

Why is flooding a problem?

What is this unit about?

This unit is about the causes and effects of river flooding. It shows how flooding can affect people in different ways and suggests how the risk of future flooding may be reduced.

In this unit you will learn about:

- ◆ the water cycle
- ◆ what happens to rain when it reaches the ground
- ◆ the causes of flooding and how individuals and communities respond to the problem
- ◆ how the effects of flooding in Britain are different from those in Bangladesh
- ◆ how the risk of flooding can be reduced.



A

Bangladesh



B

Bangladesh



C

Carlisle

D

Carlisle

Why is this flooding topic important?

Flooding is an increasing problem across the world. More than 7 million people in the UK are now at risk from flooding every year. Even if flooding has not affected you yet, it could easily do so some time in the future. For these reasons, we need to understand the causes and effects of flooding so that we can try to manage the problems they create.

This unit can also help you to:

- ◆ be aware of the effects of flooding
- ◆ find out if flooding is a problem where you live
- ◆ prepare for a flooding situation
- ◆ know what to do during and after a flood
- ◆ be able to help other people affected by flooding.

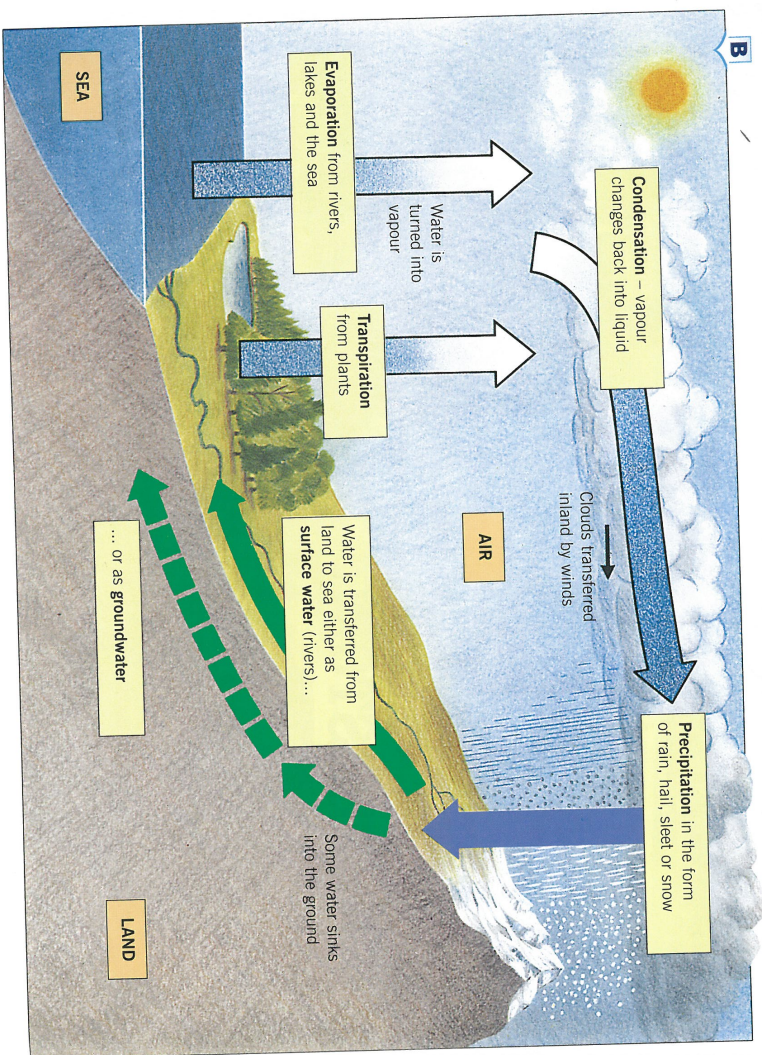
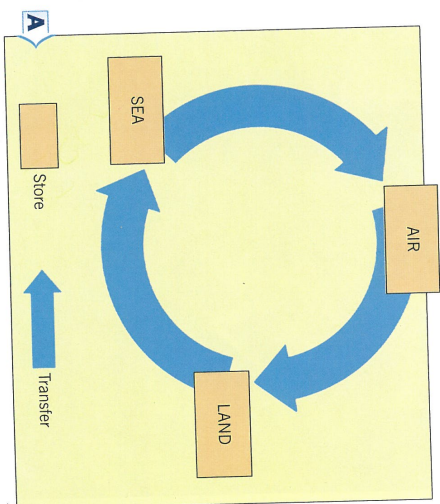
- ◆ Look at the people in the photos.
 - What problems do they face?
 - What help do they need?
 - Who needs the most help?
 - How could they prepare for the situation?
 - What could you do to help them?



How does the water cycle work?

Rainy days are annoying and a nuisance to most of us. Yet rain is very important to our world as it is part of a never-ending cycle in which water is used over and over again. This cycle is called the **water cycle**. The amount of water in the cycle always stays the same. Some of the water may be **stored** in the sea, in the air or on land. Later, some of this water will be moved or **transferred** around the cycle. The main **stores** and **transfers** in the cycle are shown in diagram A.

The water cycle can be very complicated but its main features are shown in diagram B. Notice that the water can be moved in different forms – as vapour, rain, snow or hail. Some of the geographical terms used on this diagram are long and will be new to you. Chart C on the next page explains what these words mean.



Evaporation		The transfer and change of water from the ground into water vapour in the air. Water vapour is an invisible gas.
Transpiration		The transfer and change of water from plants into water vapour in the air.
Condensation		Water vapour in the air changes back into a liquid. It forms small droplets which are visible as cloud.
Precipitation		The transfer of water from the air to the land. Water can fall to earth as rain, hail, sleet or snow.
Surface water		The transfer of water back to the sea over the ground surface. It is called surface run-off. It is easiest to see where it forms rivers.
Groundwater		The transfer of water through the ground back to the sea.

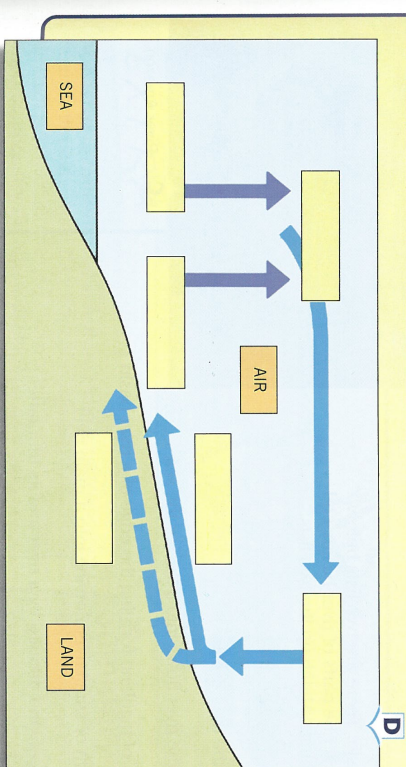
Activities

1 Diagram D shows part of the water cycle. Draw the diagram and complete the boxes. Choose your answers from the following:

- condensation
- evaporation
- groundwater
- precipitation
- surface water
- transpiration

2 What would happen to surface water (the river) if there was:

- an increase in rainfall
- a decrease in rainfall
- a lot of snow which did not melt
- a lot of snow which melted very quickly?



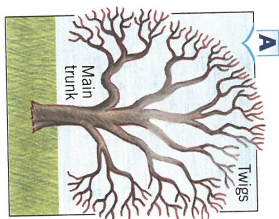
Summary

Water can be stored in the sea, in the air and on land. The water cycle is the never-ending transfer of this water between the sea, the air and the land.

What is a river basin?

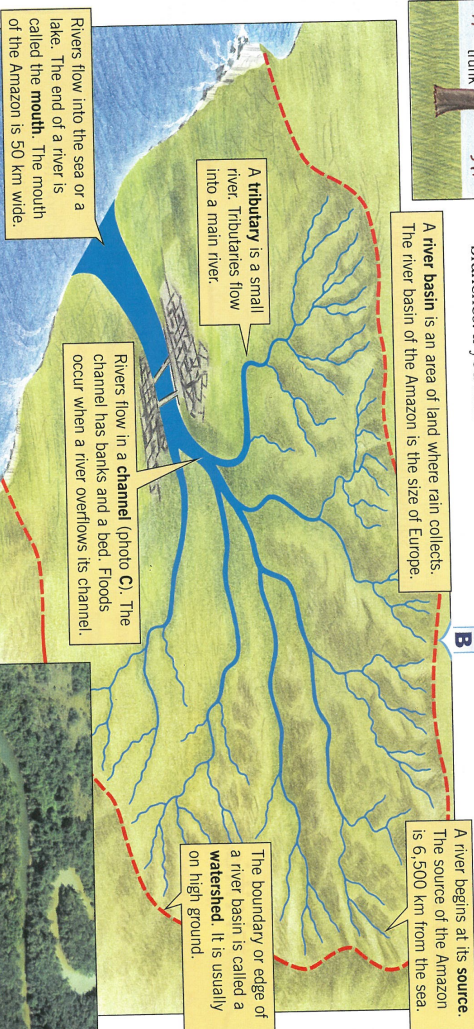
Most water that falls on land as rain eventually finds its way into a river. This is an important part of the **water cycle** which was explained on pages 42 and 43. Rain is a type of **transfer** whilst the river is a **store**. Although rivers differ in many ways, they all have similar features. Some of these are shown in B below.

If you look at the top of a large tree you will see lots of twigs. Twigs are small branches. If you follow these downwards,



you will see these twigs joining to form branches. These branches in turn join to form one big trunk.

A **river** is like a tree. It has lots of small streams which join to form **tributaries** which later join to form the main river. When it rains, most of the water slowly drains into streams, then into tributaries and finally into the main river. A **river basin** is the area of land drained by a main river and its tributaries.



C River Amazon

Activities

Diagram B shows a river basin. There are two lists below. One gives words used to describe parts of river basins and the second gives their meanings. Match up the two lists.

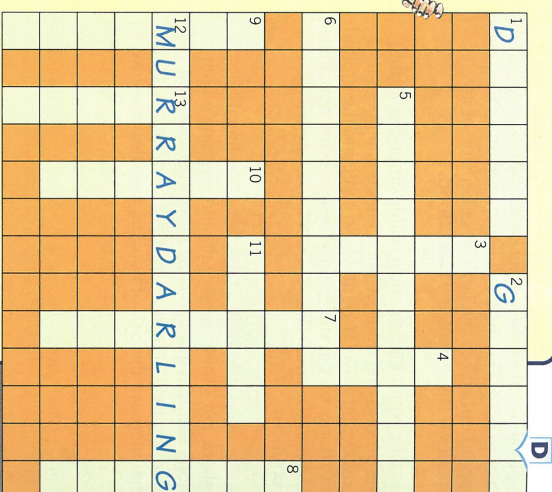
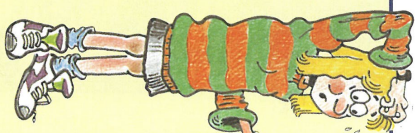
- A watershed is where a river begins
- The source is where the river flows
- A river basin is where the river flows into a lake or the sea
- A tributary is an area of highland forming the edge of a river basin
- A channel is a stream or small river flowing into a main river
- The mouth is an area of land drained by a river and its tributaries

Where are the world's most important rivers?

Activities

Thirteen important world rivers are, in alphabetical order, the Amazon, Colorado, Danube, Ganges, Murray-Darling, Mississippi, Nile, Rhine, St Lawrence, Volga, Yangtze, Zambezi and Zaire (or Congo).

- Fit the names of these rivers into crossword D on the right. The number of letters in each word will help you to fit them into the puzzle. For example, the Murray-Darling, which has been done for you, was the only word with 13 letters. It could only fit into that one place.
- With help from map E below, sort the rivers into groups under the headings: *Africa, America, Asia, Australia and Europe*.
- The three longest rivers in the United Kingdom are the Severn, the Thames and the Trent. Name **one** city on each of these rivers. The map on the back cover will help you.



EXTRA

Match the 13 rivers named in activity 1 above with a country through which they flow. Some flow through several countries, so choose **one** important country. An atlas will help you with this.

Summary

Rain collects in rivers in a river basin. Rivers have their source in highland areas and flow in a channel to the sea or to a lake.

What causes a river to flood?

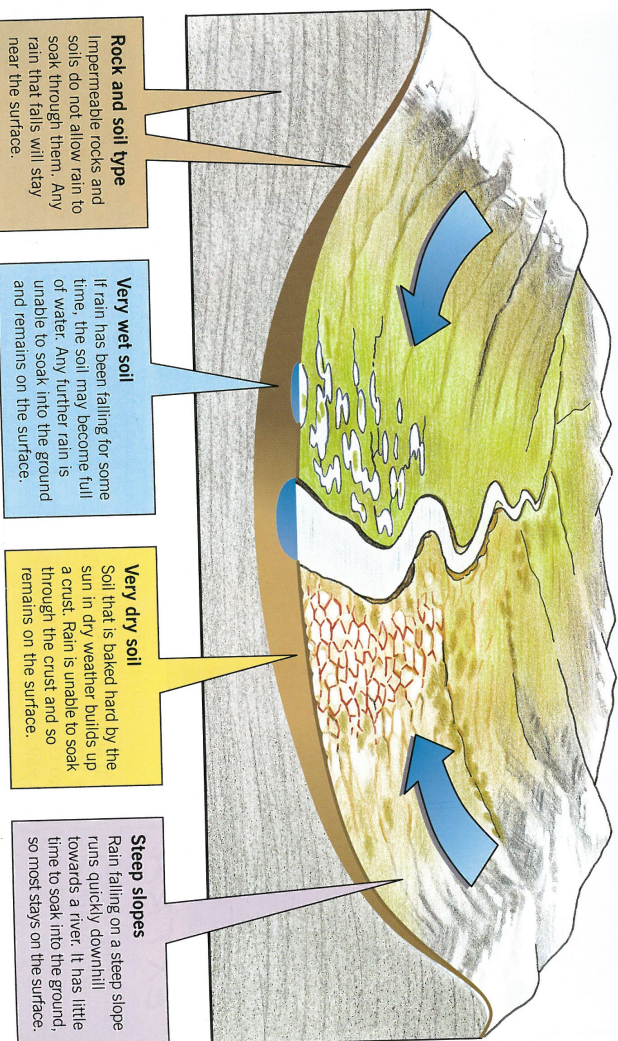
All of the water that flows down a river comes from rain or melting snow. Sometimes after heavy rain or a rapid snow melt, there may be too much water for the river to hold. The river will then overflow its banks and spread out across the land on either side of its channel. This is called a **river flood**.

Usually when it rains, most water simply soaks into the ground and there is little chance of a flood. If, however, the water is unable to soak into the ground, it will stay on the surface and flow quickly downhill and into the river. This is when floods are most common.

Some rivers are more at risk from flooding than others. Put simply, heavy rain and anything which stops that rain from soaking into the ground will increase the chances of flooding. Some of the factors that increase the risk of flooding are shown below.



The rapid melting of snow can cause flooding



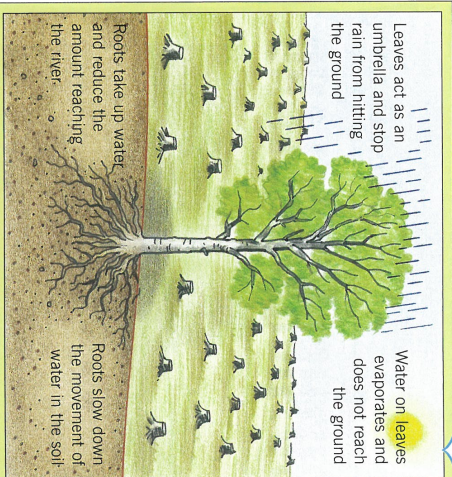
Rock and soil type
Impermeable rocks and soils do not allow rain to soak through them. Any rain that falls will stay near the surface.

Very wet soil
If rain has been falling for some time, the soil may become full of water. Any further rain is unable to soak into the ground and remains on the surface.

Very dry soil
Soil that is baked hard by the sun in dry weather builds up a crust. Rain is unable to soak through the crust and so remains on the surface.

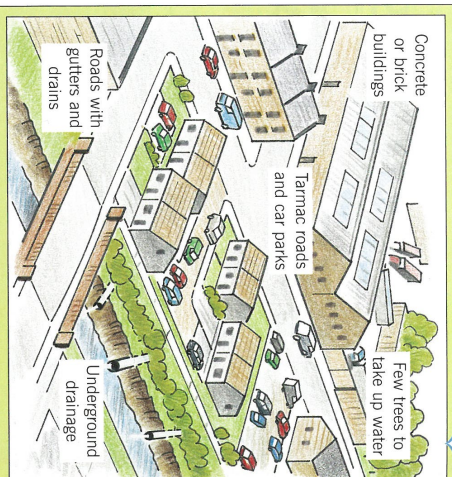
Steep slopes
Rain falling on a steep slope runs quickly downhill towards a river. It has little time to soak into the ground, so most stays on the surface.

Floods are more common now than they used to be. There are more of them and they are increasing in size. Many people are blaming human activity for this.



Cutting down trees (deforestation)

Many of the world's forests are being cleared to make way for other developments. In some countries the number of serious floods has more than doubled since large-scale tree clearing began.



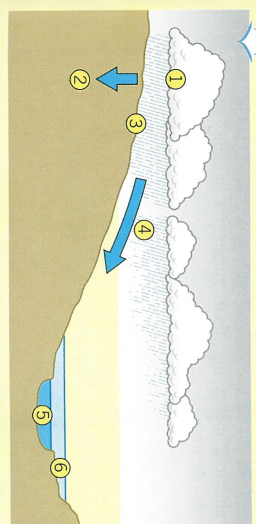
Buildings and roads (urbanisation)

Rain falling on concrete and tarmac is unable to soak into the ground, so stays on the surface. Gutters and drains then carry the water quickly and directly to the river. Large towns are most at risk.

Activities

1 a Make a larger copy of drawing E.

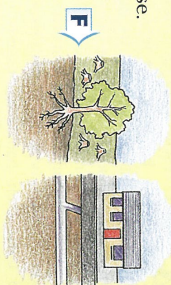
- b Add the following labels to your drawing to show how a river floods:
- River level rises
 - Water quickly reaches river
 - River floods
 - Water runs over surface
 - Heavy rain falls
 - Rain soaks into ground



2 Describe four factors that increase the risk of flooding.

3 With the help of diagram F, describe how:

- a cutting down trees, and
b building towns
can make floods worse.



Summary

River flooding is most likely after heavy rain or rapid snow melt. The flood risk is greatest when water is unable to soak into the ground. Human activities can increase the chance of flooding.

Floods in the UK, 2000

Evening COURIER

Sussex
Friday, 13 October 2000

FLOOD HAVOC HITS SOUTHERN ENGLAND



A massive rescue operation was underway last night as tens of thousands of homes were hit by the UK's worst floods for 30 years.

More than a month's rain fell in 24 hours as torrential downpours and storms caused six of this region's rivers to burst their banks. Thousands of homes, shops and offices filled with water up to 2 metres deep. Most of the main roads in the region were blocked and all rail services cancelled.

Emergency services, including lifeboats, coastguard helicopters, the

fire service and police were scrambled to rescue hundreds of people trapped in buildings and on rooftops.

Worst hit was Lickfield which was completely submerged and cut off after a wall of water, almost 2 metres in height, crashed through the town centre. Cars were swept away and the soggy contents of shops floated into the streets. Thousands of homes in the area suffered severe damage. Many people have lost all of their belongings. The council have set up refuge centres at a local school and leisure centre.

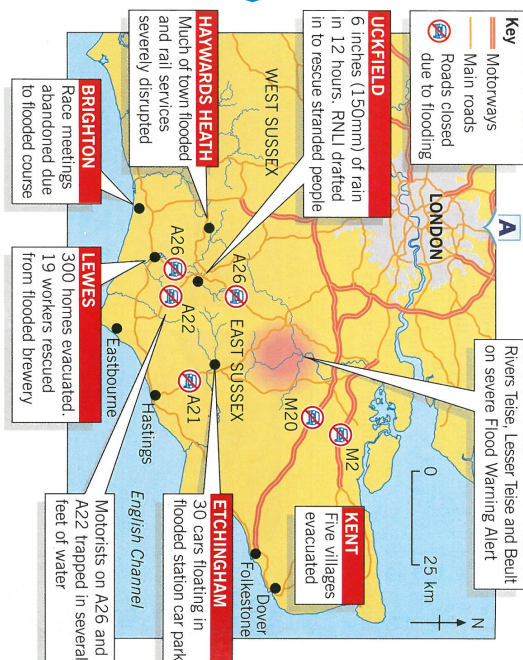
As the flood water subsides, people returning home are finding everything covered in a thick layer of foul-smelling mud. The clean-up operation will take weeks. Many people will not be back in their homes for months and some businesses may never re-open.

Insurance experts are putting the cost at over £500 million but there are fears that many people will not be insured. The government has promised help to areas most in need.

The south of England has had many floods recently. Most have been caused by very heavy rain. Floods like these are called **flash floods** because they happen very suddenly and last for just a short time. Flash floods can be dangerous as they come without warning and give people little time to escape.

A serious flood rarely has one single cause, though. In the south of England much of the land is low-lying and many new developments have been built on the floodplain. Some river embankments collapsed, and reservoirs that had reached the point of overflowing added to the problem.

- The October 2000 flood**
- 1 Heavy rain had been falling in the area for more than a week.
 - 2 The ground became full of water and could take no more.
 - 3 Almost two months of rain fell on the area in less than 24 hours.
 - 4 Rivers burst their banks and water flooded surrounding areas.
 - 5 Recent building in floodplain areas made the problem worse.



Activities

- 1 Imagine that you are a reporter for the *Evening Courier* and have been asked to write a report on the flood disaster for the weekend paper. Make notes for your report using the headings below.

Flood disaster report

- a When did it happen?
- b Which places were worst affected?
- c What were the main effects of the flood?
- d How were car owners and rail travellers affected?
- e What help was available to flood victims?
- f What problems will there be once the flood waters have gone down?

- 2 Make a larger copy of diagram C and add six causes of the October 2000 flood.



Summary

Floods can cause much damage and seriously affect people's lives. There are usually several different causes of floods but some places are more at risk from flooding than others.

How does the UK cope with floods?

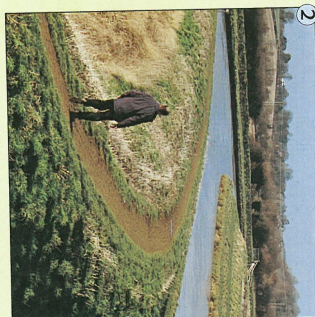
Flooding is a serious problem in the UK and it is happening more often. There are 2.3 million properties at risk and this number is expected to increase to over 5 million in the next 50 years. Autumn 2000 was the wettest since records began in 1766. Major flooding affected large parts of the country, and in some cases water levels were at their highest for over 100 years. Whilst flooding cannot be prevented, in rich countries like Britain much can be done to reduce the risk of floods and limit their worst effects.

The **Environment Agency** is an organisation that looks after rivers in England and Wales. It monitors rainfall, river levels and sea conditions 24 hours a day. This information is used to predict the possibility of flooding. If flooding is forecast, the Environment Agency's **Floodline** issues warnings. It also gives advice on what to do before, during and after a flood.

A Planning for flooding in the UK



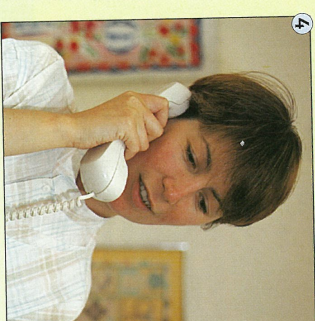
1 Study the UK's rivers and coasts and identify areas most at risk and where flooding would do most damage.



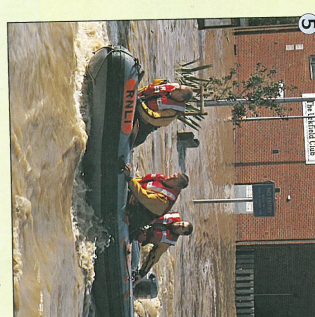
2 Recommend the building of flood defences such as embankments and overflow channels where they are needed.



3 Continually check rainfall and water levels to see if a river is going to flood.



4 Issue warnings through radio, TV and home visits for those in most danger, when floods are expected.



5 Alert emergency services such as the police, fire brigade and army, to provide help for those in need.



6 Ensure that food and shelter is available for those made homeless. Emergency medical care should also be available.

"Flooding – you can't prevent it, but you can prepare for it."



ENVIRONMENT
AGENCY

Flood warning codes



Flood Watch means flooding is possible. Be aware! Be prepared! Watch out!



Flood Warning means flooding of homes, businesses and main roads is expected. Act now!



Severe Flood Warning means serious flooding is expected. There is imminent danger to life and property. Act now!



All Clear means there are no longer flood watches or flood warnings in force. Seek advice to return.



What to do in a flood

Before a flood

Be alert for flood warnings and take action. Check on family and nearby neighbours. Move people, pets and valuables to safety. Collect warm clothes, food and a torch. Block doorways with sandbags. Switch-off electricity and gas.

During a flood

Listen to the local radio for flood news. Never walk, drive or swim through flood water. Avoid flood water as it may be contaminated.

After a flood

Check if it is safe to turn electricity and gas on. Open windows and doors for ventilation. Throw out contaminated food. Wash taps and run them before use. Clear up by disinfecting walls and floors. Beware of rogue traders offering to help. Call your insurance company for advice.

Activities

- 1 a Describe three ways that the Environment Agency can help reduce the risk of flooding.
b Describe three ways that the Agency can help limit the worst effects of flooding.

- 2 Which flood warning would have been given for the south of England floods of October 2000 (pages 48 and 49)? Give reasons for your answer.

- 3 'Floodline' encourages people to make a family flood plan like this one. Write out the plan and add a reason for each point.

Family Flood Plan

- Know how to contact each other.
- Put together an emergency flood kit.
- Know how to turn off power supplies.
- Put emergency numbers in a safe place.
- Understand the flood warning system.
- Listen to the local radio programme.

- 4 a Find out more about Floodline by telephoning for a Flood Warning Pack or using their website.

- b Design a leaflet to give to people living in areas where there is a flood risk. Explain to them briefly what information is available and what they should do.

Floodline

Telephone: 0845 988 1188

Website: www.environment-agency.gov.uk/flood

Summary

There is no easy way to cope with floods. Rich countries like the UK can afford schemes that help reduce the damaging effects of flooding.

Floods in Bangladesh, 2004

সূরমা

**SURMA
NEWSWEEKLY**

Dhaka
28 July 2004

Floods hit Bangladesh yet again

The floods in Bangladesh are the worst since 1998. They have devastated two-thirds of the country, affecting 22 million people and making over 4 million homeless. The official death toll is 1,679 although many more are still missing. Most of the deaths were caused by drowning, lightning, poisonous snakes that slither through the water during flooding, and outbreaks of water-borne diseases.

Most of Dhaka, the country's capital city, is under water. Residents waded through the waist-deep flood waters holding their belongings over their heads. Small wooden boats and cycle rickshaws formed traffic jams whilst electrical wires dangled dangerously over some roads. The water turned blackish and foul-smelling as it mixed with raw sewage.

Reservoirs were polluted and gas outlets swamped, causing shortages of clean water and cooking fuel. The threat of disease is increasing and hospitals are already full of people suffering from dysentery and diarrhoea. Many children have developed fevers, coughs and rashes.

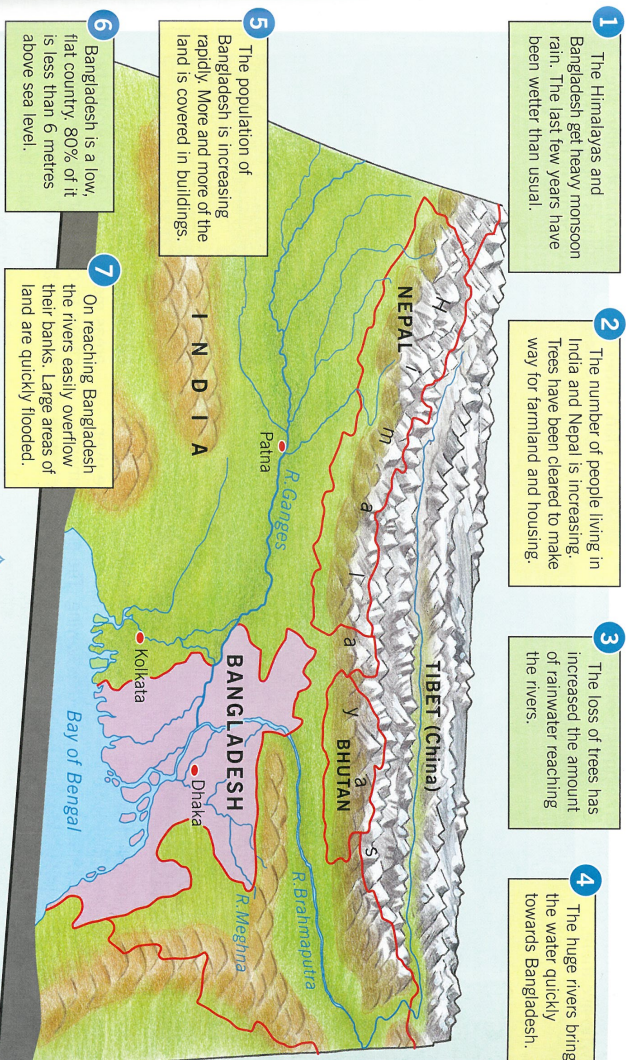
The countryside areas have also been badly hit. Many families are just recovering from the floods of six years ago. Once again they have lost their homes, lost their land and lost their cattle. Their crops have been ruined and they have no food or money. As in 1998, they desperately need help if they are to survive.



What caused the Bangladesh flood?

Bangladesh is a country in Asia. It is located at the mouth of two of the world's longest rivers, the Ganges and the Brahmaputra.

Bangladesh has floods every year – but they seem to be getting worse. The country relies on the heavy monsoon rains to flood the rice fields, but too much rain can destroy the crop as well as the homes of the farmers. In four monsoon months, Bangladesh can get as much rain as London gets in two years!



Activities

- Describe the effects of flooding in Bangladesh using the newspaper headlines shown in B.
- Flooding is due mainly to natural events. Explain how each of the following facts is a cause of floods in Bangladesh:
 - monsoon rains fall from May to September
 - many rivers flow into Bangladesh
 - Bangladesh is a very flat country.
- Explain how each of the following has made the flooding problem worse in Bangladesh:
 - human activity in India and Nepal
 - human activity in Bangladesh.

A Some causes of flooding in Bangladesh

Death toll soars as millions made homeless

Dhaka worst-hit in latest big flood

Starvation and disease as floods drown country

Families worst hit as floods wreck homes

Summary

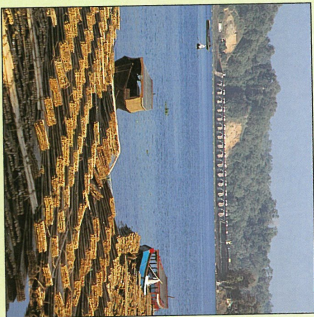
Flooding can seriously affect people's lives. Floods may result from natural events or from human activity.

How does Bangladesh cope with floods?

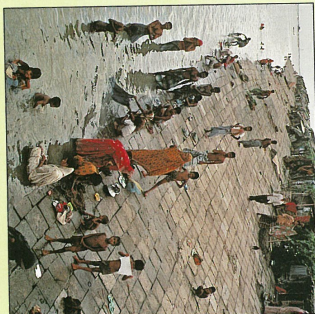
Bangladesh suffers more from flooding than any other country in the world. The problem is made worse because of the extreme poverty of the people who live there.

In 1989, after a particularly bad flood, several wealthy countries joined with Bangladesh to set up the Flood Action Plan. Under the Plan, billions of dollars are being spent on schemes which it is hoped will reduce the risk and danger of flooding. Some of the main points of the Plan are shown below.

A Flood Action Plan for Bangladesh



Build dams to control river flow and hold back the monsoon rainwater in reservoirs. Stored water can be used for irrigation and to generate cheap electricity.



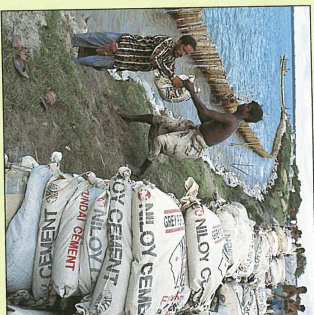
Build embankments and deepen river channels to stop the river overflowing. The embankments would be up to 7 metres high in urban areas.



Build 5,000 flood shelters in areas most at risk. These would be cheap to construct and provide a place of safety for almost everyone. They would be well stocked with food.



Improve flood warning systems. These would give early warnings of floods. They would also give instructions to people as to what they should do before, during and after the flood.



Provide emergency help when the floods arrive. Embankments would be repaired, people taken to safety and food and medical care provided to those in need.



Give after-care once the flood ends. Food, drinking water, tents, medicines and money would be available. Help would be given to plant seeds for next year's crops.

There is no easy solution to Bangladesh's flooding problem. The enormous size of the problem and the shortage of money make the task almost impossible.



Even the Flood Action Plan has not been welcomed by everyone. Many people are worried that such a large scheme could actually make the problem worse.

Activities

- 1 Copy and complete the table below to show some methods of flood control in Bangladesh. Use information on these two pages and in the Glossary.

	Description	Good points	Bad points
Dams			
Embankments			
Flood shelters			

- 2 Look carefully at the flood warning poster D.
- a What does the poster encourage people to do?
- b What are the flags and megaphone for?
- c Why does the flood warden have a radio?
- 3 Some people say that Bangladesh will never be able to cope with its flooding problem. Do you agree with this? Give reasons for your answer.

Flood warning poster D



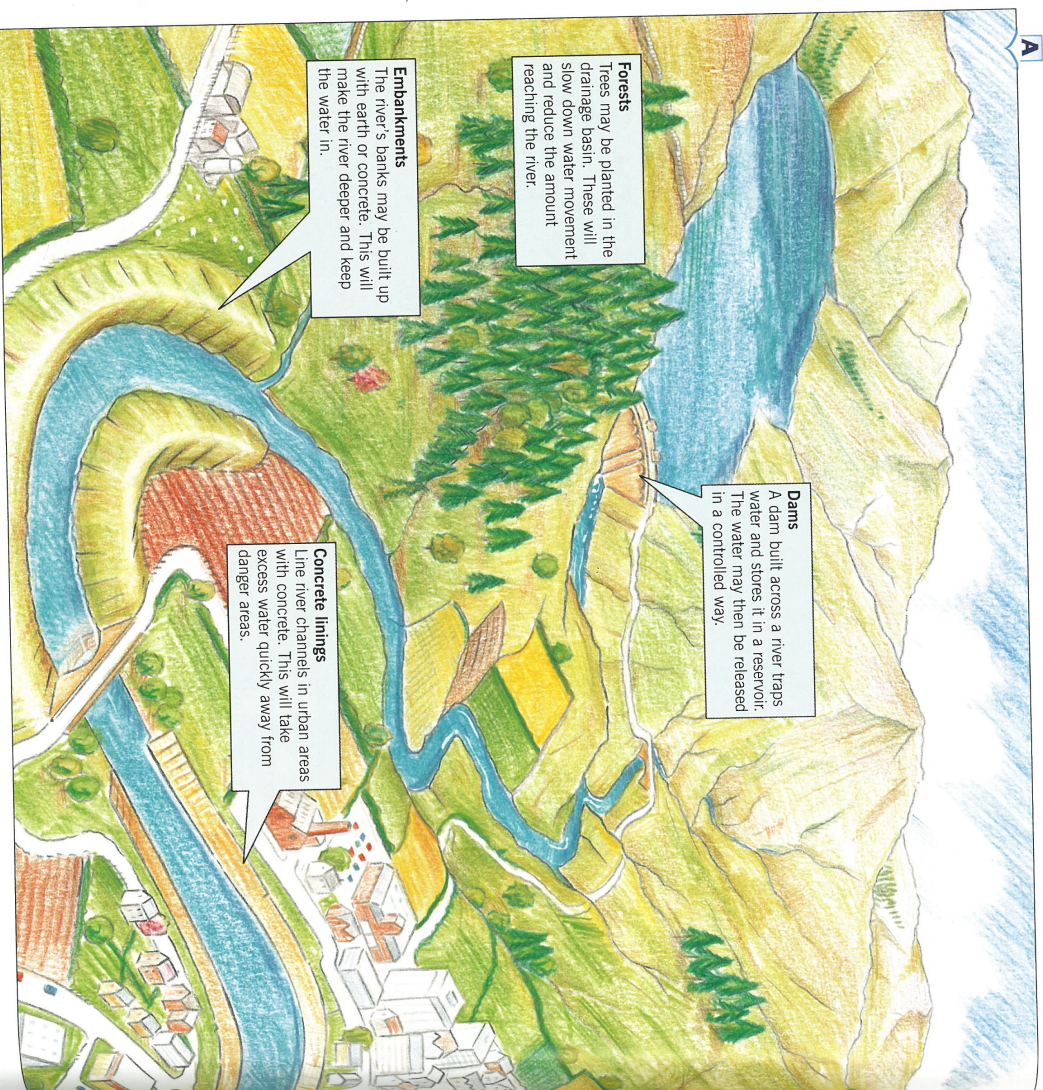
Summary

Poor countries like Bangladesh find it very difficult to cope with floods. The effects of flooding are therefore a lot worse than they would be for a rich country.

How can the risk of flooding be reduced?

There are many different ways of controlling rivers and reducing the risk of flooding. The methods shown below are called **flood prevention schemes** because they try to stop floods happening.

Many people now believe that complete river and flood control is impossible. They say that flooding should be allowed to happen as a natural event. Flood prevention schemes can, in the long term, save money. They also improve water quality and help support wildlife.



Dams
A dam built across a river traps water and stores it in a reservoir. The water may then be released in a controlled way.

Forests
Trees may be planted in the drainage basin. These will slow down water movement and reduce the amount reaching the river.

Embankments
The river's banks may be built up with earth or concrete. This will make the river deeper and keep the water in.

Concrete linings
Line river channels in urban areas with concrete. This will take excess water quickly away from danger areas.

Activities

- 1 Draw a star diagram to show eight ways of reducing the risk of flooding. Write a short sentence to describe each one.
- 2 Look at the different approaches to flood prevention. Which approach do you think:
 - a costs most
 - b costs least
 - c may drown farmland and houses
 - d uses up most land
 - e protects the natural environment?
 Give reasons for your answers.

- 3 One approach to flooding is simply to allow rivers to flood naturally. For each of the people below say if they would be **for** or **against** this method. Give reasons for your answer.



Local farmer



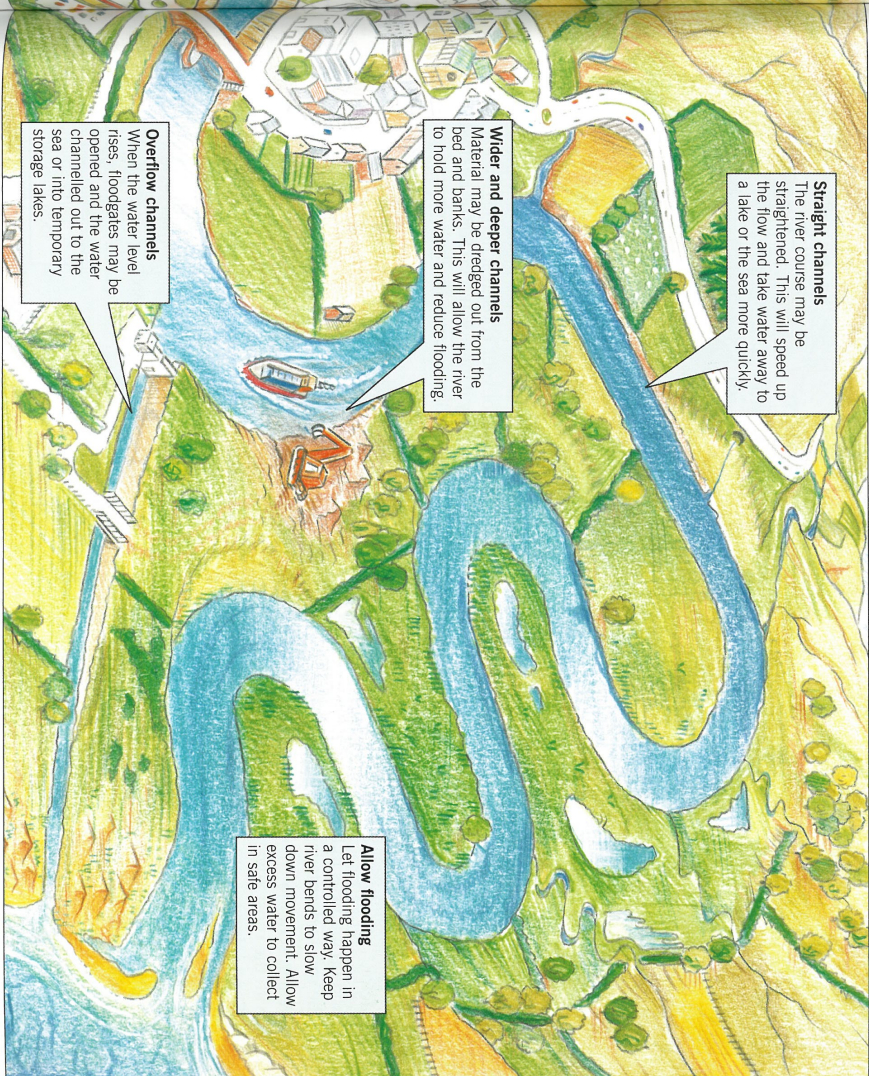
Flood protection manager



Bird watcher

Summary

A variety of methods can be used to reduce the risk of floods, but there is no way to stop flooding completely. A modern approach is to allow parts of a river to flood naturally.



Straight channels
The river course may be straightened. This will speed up the flow and take water away to a lake or the sea more quickly.

Wider and deeper channels
Material may be dredged out from the bed and banks. This will allow the river to hold more water and reduce flooding.

Overflow channels
When the water level rises, floodgates may be opened and the water channelled out to the sea or into temporary storage lakes.

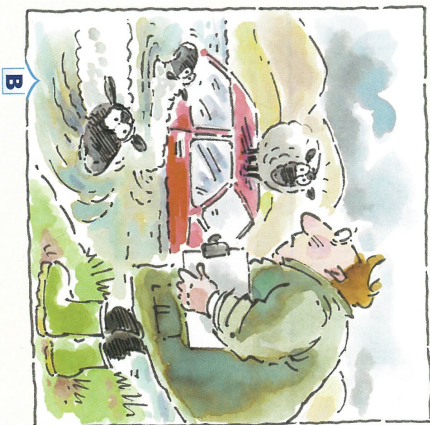
Allow flooding
Let flooding happen in a controlled way. Keep river bends to slow down movement. Allow excess water to collect in safe areas.

How should the Doveyton valley be protected from flooding?

Look at map D, which shows part of the Doveyton valley. In most years, the river overflows its banks and causes serious damage. The people in the area want their homes and land to be protected from the flooding. The Environment Agency has

agreed to look at the problem. It has made a study of the area and suggested four different schemes to help stop the flooding. It is your task to decide which is the best scheme.

Factors to consider	Scheme A	Scheme B	Scheme C	Scheme D
Prevents all flooding				
Stops flooding in Crofton				
No homes lost				
No roads submerged				
No grazing land lost				
No good farmland lost				
Helps with irrigation				
Helps protect wildlife				
Not too expensive				
Total				



1 a Copy table A which shows some factors that have to be considered when choosing a flood protection scheme.

b Look carefully at the map and scheme descriptions. Show the advantages of each scheme by putting ticks in columns A, B, C or D. Complete one factor at a time. More than one column may be ticked for each factor.

c Add up the ticks to find which scheme has the most advantages.

d Which scheme would you choose? The one with the most advantages would be the best. If two schemes are equal, think about which parts of the valley you would want to protect most.

e Briefly describe the scheme you have chosen. Explain how it will help protect the valley from flooding.

2 The flood protection scheme will affect different people in different ways. Work in pairs and discuss what the people in the drawing below will think of your chosen scheme. For each person say if they would be **for** or **against** the scheme. Give reasons for their views.



Trudy Trout, owner of Crofton caravan park



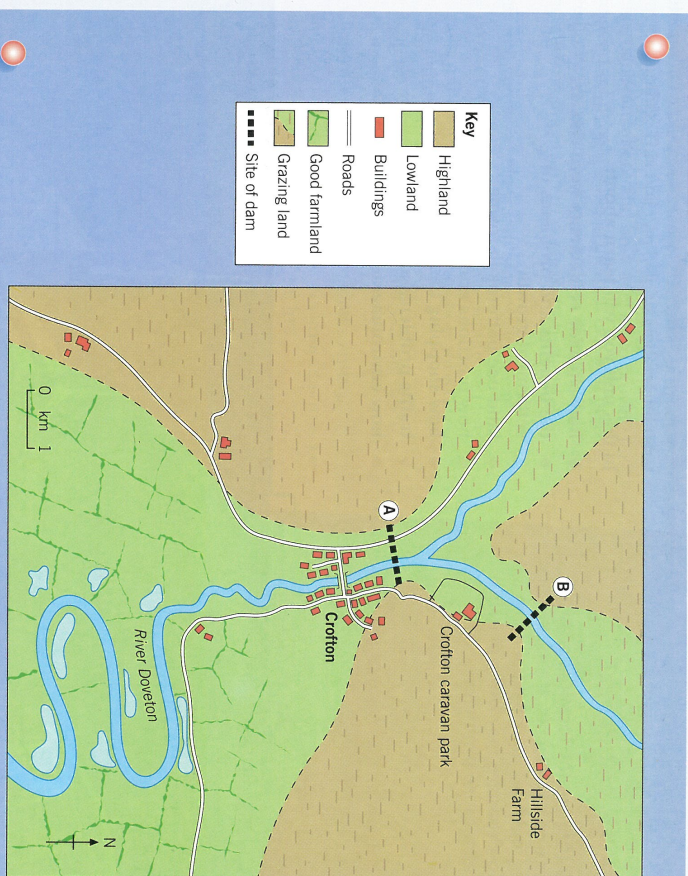
Farmer Wally Wade of Hillside Farm



Barry Beer, owner of the Crofton Inn



Larry Laugh, local lorry driver



Scheme A

Build a dam at A and create a large reservoir above the village. Much farmland and several farms would be flooded. The scheme would stop flooding in the village and protect most of the valley. **Cost = ££££**

Scheme C

Build a dam at B and deepen the river channel through Crofton. This would allow the water flowing through the village to move away more quickly. The scheme would protect Crofton but there may still be some flooding downstream. **Cost = £££**

Scheme B

Build a dam at B and create a small reservoir higher up the valley. Nobody would lose their home but some grazing land used by sheep and cattle would be lost. There would still be some flooding in Crofton and further downstream. **Cost = ££**

Scheme D

Build embankments at Crofton. Deepen and straighten the river below the village to take water away quickly. Allow natural flooding to happen downstream at the river bends. There would still be some flooding, especially upstream of Crofton. **Cost = £**