SPAIN

Source: esri

General

Spain - officially the Kingdom of Spain - is mostly located on the Iberian Peninsula. The country's mainland is bordered in the South and East by the Mediterranean Sea except for a small land boundary with Gibraltar, in the North and Northeast by France, Andorra, and the Bay of Biscay and in the West and Northwest by Portugal and the Atlantic Ocean. The country has an area of 50.6 Mha (million hectares) with, in 2022, a population of 47.6 million, or 0.94 persons per ha (Wikipedia and United Nations, 2022).

Climate and geography

Three main climatic zones can be distinguished according to geographical situation and orographic conditions (source: Wikipedia):

- *Mediterranean climate*, characterised by warm/hot and dry summers, is dominant in the peninsula. It is predominant in the Mediterranean and Southern Atlantic coast and inland throughout Andalusia, Extremadura and most of the Centre;
- *semi-arid climate*, is predominant in the south-eastern quarter of the country, but is also widespread in other areas of Spain. It covers most of the Region of Murcia, southern Valencia and eastern Andalusia, where hot desert climate also exist. Further to the North, it is predominant in the upper and mid reaches of the Ebro valley, which crosses southern Navarre, central Aragon and western Catalonia. It is also found in Madrid, Extremadura, Castilla-La Mancha, and some locations of western Andalusia. The dry season extends beyond the summer and average temperature depends on altitude and latitude;
- *oceanic climate*, located in the northern quarter of the country, especially in the Atlantic region. Additionally it is also found in northern Navarre, in most highland areas along the Iberian System and in the Pyrenean valleys, where a humid subtropical variant also occurs. Winter and summer temperatures are influenced by the ocean, and have no seasonal drought.

Spain is a mountainous country, dominated by high plateaus and mountain chains. There are several major rivers such as the Tagus, Ebro, Guadiana, Douro, Guadalquivir, Júcar, Segura, Turia and Minho. Alluvial plains are found along the coast, the largest of which is that of the Guadalquivir in Andalusia.

The Group Polder Development (1982) states that the polder areas are mainly found on the South-west coast and on the East coast between Valencia and Ebro Delta.

Existing polders

The following polders have been identified by the Group Polder Development (1982):

- *polders between the Ebro Delta and Valencia/Alicante*. There are nine polders with respectively the following areas: 888 ha, 1,058 ha, 798 ha, 1,118 ha, 370 ha, 1643 ha, 19,575 ha, 5,743 ha and 1,482 ha (Figure 1) (Gil Sánchez, 1983);
- *Ebro Delta*. The total area of the delta is 20,000 ha. The delta has been subdivided in 6 polders of 2,000 – 4,000 ha each;
- *Guadalquivir River*. In the area called the Marismas, South of Sevilla, there are polders with a total area of 75,000 ha (Figure 2) (Guzmán, 1983). Rivera (1983) briefly describes how the area was reclaimed. Some of the marshes on the left bank have been reclaimed;
- *Cadis Bay*. An area of 4,230 ha has been reclaimed. Gomez-Miguel *et al*. (1983) mention that the Castillo de Dona Blanca Polder of 1,500 ha is located along the right hand side of the Guadelete River;
- *Odiel-Tinto Marshes*. There is a reclaimed area, mainly for industry;

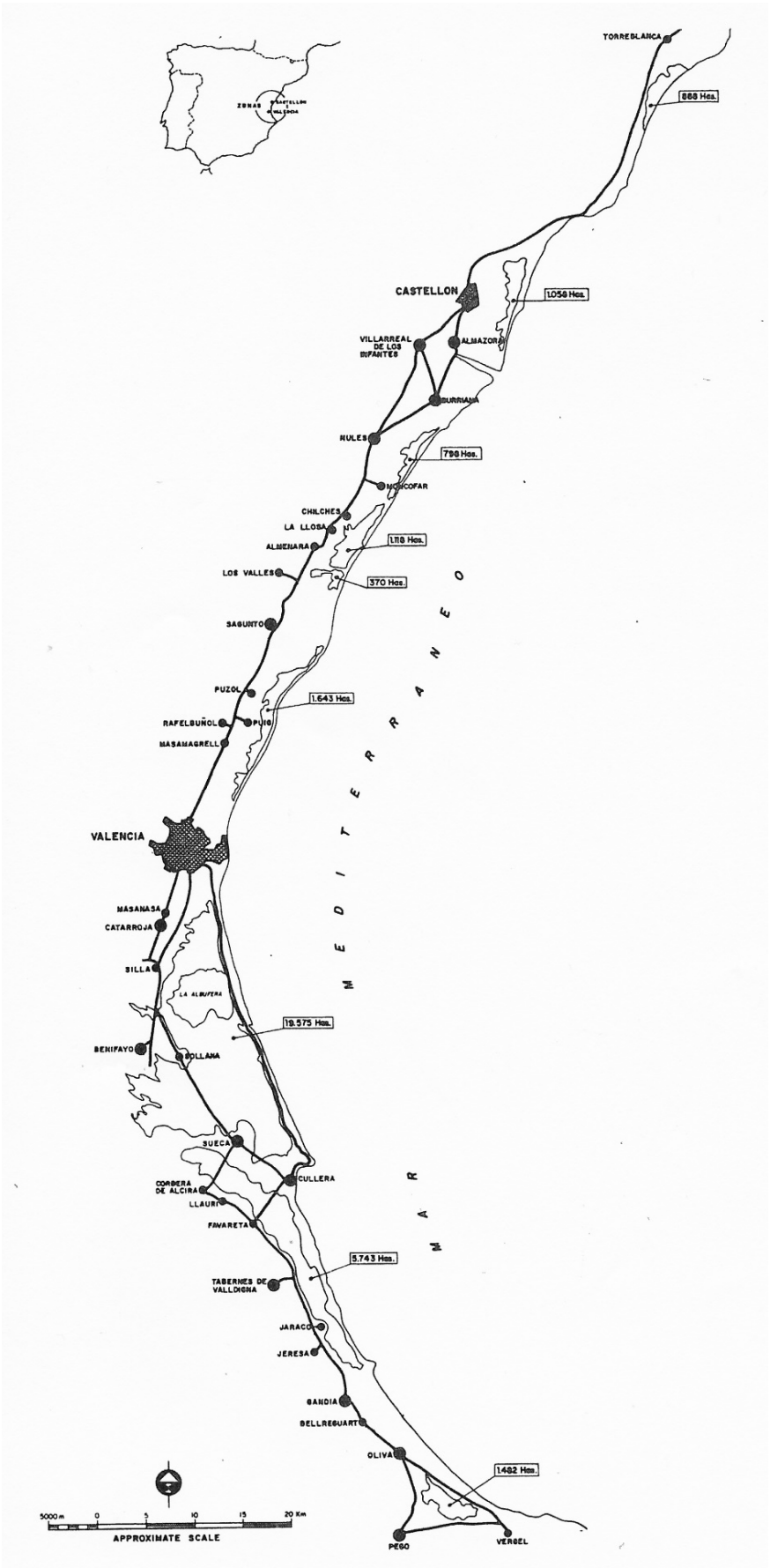

Figure 1. Location map of actual and potential polders on the eastern Spanish littoral (Gil Sánchez, 1983)

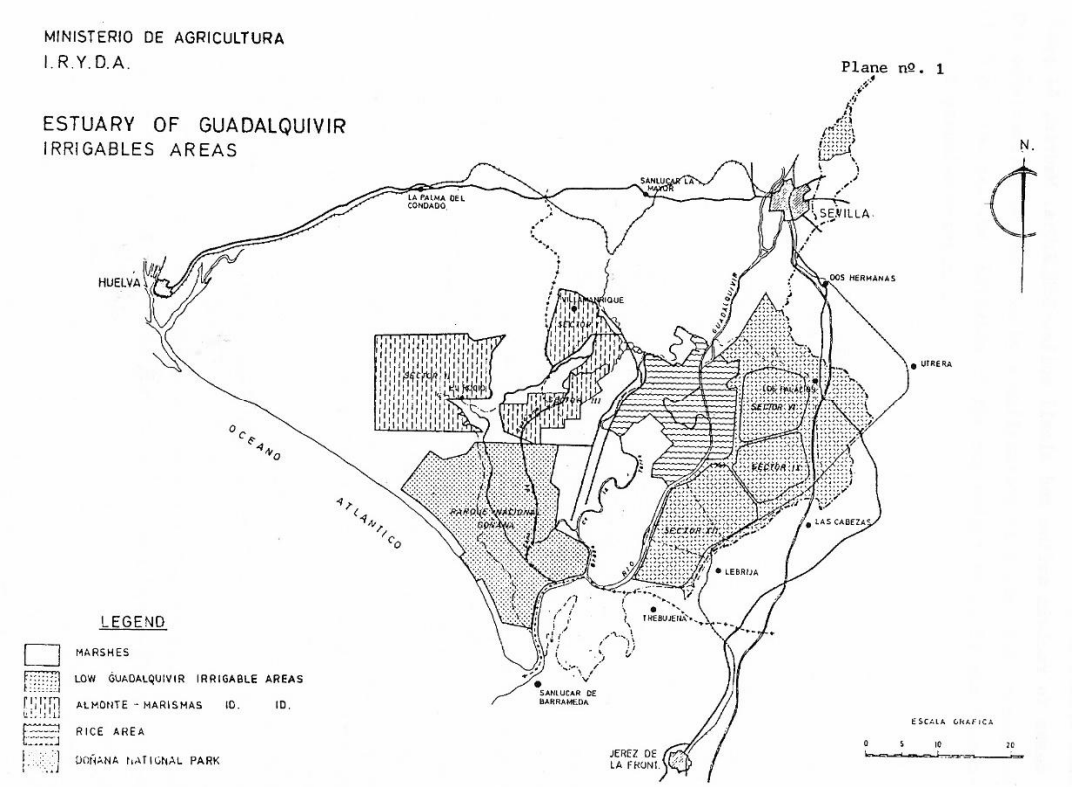

Figure 2. Location of the polders in the marshes (Marismas) of the Guadalquivir River Estuary (Guzmán, 1983)

- *Pego-Oliva Polder* (Figure 3) (Beltran, 1987);
- *polder south of Granada*. Motril Plain;
- *in addition the following areas are mentioned*: Guadiana River Marshes, Barbate River Marshes, Algeciras Bay, Albufera Plains/Marshes.

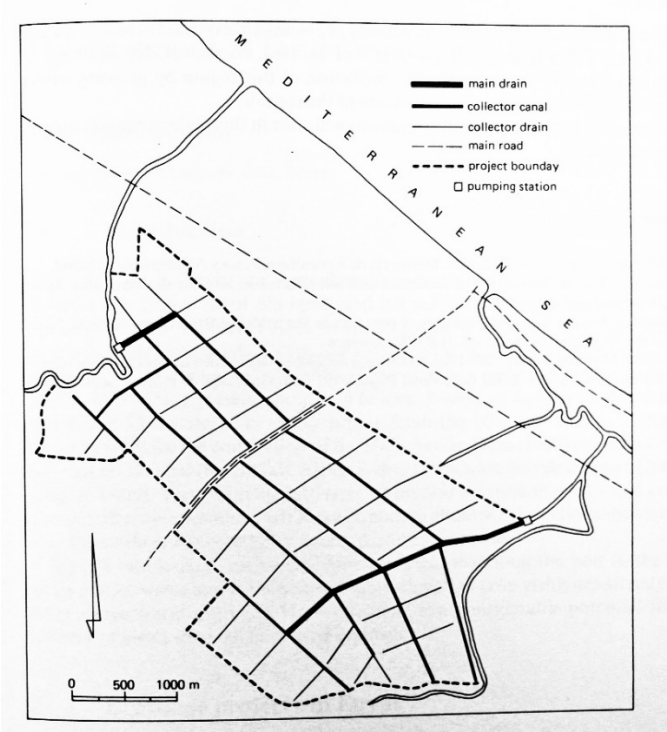

Figure 3. Drainage system of the Pego-Oliva Polder (Beltran, 1987)

General characteristics of the polders in Spain are shown in Table I. Table II shows the characteristics of the water management and flood protection systems of the existing polders.

Proposed polders

No proposed polders have been identified.

Location of the polders in Spain as shown on the World polder map

The location of the polders in Spain is shown in Figure 4.

Figure 4. Location of the polders in Spain (source: esri – Batavialand)

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

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Bart Schultz

Lelystad, February 2024

Table I. General characteristics of existing polders in Spain

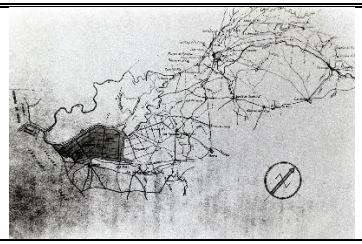
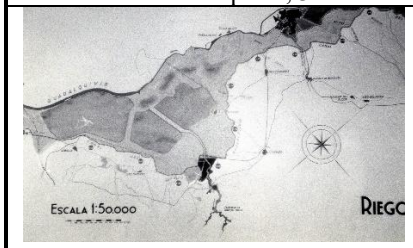
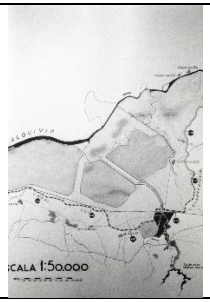
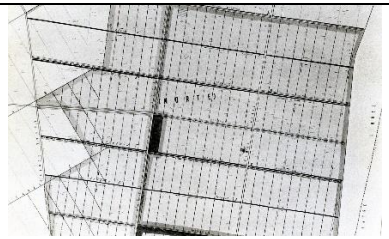
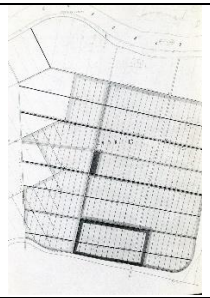
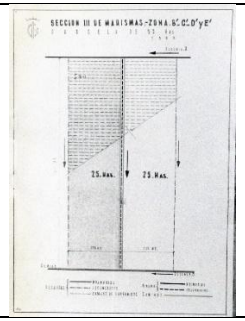
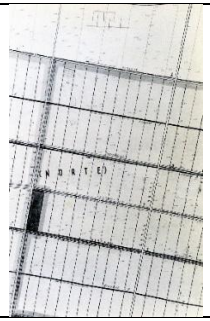
Name	Reclamation	Area in ha	Type *)	Latitudes	Longitudes	Elevation in m+MSL	Land use
Albufera Plains/Marshes	x	19,575	RLL	39º 17' N	0º 19' W	-9	Agriculture and nature
Algeciras Bay	x		RLL	36º 10' N	5º 27' W	-1	Agriculture and urban
Barbate River Marshes	x		RLL	36º 11' N	5º 54' W	1	Agriculture
Cadiz Bay	x	4,230	RLL	36º 35' N	5º 10' W	5	Agriculture
Castillo de Dona Blanca Polder	x	1,500	RLL	36º 37' N	6º 9' W	2	Agriculture
Ebro Delta – six polders	x	20,000	RLL	40º 42' N	0º 43' E	0	Agriculture
Motril Plain	x		RLL	36º 44' N	3º 32' W	5	Agriculture
Odiel-Tinto Marshes	x		RLL	37º 15' N	6º 59' W	2	
Pego-Oliva Polder	x	1,482	RLL	38º 52' N	0º 3' W	6	
Polder near Almenara	x	370	RLL	39º 43' N	0º 12' W	0	Agriculture
Polder near Castellon	x	1,058	RLL	39º 59' N	0º 0' W	6	Agriculture
Polder near La Llosa	x	1,118	RLL	39º 45' N	0º 11' W	-1	Agriculture
Polder near Nules	x	798	RLL	39º 50' N	0º 7' W	-1	Agriculture
Polder near Puzol	x	1,643	RLL	39º 36' N	0º 16' W	-2	Agriculture and urban
Polder near Tavernes de la Valldigna	x	5,743	RLL	39º 5' N	0º 15' W	2	Agriculture
Polder near Torre Blanca	x	888	RLL	40º 11' N	0º 12' W	-1	Agriculture and nature
Polders in Estuary of Gaudalquivir River		75,000	RLL	36º 59' N	6º 8' W	-1	Agriculture and nature
Total		133,405					

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

Table II. Characteristics of the water management and flood protection system of existing polders in Spain

Name	Design criteria in chance of occurrence/year							
	Water management						Flood protection	
	Drainage					Irrigation	Rural	Urban
	Type	Design criterion	Percentage of open water	Discharge capacity				
				m^3/s	mm/day			
Pego-Oliva Polder	RLL	0.1 per year			60			

Table III. Pictures of polders and lowlands in Spain by Prof. Adriaan Volker

			
A4 001/VIII.4.1 Aranjuez San Isidro, Prof. Adriaan Volker at a reception, 3 June	A4 002/VIII.4.2 Prof. Adriaan Volker between children	A4 003/VIII.4.3 Prof. Adriaan Volker during a diner	A6 0045/VIII.6.45 Polders in Estuary of Guadalquivir river
			
A6 0046/VIII.6.46 Polders in Estuary of Guadalquivir river	A6 0047/VIII.6.47 Polders in Estuary of Guadalquivir river	A6 0048/VIII.6.48 Lay out of a polder in Estuary of Guadalquivir river	A6 0049/VIII.6.49 Lay out of a polder in Estuary of Guadalquivir river
			
A6 0050/VIII.6.50 Lay out of a polder in Estuary of Guadalquivir river	A6 0051/VIII.6.51 Lay out of a polder in Estuary of Guadalquivir river	B1 6 001/B.1.6.41 Excavator	B1 6 002/B.1.6.42 Lifting device