

Geographical Eye River Floods

Programme topics **1** The Floods of 1995 **2** Reducing the Risks

I N F O R M A T I O N S H E E T

Summary of programmes

In February 1995 large areas of the Low Countries were deluged with water, and floods threatened many major towns. The Rhine and its tributaries burst their banks in France, Belgium, the Netherlands and Germany.

These two programmes tell the story of how the floods happened, using the dramatic footage of the time. They explore whether human activity along the river aggravated the problem and look at attempts to minimise the hazards from flooding – past, present and future.

The Rhine river basin

1 The River Rhine is the major waterway of the European continent.

2 It rises in the Alps, flows north and west for 1,320 kilometres (820 miles) and drains an area of 220,000 sq. km before flowing into the North Sea.

3 On its way it passes through Switzerland, Germany, France and the Netherlands (where it is called the River Waal). In the Netherlands the river is in its lower course and it flows into many distributaries.

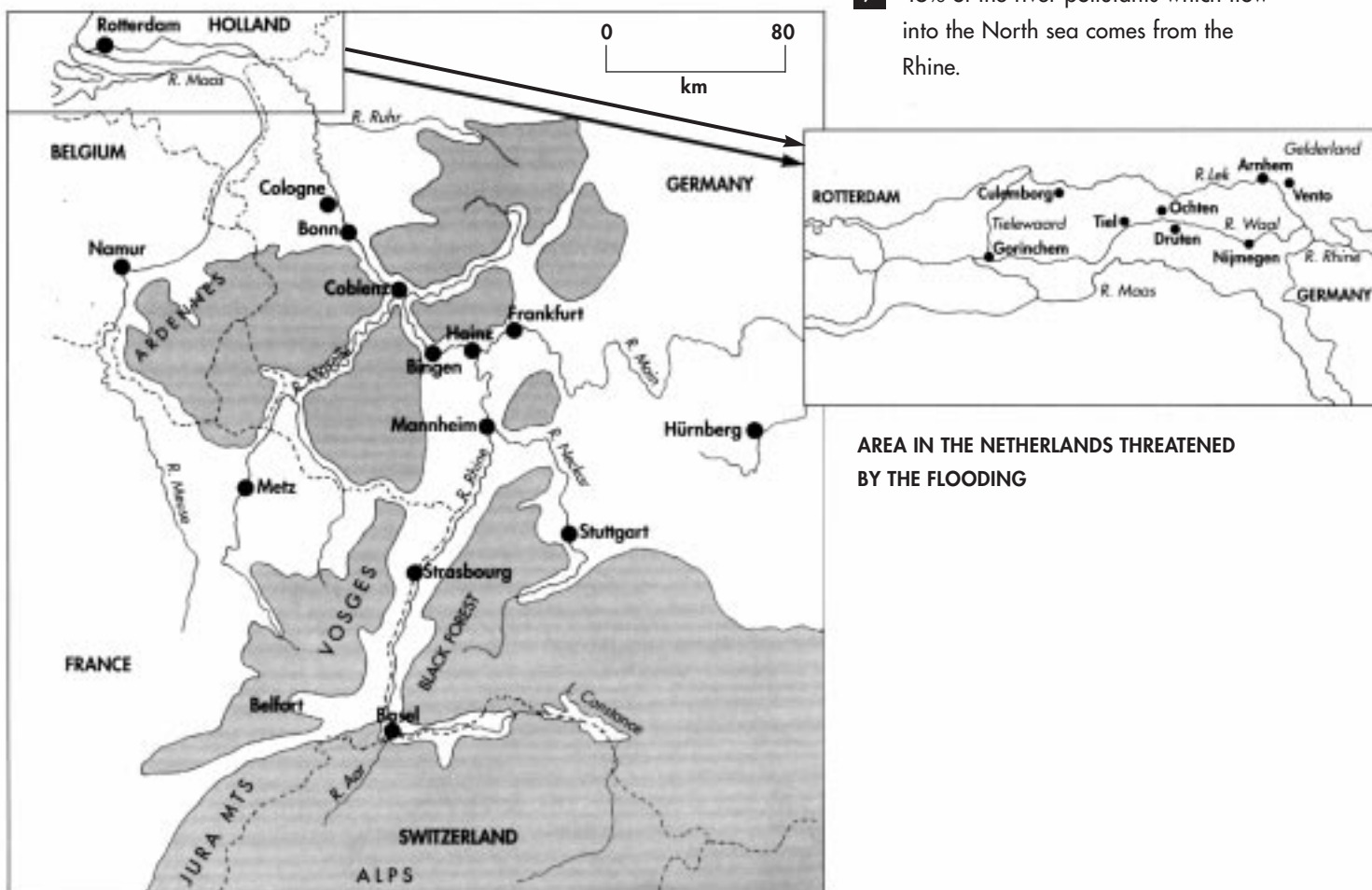
4 Its tributaries include the rivers – Meuse (Maas), Main, Moselle (Mosel) and Ruhr.

5 40,000,000 people live either along the Rhine or in its drainage basin.

6 The River Rhine passes through some of the most important industrial areas in the world.

7 45% of the river pollutants which flow into the North sea comes from the Rhine.

THE RHINE RIVER BASIN



AREA IN THE NETHERLANDS THREATENED BY THE FLOODING

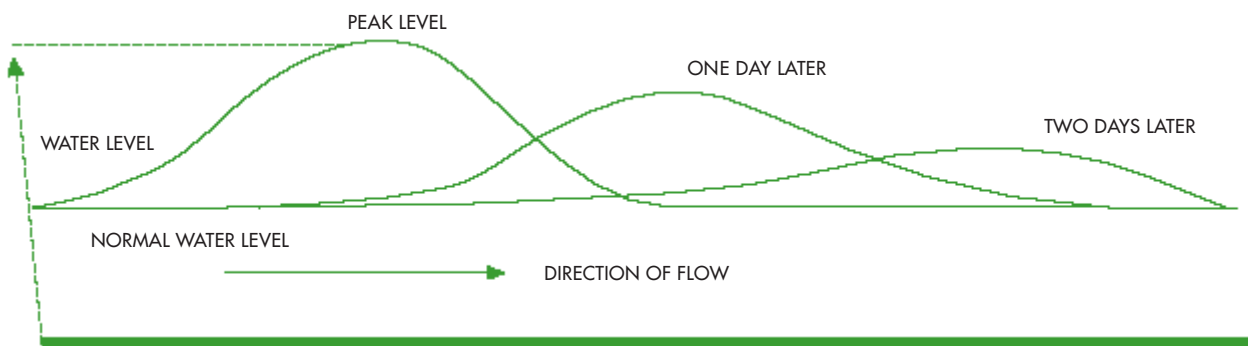
Facts about the floods in the Netherlands: the background

- 1 Holland is a country where 75% of the land is below sea level and, as a result, 15,000,000 people live below sea level. The dykes are the only protection the Dutch have against flooding.
- 2 In February 1995, the Rhine and its tributaries (the Meuse and the Mosel), burst their banks in France Belgium, the Netherlands and Germany. Large areas of the Low Countries (Belgium, Luxembourg, the Netherlands) were flooded and many major towns were threatened.
- 3 The Dutch have defended themselves against the sea for centuries by an elaborate network of dykes 2,500 km (1,500 miles) long but, this time the floodwaters came from the rivers, from water flowing as a result of heavy rainfall in the Ardennes and a flood of melted snow in the Alps. For two years running, levels of flooding have occurred that, statistically, would normally happen only once a century.
- 4 The flood waters swamped farmland, much of it in the polder regions, where the land had been reclaimed from estuaries and river basins.
- 5 A full-scale catastrophe in the Netherlands was avoided, thanks partly to the action to shore up threatened dykes and well-organised evacuation procedures. If the protecting dykes had collapsed the land would be submerged under 20 feet of water.
- 6 While the dykes are all sufficiently high, the danger comes from water undermining their stability from underneath. Dykes are made of sand and clay and act like a sponge, absorbing water. The longer the exposure the greater the risk of collapse.

Facts about the floods in the Netherlands: the timescale

- 1 On 31 January 1995, at Lobith, where the Rhine enters the Netherlands from Germany, the level had risen to 13.48 metres above sea level.

The diagram below shows how the water levels changed during the period of the floods.



- 2 In the Netherlands, at least 4 people were killed, some 250,000 had to be evacuated and large tracts of cities were submerged between 30 January and 1 February 1995 – mostly from the Limburg region south of Nijmegen and from Zeeland, around Rotterdam, Europe's largest port.
- 3 On 2 February 1995 there were signs that the dykes around the River Waal were crumbling. The Waal, one of the two Dutch arms of the Rhine, was several miles wide and looked more like the Amazon or the Mississippi than a continental European river. The potential for greatest damage to the environment and property was south of the Waal, to the east of Nijmegen.
- 4 Germany, France, Belgium and the Netherlands suffered heavy economic costs in terms of damaged property and lost output.

Causes of the floods: natural causes

- 1 Floods are part of the natural water cycle and flooding is, for the most part, steered by natural processes.
- 2 In a flood, the volume of water in the catchment cannot be contained in the river channel and spills out over surrounding land.
- 3 The immediate cause of the most recent floods, was abnormally high rainfall combined with unusually mild temperatures, which melted mountain snows, to produce a massive torrent of water.
- 4 Over the past century, average temperatures in southern Germany have increased by between 1°C – 1½°C. Rainfall in the Rhine catchment area has risen steadily this century and winter precipitation has increased by 40%.
- 5 The catastrophic flooding might be an early sign of a change in the climate caused by global warming. The growing concentration of 'greenhouse gases' could lead to even milder winters in N.W. Europe and hotter, drier summers.

Causes of the floods: human causes

Uncontrollable climatic factors are not the only reasons for the increasingly frequent occurrence of flooding and a number of human-made factors have made the problem worse.

Apart from the river bed, there are four important factors which improve the water storage effect of a river's catchment area and help to control flooding levels:

- **Vegetation** – trees and plants store large quantities of water and also 'catch' precipitation before it reaches the ground.
- **Soil** – stores water very effectively and can store up to one hundred times the quantity of water as vegetation. It behaves like a sponge.
- **Ground** – Steep land does not retain much water. There is little surface retention in mountainous areas but vegetation on steep land helps to retain water. By contrast, more water is stored in flat areas.
- **Drainage Networks** – small streams, rivers and their water meadows fill up and flood when water levels rise, acting as water storage areas.

When water storage in vegetation, soil, ground and drainage networks is overloaded the drainage situation changes dramatically.

- 1 The Rhine, for several decades, has been put into a kind of straitjacket. In the past, excess water would flow out over marshes and floodplains. These acted like sponges, soaking up the water, but since then some of the land has been dried out, cemented and asphalted for buildings and roads.
- 2 The embankments have been strengthened and raised to protect residential and industrial areas, but raising them has closed off former flood meadows. Steep concrete flood walls along the upstream river banks channel flood water quickly from the upper reaches of the river but this has shifted the flooding problems down stream. (Politicians came under pressure to make riverside land available for local businesses or housing).
- 3 The river Rhine is a major shipping highway. To enable larger barges to use it and to speed up the journey time it has been strengthened, deepened and canalised.
- 4 When a storm takes place the flow of water (or discharge) does not increase straight away. There is a gap, called a 'Time Lag' between the high rainfall and the peak discharge. A river with a short time lag and high discharge increases the danger of flooding.

- 5 Stretches of the Rhine have been straightened and banks heightened, cutting some 50 kilometres off the river's 1,320 kilometre meander to the sea. This has doubled the speed of the water's flow from Basle, at the Swiss border, to Rotterdam.

Now, when there is heavy snow or rain upstream, water cascades down to flood at the mouth or half-way along, instead of soaking into marshes near its source.

- 6 Building Hydro-electric power stations along much of the upper Rhine has increased the problem. Since the 1950's, the upper Rhine, along the Franco-German border, has been changed with the construction of 10 hydro-electric power stations.

The 'Power Project' involved building a 'new' river parallel to the old Rhine and the construction of these H.E.P. stations created a deeper, faster Rhine.

- 7 Changes in farming practices have made fields less absorbent, as hedges and forests have been chopped down to create prairies farms. The drainage of swampy areas, and pumping out the ground water for irrigation purposes have dried out the land even further. The extensive network of cemented farm roads act as extra drainage channels.

- 8 Environmental damage as a result of development along the river has created problems in areas along way from the region in which it occurs. For example, spills from chemical factories; tree felling in the Alps (in Germany the forested areas have increased only marginally); construction of high concrete banks all produce harmful effects for people living at the mouth of the river.

All these human-created problems have made the river systems less able to accommodate flood waters than they used to be.

Prevention of floods

It seems clear that instant easy solutions will not have any effect and only drastic remedies can make any real difference. But what are the remedies?

- 1 The capacity of the land surrounding the River Rhine and its tributaries to absorb flood water has been reduced and a priority will be to restore to the landscape its natural retention functions. As much water as possible must be held on the surface (this also has the added advantage of raising ground water levels too):

- An increase in 'water meadows' must be encouraged which can be allowed to flood when necessary.
- The sealing of the soil surface with tarmac or concrete in vulnerable areas should be limited to slow the water run off into the rivers.

- Ground coverage of vegetation with woodlands and grasslands should be increased.
- The use of fertilisers on soil should be very carefully monitored because fertilisers affect the soil structure and its ability to retain water.

2 'Natural Water Protection' methods will not on their own provide sufficient flood protection measures. 'Technical Flood Protection' measures must also be examined and action taken i.e. Dykes; Walls; Flood Retention Basins and Impounding Dams.

► **Dykes**

When dykes overflow the dyke material is eroded and entire sections break away. The protected areas behind the dykes are then flooded. Dykes are affected by natural wear and tear and all Dykes and Flood Walls must be adequately maintained.

► **Flood Retention Basins and Impounding Dams**

'Impounding Dams' are valleys filled with water which provide drinking water, produce electricity or supplement low flows. The water stored in impounding dams is drawn off from flood waters and during flood periods the water is merely moved for a time from one place to another.

'Flood Retention Basins' are only filled with water during periods of flood, after which they are emptied in order to be ready for the next flood.



- 3** It has been suggested that higher embankments should be built and the river deepened **but**, where this has been done, (e.g. the Mississippi) it has produced rivers flowing many metres above the surrounding floodplain. As the levee is built up, sediment in the river grows too; the river beds – and the water levels rise. This leads to disaster when the barriers collapse.
- 4** Another, more expensive, idea is to build a relief channel to siphon off the Rhine when the delta near the sea becomes overloaded.
- 5** A frequently suggested solution is to give the rivers 'more space', restoring them to nearer their original

shape, and letting them find again their own courses and marshland areas. This solution, though, would require a great degree of co-operation among the authorities in the countries through which the Rhine and its tributaries flow.

6 There are signs that the floods may have stirred the Dutch government into action, and there is pressure on their neighbouring nations, Germany in particular, to amend their policies of canalising the rivers – policies which force more water downstream into the Netherlands at times of heavy rain and snow.

7 Other suggestions to reduce future flooding involve specific town and country planning policies. An action plan for the Rhine is needed to create larger areas to contain flood waters and limit residential development within the flood plains of the Rhine, the Meuse (Maas) and the Saar-Mosel. These include:

- plans to make it easier to trap more of the water in the river basin areas;
- planned use of agricultural land and the maintenance of 'open flood plains'; allowing feeder streams to flow naturally; establishing flow control areas;
- controlled reforestation measures;
- de-urbanising areas bordering the rivers – stopping the spread of urbanisation in the high-risk areas bordering the rivers Rhine and Meuse;
- controlling the location of new buildings and the construction methods used, so that buildings are able to cope with floods when they occur.
- monitoring the construction of outdoor leisure facilities which might reduce the water retention efficiency of land in vulnerable areas.
- strictly controlled policies in transport, energy and environmental protection.

8 Co-ordinated water management policies across national borders is necessary if winter floods are to be avoided in the future, e.g. buffer zones, dykes, water flow regulation.

The job of developing these flood control measures will cost hundreds of millions of pounds. However, if they are adopted, not only will the dangers of flooding be reduced but they will also help to protect the environment in areas along the banks of the affected rivers.

It must not be forgotten though that flooding is, for the most part, controlled by nature and humankind can influence the impact of flooding to a limited degree only.