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399

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RIVER MANAGEMENT SCHEMES – BLESSING OR CURSE?

People have a love-hate relationship with rivers. Water is vital to life. Rivers and their valleys are immensely valuable natural resources. Riverside locations have always been attractive places for settlement. Most of the water consumed for domestic, industrial or agricultural purposes in the world is drawn from surface streams. Not only do rivers represent a fresh water supply, but food supplies can frequently be supplemented by fishing. Many rivers are also important communication routes, providing access to other places, sometimes hundreds of kilometres away.

The principal drawback of a riverside location is that, in their natural state, all rivers flood. It is an unfortunate fact that by farming and settling a river valley, people increase the frequency and intensity of river floods. Much less rainfall is intercepted by cropland than by woodland. Solid surfaces in urban areas not only prevent infiltration, but, by feeding water down pipes and into underground drains, they positively encourage the rapid transfer of rainwater to surface streams.

Scale of river management

Nearly all rivers which pass through urban areas come under some degree of direct human control. Strengthened and raised river-banks, sometimes walled off on both sides, are the most visible signs of river management. Along the upper courses of such rivers, small dams or barrages are common for water supply and flood prevention. On floodplains, raised levees and river-cuts or spillways (to lead water away faster towards the sea) are typical management methods. In both urban and rural areas, examples of small-scale management of rivers are widespread.

Figure 1: World dam construction

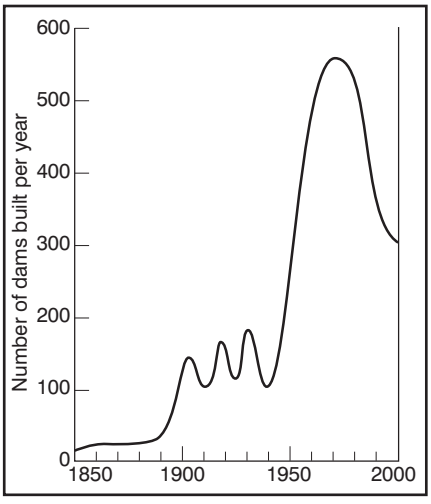
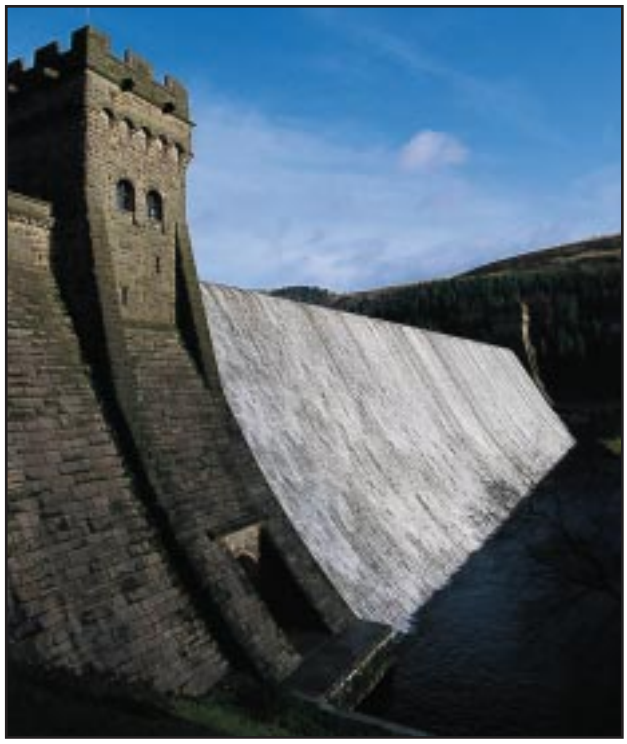


Figure 2: The Howden Reservoir dam. An impressive pre-war structure familiar to many walkers in Derbyshire's Peak District



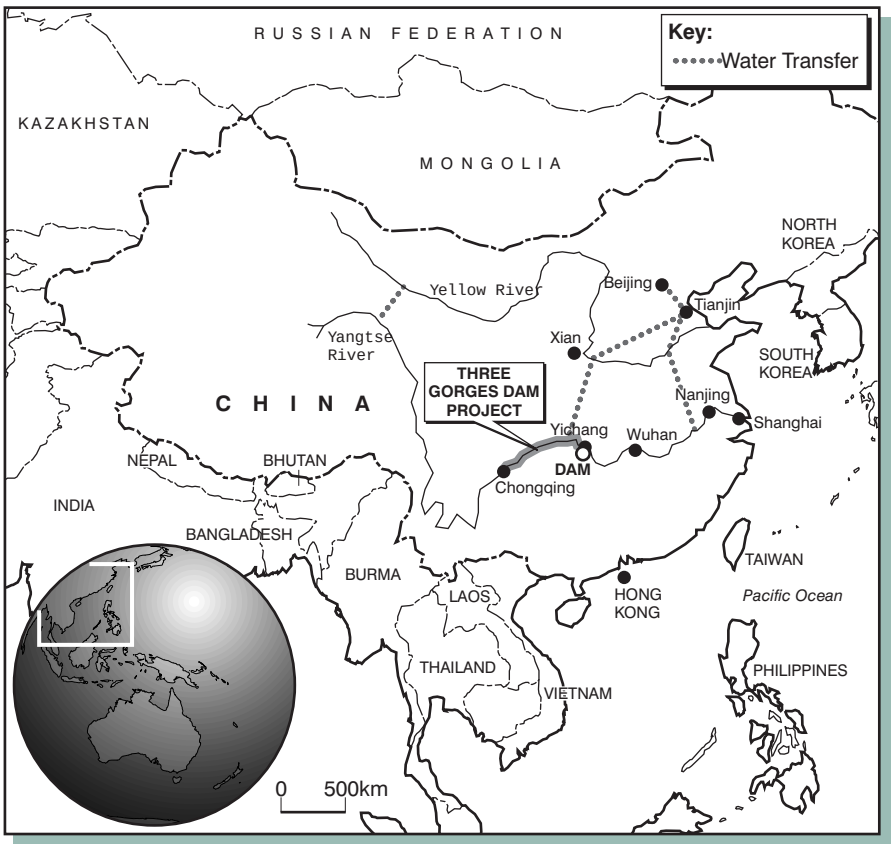
Source: Severn Trent Water

On a larger scale, dam-building is the traditional way of creating reservoirs for water storage and for regulating river discharge. You may be surprised at the number of dams in the world. There are about 40,000 large dams (higher than 15m) and hundreds of thousands of smaller ones. A further 300 or so large dams are built each year. In 2000 it was estimated that 1,600 dams were under construction in 42 different countries, principally India, China, Turkey, Korea, Japan, Brazil, Spain, Thailand and Romania. Dam-building as a tool of river management effectively dates from about 1850 in Britain and Western Europe, where industrial and urban growth created the need, and technological advance generated the engineering and construction skills. From the middle of the 20th century, improvements in technology and greater wealth facilitated a sharp increase in the number of dams (Figure 1). Growth in population and rising demand for food, accompanied by rises in manufacturing industry and improved standards of living, created the demand for dams. The USA led the way. During the 1940s, 1950s and 1960s more large dams were built in North America than in all the rest of the world put together. The era of big dam construction and the concept of total river management had arrived.

The Colorado River is a classic example of river management. Once renowned for its enormous and uncontrolled variations in flow, today no more than a trickle of water reaches the Gulf of California in most years, so complete is the river management after the construction of 11 major dams. This did not happen overnight – it is the culmination of around 100 years of management, progressively increasing in scale and complexity.

Over time, countries in the less economically developed world took up large dam-building projects. This happened principally after 1960, most enthusiastically in Asia and Brazil. Since independence in 1947, India has built over 3,000 large dams. Water has allowed otherwise parched lands to be cultivated and enabled second or third crops to be grown during the dry seasons before and after the monsoon rains. Brazil, the giant among South American countries, began to stir in the late 1950s. An

Figure 3: China's large water projects



Sources: *Times Educational Supplement*, 26 March 1999; *The Guardian*, 19 October 2000

important part of the government's development policy was a massive programme of dam construction along the big rivers of the interior. Electricity production, to overcome the country's shortage of fossil fuels, was the main purpose. The era of big dam construction also spread to Africa, the least wealthy continent, in the 1960s. The lakes created by the continent's three massive schemes can be readily seen on any atlas map – Lake Volta, on the river of that name in Ghana in West Africa, Lake Kariba on the Zambesi River straddling the border between Zambia and Zimbabwe in southern Africa, and Lake Nasser, held back by the Aswan High Dam on the Nile in the north.

Since the 1970s there has been a reduction in the number of very large dams under construction, due to two quite different factors. Most of the best sites have already been used up. Secondly, environmental objections have increased to the point where it can be guaranteed that any new large dam proposal will become an environmental issue. However, just when many people believed that the era of very big dam construction was over, China announced its intention to go ahead with the Three Gorges Dam on the Yangtse River. Damming of the river began in 1997. When it is finished in 2009, at 185m high, it will be the largest dam ever constructed. Water levels in the Yangtse River will be raised by 70m for some 250km behind the dam. The project is viewed by China's government as an icon of modernisation, and by environmentalists as China's folly. Then came the announcement in early 2000 that the Chinese government intends to go ahead with an even more grandiose water project to transfer Yangtse water to water-poor regions in north-east China, as far away as Beijing (Figure 3): 'Why should 94% of the Yangtse's water be allowed to flow out to sea when water needs in northern China are so great?'

The benefits of large schemes

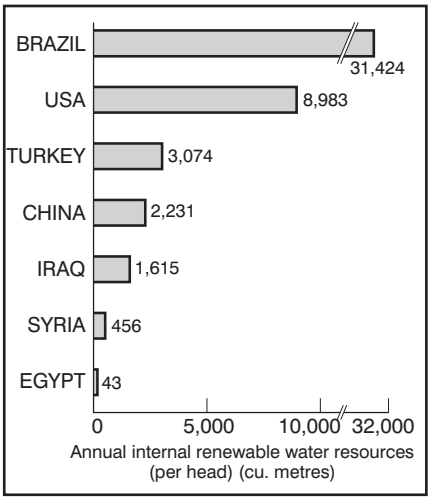
In order to justify the great cost of their construction, most large dam schemes are likely to serve a combination of each of the following purposes: water supply, flood control and electricity generation. The relative importance of each element, of course, varies greatly.

Brazil has come closest to having single-purpose large schemes, with the focus clearly upon HEP. Brazil is a water-rich country (Figure 4); only for schemes in the dry shoulder of Brazil's North East was a water supply element necessary. However, to say that they had only one purpose may be an over-simplification. Political motives were also strong: building big dams was one arm of the policy to attract migrants from the well-populated coastal zone into the empty interior. To the international community they were intended as symbols of economic development, indicators that Brazil could not be lumped together with other LEDCs, so that overseas investors should not miss out on the great opportunities in South America's largest country.

In contrast, the purpose of the Aswan High Dam was focused more tightly upon water supply and control of the River Nile. Egypt has long been described as the 'gift of the Nile'. For centuries Egyptians dreamt of being able to control the waters of the Nile, to stop the damaging floods in summer and to have a reliable supply of irrigation water throughout the year. The Aswan High Dam, started in the 1960s, is an example of one dam for an entire river basin. After its completion, the area of cultivated land more than doubled, two crops per year could be grown instead of one, and controlled water use allowed higher yields. Other advantages are that it has doubled Egypt's previous output of electric power and added another tourist attraction in Upper Egypt; useful as these two advantages are to the Egyptian economy, however, in themselves they could never have justified the cost of construction.

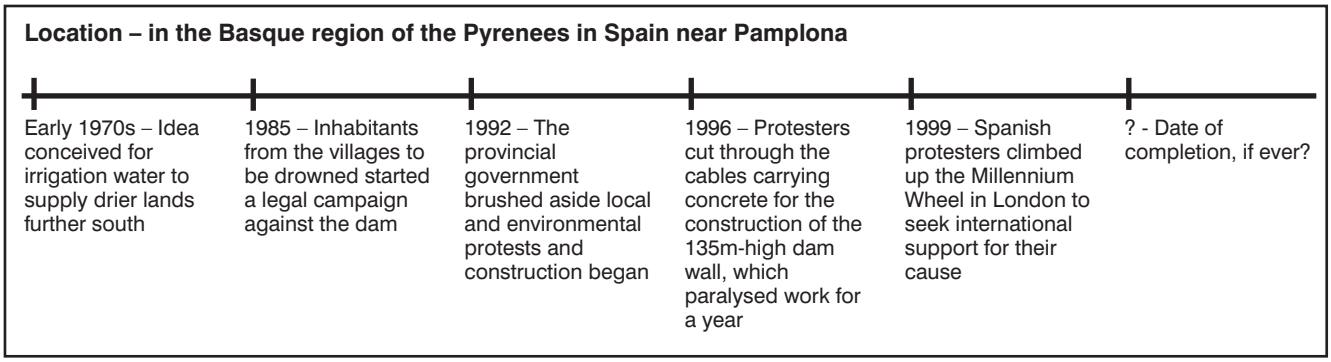
In a nutshell, therefore, dams can

Figure 4: Water-rich or water-poor? The relative water wealth of countries mentioned in this article



Source: *World Resources—A Guide to the Global Environment* (OUP), p.305

Figure 5: The Itoiz dam – a time line



deliver clean energy, safe drinking water and reliable supplies of water for irrigation, along with other economic benefits such as tourism, recreation and fishing.

The drawbacks of large schemes

In a way all dam-based schemes are ultimately self-defeating; about 1% of dam capacity is lost each year by silting. Although the human intention may be just to manage one stretch of river, the knock-on effect on natural processes cannot be avoided along sections downstream. When a river's load of silt is trapped in the lake behind a dam, this increases the likelihood of bank erosion downstream. Depositional landforms such as deltas are dynamic features that rely for their continued existence upon the regular deposition of fresh supplies of silt – without it, they retreat and become salty. These are two of the serious post-Aswan dam problems in the Nile Valley. The soil's fertility on the flood plain is no longer being renewed because there is no longer annual flooding of the Nile. Similarly, the Colorado delta is now a wasteland due to lack of water flow, and is unable to support more than vestiges of the varied bird, mammal and fish life, which once characterised the wild environment.

To environmentalists these are just two of the many ecological disasters that have resulted from building large dams. Another is that vegetation left to decay and decompose under the rising waters releases immense amounts of methane and carbon dioxide, both of them greenhouse gases, especially when tropical forests are covered without prior clearance, as happened in some Brazilian schemes. Many animals were trapped by the rising waters and died.

Some dams have also been described as social disasters, because of the number of people displaced by the flooding of valleys, which, after all, are the most favoured places for settlement. Displaced people are rarely beneficiaries from new dams. Estimates are that a staggering 50 million people have already been displaced by the 3,000 plus dams built in India. Only those who owned land received compensation. Resettlement accommodation rarely lived up to what had been promised. Farming people were resettled on land that was steeper and less fertile than the land that was flooded. This is why the current opposition to the series of new dams proposed in the Narmada valley in India, where another 20,000 people are threatened with removal, has reached levels of vehemence and persistence not previously seen, resulting in several years of delay.

The basis for many people's objection to the Three Gorges project in China is that the homes of over one million people will be flooded. These people will need to be resettled within the next 10 years. During the first three years of work, government statements frequently emphasised how well resettlement was proceeding and how happy the resettled people were in their new homes. However, by 2000, after 150,000 had been resettled, it was becoming difficult, even for the Chinese government, to conceal that problems existed. The majority haven't found the work promised in the new towns. The meagre compensation each person received (equivalent to about US$800) was paid out via local officials, many of whom have been corruptly pocketing part, or all, of the money. Neighbouring provinces are not looking forward to absorbing hundreds of thousands of unemployed and very discontented rural labourers over the next few years.

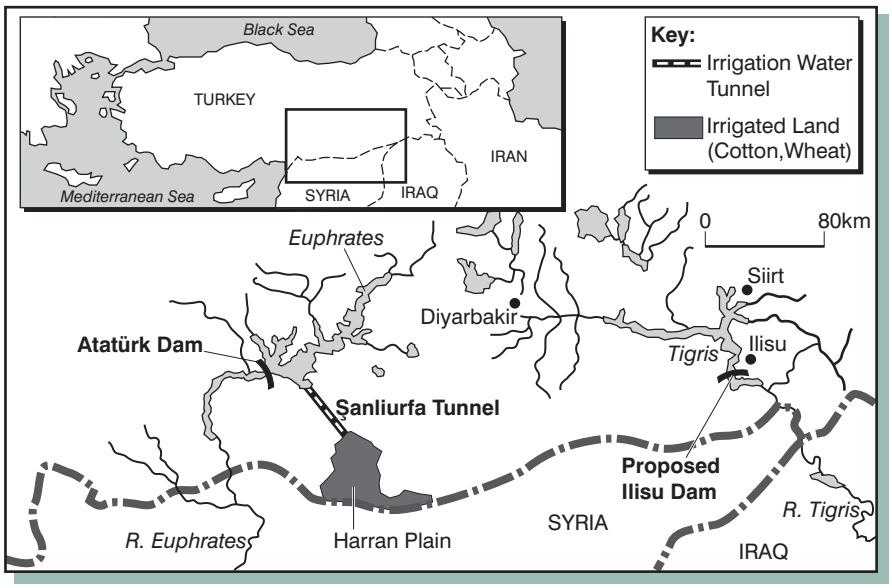
Environmental groups are now better organised and resourced than ever before. If a dam proposal is subject to a public enquiry, objections will certainly delay the date for starting the work. In India activists have gone on hunger strike in jail to protest. In Spain protesters took direct action which halted work on the Itoiz dam for a year. Their present campaign is designed to raise international awareness of the damage the dam will cause by the flooding of three villages and two national nature reserves (Figure 5). Pressure groups are increasingly targeting the contractors and financiers in developed countries, without whom such projects cannot proceed.

International issues are conspicuous with some schemes, none more so than in Turkey's GAP project, which involves damming the headwaters of the Euphrates and Tigris rivers for electricity and irrigation in south-east Anatolia, one of the country's most backward regions. By doing this, Turkey will thereby reduce water flow into Syria and Iraq, already less water-rich countries than Turkey. Both lie in the Arab part of the Middle East that suffers from scarcity of water, with all the political turbulence that might follow from this. Turkey has steadfastly refused to consult with these two countries, arguing that it is impossible to deal with dictatorships and that both countries squander the water they already have. The proposed, even larger Ilisu dam has activated an international campaign on social, environmental and political grounds (Figure 6).

Blessing or curse? The debate over the building of large dams is polarised

One side sees large dams as man-made wonders of the world. The pro-dam enthusiasts stress their role in generating one-fifth of the world's electricity, electricity that is clean and cheap. Fossil fuels are major polluters

Figure 6: The GAP project in south eastern Turkey



Source: *The Financial Times*, 10 November 1994, p.8

and the principal fossil fuel, oil, has a possible remaining life expectancy of only 40 years. HEP doesn't contribute to air pollution and it is the one alternative energy source that is price competitive with fossil fuels. Others point out the value of dams in preventing floods, at a time when some commentators are suggesting that global warming is increasing the frequency and magnitude of river floods. Much stress is placed upon their critical importance for supply of water, a resource made increasingly precious by world population increase. Predictions are that human water use will increase by 40% during the next 20 years. Supporters can point to clear benefits from existing dams. They argue that the disappearance of old village communities is a necessary price to pay for progress. Something always has to be sacrificed for the greater good; hundreds of thousands of people have the right to water, food and a better future. According to such advocates, only dams can sustain the world's growing population, especially as in many places water from aquifers is being consumed more quickly than it is being replenished, leading to falling water tables in populous countries such as China, India and Mexico.

The opponents of large dams see them as social and ecological disasters – symbols of power-mad governments and ambitious politicians and financiers. Although policies to reduce damaging effects upon people and environments are included in many proposals, there is often a big gap between theory and reality. Few if any sanctions seem to be applied to dam-builders who fail to fulfil agreed environmental conditions and resettlement policies. This lobby sees big dams as damaging temporary solutions. They argue that there are better, equally effective smaller-scale solutions. Instead of the Three Gorges dam, environmentalists suggest that a series of smaller HEP dams on the Yangtse's tributaries would be a more efficient way of generating power and managing the flood-prone river, without causing massive social and economic upheaval to the valley's farmers.

The question of whether the benefits of a large river management scheme outweigh the costs is in many cases unanswerable. There is often disagreement between the two sides over even basic facts. Look at Figure 7, which shows arguments against the proposed Ilisu dam in Turkey from environmentalists and responses from one of the large civil engineering companies involved in the project. Can you decide who is right?

Figure 7: The case for and against the Ilisu dam

Environmentalist claims	Construction company responses
• Ilisu will deprive Syria and Iraq of water.	• The dam is for power, not irrigation, so no water will be removed.
• The dam will pollute the river.	• Power turbines do not pollute water flowing through them.
• Turkey could block water flowing to Syria and Iraq at will.	• The dam has no diversion canal. Water would spill over the top in weeks if it were closed.
• The dam is part of an ethnic clearance of Kurds.	• Many non-Kurdish Turks live in the area and all residents will have rights to compensation.
• The dam will flood Hasankeyf, an ancient Kurdish town.	• The town is largely non-Kurdish and its spectacular upper town would survive the flooding.
• Ilisu is an environmental disaster.	• HEP is cleaner than fossil fuel generation.

Source: *The Financial Times*, 17 December 1999, p.3

Focus Questions

1. (a) What is meant by river basin management?
(b) Why is management needed along sections of most rivers?
(c) Outline why all management schemes have drawbacks.

2. (a) Why did the building of large dams become a worldwide phenomenon in the 1960s and 1970s?
(b) Account for the multi-purpose nature of many large river basin management schemes.
(c) Identify and comment on some of the political issues that arise from large-scale dam construction.

3. With reference to examples, discuss the extent to which it is possible to determine the relative weightings of the drawbacks and benefits of a large river management scheme.