural resources both on the coast and in inland areas. In this way tourism to beach areas is counterbalanced by agritourism which represents a valid alternative.

Because of the particular characteristics of the environment that has conditioned and slowed down the development of the entire area, also the industries are not quite developed. However, the territory has small-median enterprises and small laboratories of handicrafts that are quite productive. The economy of Grosseto is mainly based on building, mechanic, metal, textile and food industries.

Water managing infrastructures

The Bruna River dam

In the past the waters of the Bruna River were used in fish aquaculture. Furthermore, the final part of the Bruna River supplied the Castiglione della Pescaia Lake known at that time, as the "fish farm par excellence" of Southern Tuscany. In this context, the Republic of Siena decided to build a large artificial basin for freshwater fish aquaculture. The work for the construction of the dam started in 1468.



Remains of the dam

Unfortunately, in 1492, after recurrent floods, the dam collapsed carrying away and killing a lot of people and animals. The dam was never repaired. The remains of this structure, absolutely extraordinary for the time in which it was built, are still visible along the road that runs from the Via Aurelia to Ribolla.



Remains of the dam

The Steccaia of the Ombrone River

Immediately behind the city of Grosseto there is a water managing structure that characterises the course of the Ombrone River, the so-called "Steccaia". This interesting structure is an artificial barrier to the river that was built under Leopold II of Lorraine to reclaim land from the wetlands of Castiglione della Pescaia through artificial aggradation (filling up technique). The first Steccaia was simply made of wooden poles pushed into the river bed. However, this barrier was continuously washed away by the strong floods of the river. Today the "Steccaia" is a stonebuilt barrier constructed between 1875 and 1879. It is a submergible dam that captures the waters of the Ombrone during floods diverting them into the Diversivo Canal.



The "Steccaia"



The dam

The Tura Bridge

Close to the Steccaia there is another water managing structure called the Tura Bridge, no longer used today. This impressive building with sluice-gates, constructed between 1905 and 1924, was designed to convey 600 m³/s of water in the Diversivo Canal 55 m wide. The Diversivo Canal was 17 m long and brought the muddy waters of the Ombrone River to the wetlands of Raspollino for land reclamation through artificial aggradation (soil filling up technique).



The Tura bridge

The Ximenes House

During the works for land reclamation, in 1767, the engineer Leonardo Ximenes built the Ximenes House or Red House under orders of Pietro Leopoldo of Lorraine. This building was used not only to regulate the water flow of the wetlands but also as obligatory passage-way for the eels that were economically important for the local population.



The Ximenes House

The Giorgini Bridge

After the failure of the works for land reclamation by Ximenes, in 1826, Pietro Leopoldo of Lorraine called the engineer Gaetano Giorgini for the construction of a bridge across the Bruna river. This bridge was built so as to avoid the mixture of marine with freshwater thought at those times to be the main cause of malaria. The bridge was provided with three sluice-gates that prevented the entrance of marine water in the wetlands but permitted the outflow of stagnant waters towards the sea. However, the Giorgini Bridge, visible today, was built in 1930 by the Maremma Consortium for land reclamation.



The Giorgini Bridge