

## POLAND



Source: esri

### General

Poland - officially the Republic of Poland - is located in Central Europe and is bordered by the Baltic Sea, Russian Kaliningrad Oblast and Lithuania in the North, Belarus and Ukraine in the East, Slovakia and Czech Republic in the South and Germany in the West. The country has an area of 31.3 Mha (million hectares) with, in 2022, a population of 39.9 million, or 1.27 persons per ha (Wikipedia and United Nations, 2022).

### Climate and geography

The climate of Poland is temperate transitional and varies from oceanic in the North-west to continental in the South-east. Poland is characterised by warm summers, with a mean temperature of around 20 °C in July, and moderately cold winters averaging -1 °C in December. The warmest and sunniest part of Poland is Lower Silesia in the southwest and the coldest region is the northeast corner, around Suwałki in Podlaskie Province, where the climate is affected by cold fronts from Scandinavia and Siberia. Precipitation is more frequent during the summer months, with highest rainfall recorded from June to September. There is a considerable fluctuation in day-to-day weather and the arrival of a particular season can differ each year (source: Wikipedia).

Poland's territory extends across several geographical regions. In the North-west is the Baltic seacoast, which extends from the Bay of Pomerania to the Gulf of Gdańsk. This coast is marked by several spits, coastal lakes (former bays that have been cut off from the sea), and dunes. The largely straight coastline is indented by the Szczecin Lagoon, the Bay of Puck, and the Wisła Lagoon. The centre and parts of the north of the country lie within the North European Plain. Rising above these lowlands is a geographical region comprising four hilly districts. South of the Northern European Plain are the regions of Lusatia, Silesia and Masovia, which are marked by broad ice-age river valleys. The longest rivers are the Wisła, the Oder, which forms part of Poland's western border, its tributary, the Warta and the Bug, a tributary of the Wisła. With almost ten thousand closed bodies of water covering more than 1 ha each, Poland has one of the highest number of lakes in the world (source: Wikipedia).

In the 13<sup>th</sup> century there seem to have already been reclamations in the Mouth of the Nogat River, for example Elbing (Elblag), Paslek (1297).

Kowalik (1983) describes that the Wisła Delta has a surface level between 1.8 m-MSL (mean sea level) at Zulawy Wislane to 10 m+MSL. In addition, he mentions that all area below 2.5.m+MSL is called Low Fens and consists of polders that have been developed since the 14<sup>th</sup> century and that the total reclaimed area is 171,000 ha. Based on the surface level he distinguishes three types of areas:

- depressive part below mean sea level, 45,000 ha;
- near depressive part with a surface level from 0.0 to 2.5 m+MSL, 72,000 ha;
- higher part above 2.5 m+MSL, 53,000 ha.

Kowalik also describes that the higher part can be drained by gravity during most of the year, the other parts are being drained by pumping stations. The latter areas cover 119,070 ha that are being drained by 115 pumping stations. He refers to Cebulac (1976) who distinguishes three types of polders:

- polders drained by one pumping station;
- polders drained simultaneously by a few pumping stations;
- polders with temporal drainage of water by gravity.

Quast and Lukianas (1999) describe that beginning in 1740 under initiative of the Prussian king, Friedrich II, large polder areas based on the Netherlanfs land reclamation model were created on the downstream sections of the Oder, Wisła and Nemunas rivers.

Chodila (2006) describes the hydraulic works by Dutch settlers to reclaim swampy lands, especially in the Wisła Delta during three periods:

- 15<sup>th</sup> – 16<sup>th</sup> century. Mouth of the Wisła and along the Wisła: 12 settlements. 221 settlements in the swamps around Gdansk and the Wisła, the Wisła Valley, Warta, Notec, Royal Pruisen, Dobrzyn land, Kujawy, Great Poland (Poman and Cakisia), Mazovia, Small Poland (Malopolska), Of these 185 predominantly by Dutch immigrants in Royal Pruisen, Pommeren (surrounding of Gdansk), swamps around the Wisła, valley of the Warta and the Notec. Examples: Torun, Landau, Schaffenburg (now Bistra), Tiegenhof (now Nowy Dwor Gdanski);
- 1660-1795. 977 settlements in Great-Poland, Pommeren (surrounding of Gdansk), Dobrzyn land, Kujawy, eastern Great-Poland, Mazovia, Small-Poland. Of these 80 by (mainly) Dutch immigrants). They settled in Royal Pruisen (55 settlements), Dobrzyn land (about 25), Mazovia (20), Great-Poland (1);
- 1795-1864 300 settlements in Pommeren (surrounding of. Gdainsk), Kujawy, Great-Poland, western Samll-Poland, Mazovia, Podlasie, region Lublin, Volhynia. Thereof 35 mainly of Dutch and German immigrants, predominantly in Great-Poland and Kujawy.

### Existing polders

The Group Polder Development (1982) shows a map (Figure 1) with the development of the reclamations in the Wisła Delta, as well as a map with the area below MSL and the location of the pumping stations (Figure 2). The Centre for Civil Engineering Research and Codes (CUR) and Ministry of Transport, Public Works and Water management (1993) state that the deepest area in the Wisła Delta is 2.5 m-MSL.

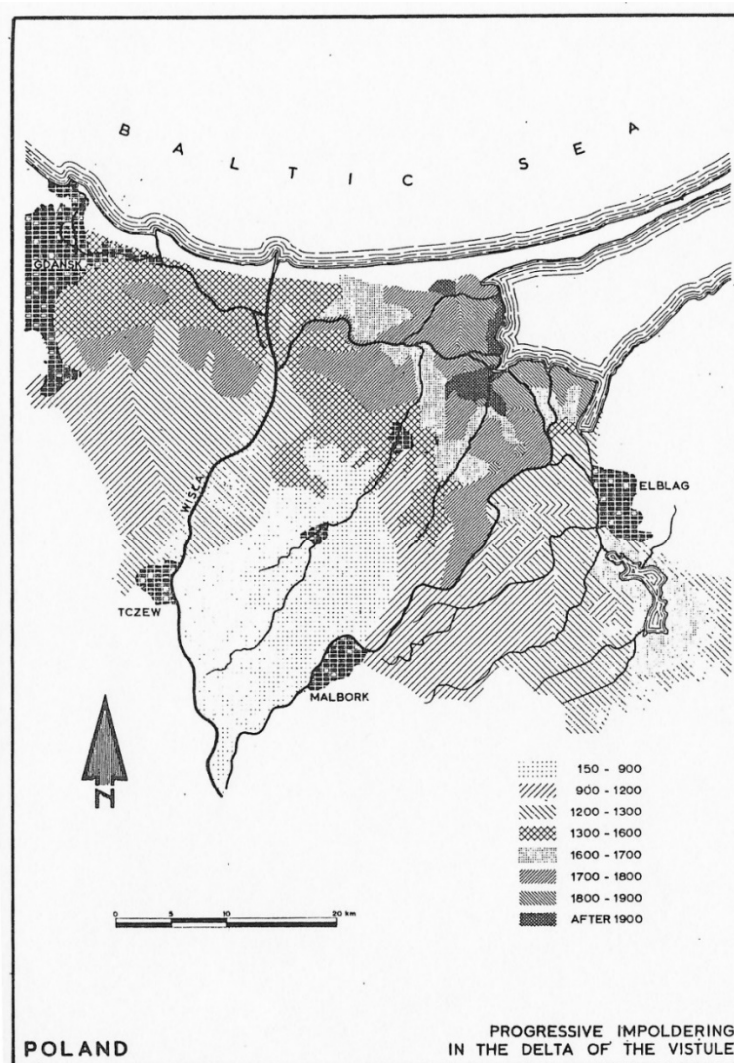


Figure 1. Progressive impoldering in the Wisła Delta (Group Polder Development, 1982)

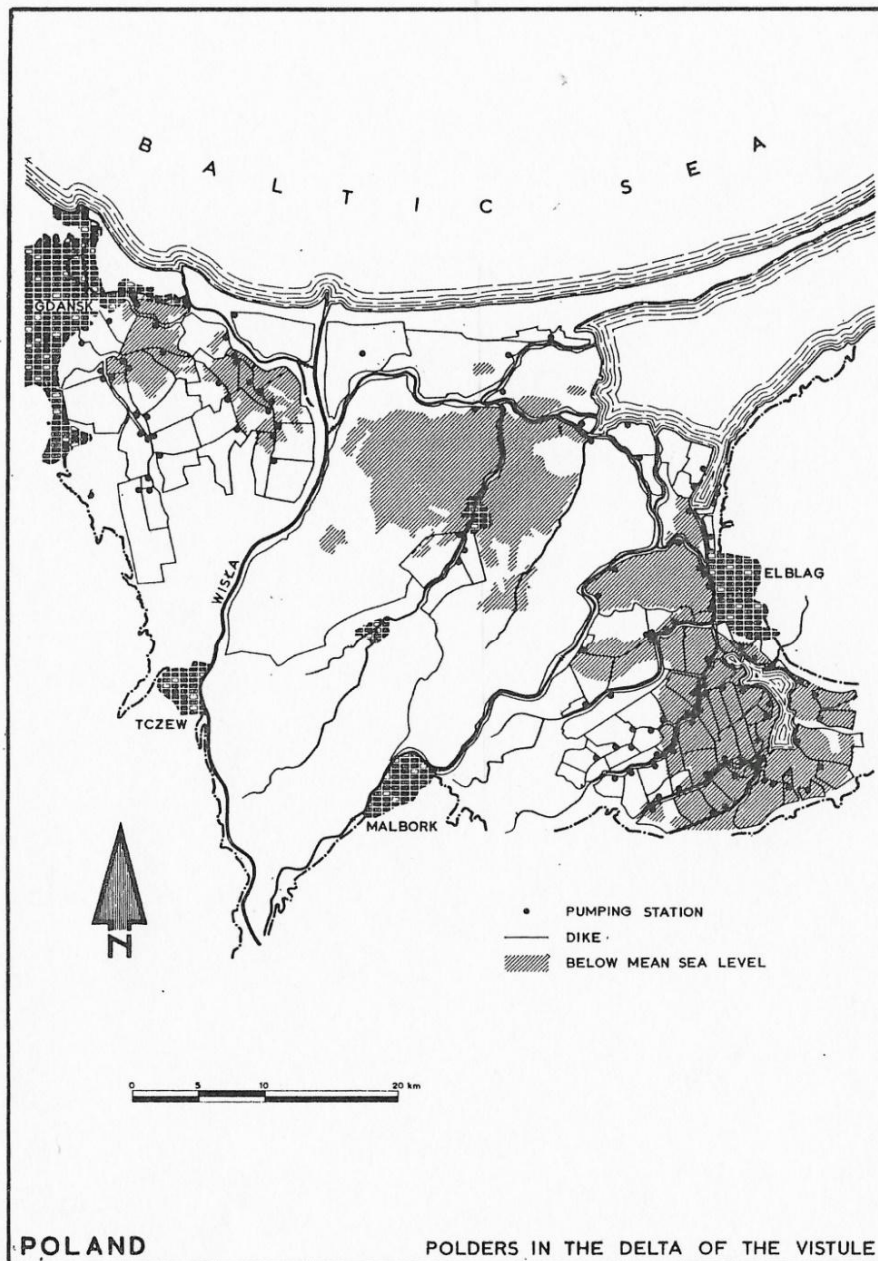


Figure 2. Areas below mean sea level and pumping stations in the Wisła Delta (Group Polder Development (1982))

Laks and Wolczak (2020) describe that the Golina Polder was constructed as part of a project to build the widely spread, natural Konin-Pyzdry valley. The complete design of the valley development involved the construction of dikes, which were to divide the valley into nine polders. The main task of the designed system was to protect the areas of the lower section of the Warta River, particularly the city of Poznań.

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

### Proposed polders

In response to the extreme flood in the Odra River of July 1997 the Polish government is carrying out a number of flood protection projects in southern Poland that are aimed at preventing future flooding. In the framework of this the Racibórz Dry Polder is to be constructed on the Odra River just upstream from the ancient town of Racibórz, on the border between Poland and Czech Republic. The polder will have a total area of 2600 ha.

## Location of the polders in Poland as shown on the World polder map

The location of the polders in Poland is shown in Figure 1.

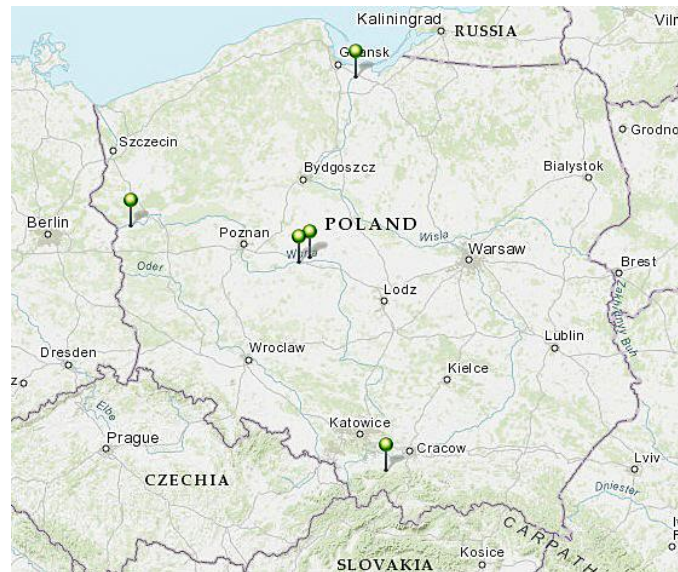


Figure 1. Location of the polders in Poland (source: esri – Batavialand)

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Table I. General characteristics of the polders in Poland

Name	Reclamation	Area in ha	Type *)	Latitudes	Longitudes	Elevation in m+MSL	Land use
<i>Existing polders</i>							
Wisła Delta	Since 14 <sup>th</sup> century	171,000	RLL	54° 10' N	19° 00' E	0	Agriculture
Oderbruch	18 <sup>th</sup> century	15,640	RLL	52° 34' N	14° 43' E	10	Agriculture
Golina Polder		3,055	RLL	52° 13' N	18° 05' E	80	Agriculture
Jamnik Polder		270	RLL	51° 28' N	16° 53' E	88	Agriculture
Warta Delta							
Polder VI Zagorow		1,180	RLL	52° 11' N	17° 56' E	73	Agriculture
Total		191,145					
<i>Proposed polder</i>							
Racibórz Dry Polder		2,600					
Total							

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