

Rivers - overview

WHAT ARE RIVERS?

A river is a body of fresh water flowing from an upland source to a lake, wetland or to the sea, fed by water sources such as groundwater springs and tributary streams. The components of a river include a channel, in which the water flows, and a floodplain (a relatively flat region of land on either side of the river channel) which can become flooded at times of high river flow.

Sediment (material transported by the river, such as sand and silt) is transported through the channel and floodplain from upland regions and on to a lake or the sea. A river starts on hillsides as small channels, or rills. The rills combine to make larger channels or tributaries that eventually come together, forming distinct streams. Streams then become rivers as the flow increases and any contributions from groundwater occur. The largest river channels formed by this convergence of tributaries can carry large quantities of water and sediment for great distances.

The image below shows boats on the River Thames outside Windsor Castle, England, UK



A river forms in a watershed (also known as a catchment) bounded by the hillsides that divide it from adjacent watersheds. When rainfall occurs on hillsides or when snow melts the water runs downhill and accumulates in streams.

A tributary stream eventually joins the main river channel at a confluence. The amount of rain or snow that falls in different parts of a watershed controls the size of a river. River features are also affected by the flow rate and the size and duration of floods. Some rivers receive rainfall almost every day in at least part of their watershed.

Other rivers, such as those in desert regions, receive water only during brief, intense storms that may cause a flash flood. The melting of snow is a source of water for many rivers. If a river flows all year round, the river is called a perennial river. Usually a slow, steady inflow from groundwater, or water found underground, provides some of the water of a perennial river.

If a river flows only during part of the year, the river is called an ephemeral river. An ephemeral river channel may have plenty of water flowing through it during the rainy season but may be completely dry in the late summer. The system of streams, tributaries and the main river is known as a river catchment, river basin or drainage basin.

Rivers are important sources of water for households, agriculture and industry, and are used for navigation and recreational activities such as angling, boating and walking. They also support a diverse flora and fauna. However, the river landscape worldwide is constantly changing, due to maintaining rivers for navigation, constructing artificial waterways and irrigation works, and building dams for water supply and hydroelectric power generation. Rivers also receive effluent from sewage treatment works and industry, and diffuse pollution from agriculture and transport. All these activities can have an impact on water quality.

Rivers play a vital role in the social and economic welfare of countries worldwide and there is increasing pressure for them to be managed in a way that brings benefit to both the people and natural habitats that depend on them. (See the accompanying Information Note on Wetlands).

RIVERS AS WILDLIFE HABITATS

The natural features found in rivers and streams support a diverse range of plants and animals. Riffles and pools are important habitats for a wide range of aquatic species, and marginal and bankside vegetation support an array of wild flowers and animals. Rivers and streams often also provide a wildlife corridor between fragmented habitats in farmed and urban areas.

In their natural state, rivers are dynamic systems continually modifying their form. However, in many cases their ability to rejuvenate and create new habitat has been reduced or arrested by flood defence structures and impoundments, and many of the rivers in the UK have been physically modified in some way to aid drainage or improve navigation. Also, flow regulation has altered patterns of sediment transport and nutrient exchange in river systems. Such activities have resulted in changes in the frequency and magnitude of flooding, altering seasonal patterns of flows with associated changes in water quality.

The plant and animal communities of rivers and streams (the biodiversity) vary according to their geographical area, underlying geology and water quality. The Lowland, nutrient-rich river systems found in Cambridgeshire are dominated by higher plants and coarse fish such as chub, dace and roach.

RIVERS AND FLOODING

The Cambridge County Council Biodiversity Action Plan is principally concerned with the channel and riparian habitats and illustrates the wide range of activities that affect the river environment.

The current factors affecting rivers and streams in Cambridgeshire include:

- Land use within the wider catchment which has an important influence on watercourses
- Water abstraction from rivers and groundwater, resulting in reduced flows and reduced dilution of pollutants
- Land drainage and flood defence works
- Changes in water quality resulting from increased nutrient concentrations leading to eutrophication and other forms of pollution
- Management of the river channel and bankside vegetation
- Spread of invasive plant and animal species
- Development and disturbance, including recreational activities such as boating
- Effects of agricultural practices
- Climate change leading to possible sea level rise and increased likelihood of extreme events such as prolonged drought and high rainfall.

Details of the Cambridgeshire case study and its action plan and targets can be found at:

<http://www.camcnty.gov.uk/sub/cntryside/biodiv/plans/stream.html>

There is a great deal of interest in reports of river flooding since, in many cases, the results can lead to serious damage to property and possessions and in others leading to loss of life and livelihoods. The problem is made worse by peoples' tendency to live and work on floodplains, adjacent to rivers, which are the natural recipient of flood water at times of high rainfall.

The effect of urbanisation in these areas has been an important factor in exacerbating the effect of flood events, leading to a greater potential for flood damage on many rivers. In addition, there is a growing debate about whether flooding is increasing in frequency and intensity as the result of changes in climate.

Flood defence measures have been used over many centuries as a means of combating floods by the construction of flood banks, realigning river sections and dredging. In the past, however, there have been many cases where these installations and engineered changes to the natural river courses have resulted in rivers becoming more efficient drainage channels, with little thought to their environmental impact.

Increasingly nowadays the emphasis is to engineer flood defence measures which are more environmentally sensitive. These allow, where possible, natural flooding of flood plains and avoiding building development where flooding may be a problem, whilst accepting that engineered defences will be important for urban areas where property and livelihoods need to be protected.

The Environment Agency in England and Wales has an important role in providing warnings about the risks of flooding. Their website provides information on managing flood risk and a flood research and development library can be found at:

http://www.environment-agency.gov.uk/subjects/flood/?lang_e

In England and Wales, two-thirds of drinking water comes from surface water, including reservoirs, lakes and rivers, and the remaining third from groundwater.

River water quality is much more variable than reservoir water as flows vary during the year and rivers are susceptible to pollution from a wide variety of sources. Water is treated at water treatment works before flowing through water mains, sometimes over considerable distances, to meet the nation's needs. (See the accompanying Information Note on Water Treatment and Supply).

During treatment, chemicals are added which bind small pieces of debris in the water together to form a blanket of sediment in the settlement tanks. As the water passes through the blanket it removes further particles. A filtration process then removes any remaining particles in the water. Finally, the water is disinfected to ensure a safe and wholesome supply. Samples are taken at each stage of treatment and within the distribution system to make ensure a wholesome supply.

Further information on the water supply cycle is contained in the accompanying Information Notes on Lakes and Reservoirs, and The Hydrological Cycle.

Unlike most other surface water bodies, rivers can flow across national or international boundaries. More than half of the 31 rivers in the EU with a total watershed area of 50,000 km² have transboundary basins.

In addition, many small and medium-size water bodies cross the borders of two and more countries.

The 1992 Helsinki Convention on the 'Protection and Use of Transboundary Waters and International Lakes' covers:

- Transboundary water monitoring and assessment
- Evaluation of measures on mitigation, elimination and reduction of adverse transboundary impact
- Information exchange between riparian countries and public awareness on results of water and effluents sampling.

To implement the provisions of the Helsinki Convention, guidelines on transboundary water monitoring and assessment were developed by the UN Economic Commission for Europe Task Force on Monitoring and Assessment. Details of a pilot project on transboundaries can be found at:

<http://www.jointrivers.org/eng/project/ecwa.php>

The Danube is an example of a major transboundary watercourse. It is the second-longest river in Europe after the Volga. It rises in Germany and crosses Austria (providing water to Vienna) and then flows through Slovakia (providing water to Bratislava) and on to Hungary. It then forms the Serbo-Croatian border, crosses Serbia and provides water to Belgrade. Onwards the river flows forming the border between Romania and Bulgaria.

It then enters Romania, forms a part of the border with Ukraine before entering the Black Sea through a large swampy delta, which is an important natural reserve.

A map of the Danube Basin is available at:

<http://www.rivernet.org/danube/basic.htm>

The European Rivers Network website lists and illustrates all river basins across Europe and can be found at:

<http://www.rivernet.org/bassincartex.htm>

TRANSBOUNDARY RIVERS

RIVERS AND THE WATER FRAMEWORK DIRECTIVE

Details of an international environmental research project called 'Mantra East' to analyse and develop strategic planning methodologies and scientific tools for the management of transboundary water basins in Europe is available at:

[\(<http://www.mantraeast.org>\)](http://www.mantraeast.org)

In the UK, the Water Framework Directive (WFD) will build on the considerable amount of work being undertaken by the Environment Agency in England and Wales, the Scottish Environment Protection Agency in Scotland and the Environment and Heritage Service in Northern Ireland. Together with large financial investment by the water utilities (amounting in England and Wales to over £4 billion between 1990 and 2000) and better controls on agricultural and industrial activities, this has resulted in a significant improvement in the quality of rivers over the last decade.

[\(\[http://www.environment-agency.gov.uk/yourenv/eff/water/213902/river_qual/?lang_e\]\(http://www.environment-agency.gov.uk/yourenv/eff/water/213902/river_qual/?lang_e\)\)](http://www.environment-agency.gov.uk/yourenv/eff/water/213902/river_qual/?lang_e)

The Directive will establish a new, integrated approach to the protection, improvement and sustainable use of rivers, lakes, groundwater, estuaries and coastal waters. It introduces two key changes to the way the water environment is managed across the European Community.

- The first relates to the types of environmental objectives that must be delivered. These apply to all surface waters
- The second key change is the introduction of a river basin management planning system.

See the accompanying Information Notes on the Water Framework Directive for more detail on the Directive and how it is being implemented.

If the environmental objectives specified by the Directive are achieved, then rivers across the EU will be clean and healthy. They will sustain diverse and healthy ecosystems and support a wide variety of water activities including recreation and fishing. In addition, benefits will include:

- Abstractions from and discharges to rivers will neither damage the environment nor threaten human health
- Pollution incidents will have been prevented at source through more effective control procedures
- The causes of water pollution and the quantities of chemicals entering rivers will have been greatly reduced
- Rivers will sustain a diverse variety of habitats and wildlife and be regarded as a valuable resource and recreational and amenity asset.

See the accompanying Information Notes on the Directive and the Environment Agency's and Defra's websites for frequently asked questions on the implementation and benefits of the Water Framework Directive:

[\(\[http://www.environmentagency.gov.uk/business/444217/444663/955573/958199/525252/?lang=_e\]\(http://www.environmentagency.gov.uk/business/444217/444663/955573/958199/525252/?lang=_e\)\)](http://www.environmentagency.gov.uk/business/444217/444663/955573/958199/525252/?lang=_e)

[\(<http://www.defra.gov.uk/environment/water/wfd/faq.htm>\)](http://www.defra.gov.uk/environment/water/wfd/faq.htm)

Three major river basin projects in Ireland illustrate investigations to develop water quality monitoring and river basin management strategies in support of the implementation of the Directive.

- The Three Rivers Project concerns the Rivers Boyne, Liffey and Suir and is available at:
[\(<http://www.threeriversproject.ie/default.htm>\)](http://www.threeriversproject.ie/default.htm)
- The South Eastern River Basin District Management System is available at:
[\(<http://www.serbd.com>\)](http://www.serbd.com)
- The Shannon River Basin Project is available at:
[\(<http://www.shannonrbd.com>\)](http://www.shannonrbd.com)

RIVER BASIN MANAGEMENT

Water management within the Water Framework Directive is based on River Basin Districts (RBD). These are made up of both river basins and associated groundwater and coastal waters.

All water bodies (rivers, lakes, canals, gravel pits, estuaries and coastal waters) within that district will be included. Nine RBDs have been defined in England and Wales as management and reporting units, together with two cross-border RBDs between England and Scotland, and one RBD wholly within Northern Ireland.

There are three international transboundary RBDs between Northern Ireland and Ireland. For each RBD there is a statutory requirement to produce and regularly review a River Basin Management Plan. The Environment Agency is the competent authority responsible for the implementation of the WFD in England and Wales. It will:

- Map the river basins and assess the quality of the water
- Set up environmental monitoring programmes
- Define what will be done to meet objectives
- Implement a river basin pilot for testing guidance and planning – the Ribble Pilot Basin.

See the accompanying Information Notes on the Directive.

RIBBLE PILOT BASIN

The Ribble Basin pilot is part of an EU pilot river basin network, comprising 15 river basin projects throughout EU member States.

By working closely with key stakeholders, the Environment Agency is exploring best-practice methods and techniques for engaging all those involved in the river basin planning process.

The stakeholders include regional representatives for business, industry, wildlife, environmental organizations and farming. The project will provide stakeholders with an improved understanding of how the WFD will impact upon their activities.

Further information on the Ribble Basin is available at:

http://www.environment-agency.gov.uk/business/444217/444663/955573/958199/518081/?lang=_e

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