Unit 3
Contested planet
Chapter 2 Water conflicts

1 Examine the factors which can create water stress in some parts of the world.

Water stress occurs when there is a mismatch between water supply and demand. Water supply, especially of freshwater, is limited and severe drought is a recurring feature of the climate of some countries. In fact, less than 1% of potential freshwater is found in rivers, lakes and ecosystems. Economic growth and rising population make increasing demands upon water supplies.

One-third of the world's population is already short of water, and this situation will get worse as agricultural and industrial development looks set to push global water demand to over 5,000 km^3 by 2020. Water stress technically occurs when the annual water supply per person falls below 1,700 m^3. Many east African countries have serious shortages and problems of access to water, and they illustrate the clear link between poverty and water stress.

Water stress may also result from conflict and political decisions. Where countries share limited water resources, there is a risk of water scarcity and related conflict. In the middle east, Israel and its Arab neighbours make heavy demands upon aquifers and the river Jordan. Further east, Syria and Iraq are in dispute with Turkey over use of water from the Tigris and Euphrates rivers.

Another problem is that economic development continues to cause environmental damage and reductions in freshwater supply in many parts of the world. Pollution and water loss in the Aral Sea region provide a classic example of this aspect of water stress.

Students might use case studies from China and India to illustrate the factors involved in water stress. Rapid economic development, population growth and increasing water demand in northern China, seen against a background of inherent drought, are the main reasons behind the country's massive water engineering projects.

Assessment

Level 1 Makes simple statements about water shortages in some places.

Level 2 Shows some understanding of how demand in some places is greater than supply, refers to some examples.

Level 3 Gives reasons why water stress occurs, uses evidence, well written.

2 Explain the links between (a) economic growth and water demand, and (b) water insecurity and water poverty.

(a) As countries develop economically their need for water increases. In poor countries, this demand comes first from agriculture, which needs to produce sufficient food for growing populations. Subsequently, industrialisation needs large supplies of water for power and factory use. Clean water for domestic use is a further demand which is seen most obviously in more developed countries, where improving standards of living involve better access to clean water supplies. A graph of wealth (GDP) versus water poverty (index) shows this direct link globally and also reveals how countries at similar levels of development or geographical locations are grouped together (see Figure 2.8 in the textbook).

Students might compare countries at different levels of development, such as Ethiopia and Canada. This would help make the above links clear. Canada is rich in water and, with a GNI per capita of over $33,000, has a water use figure of almost 100,000 m^3 per person. In contrast Ethiopia's income is below $200 per person and its water use below 2,000 m^3 per person. These are staggering statistics which reflect the immense economic and resource gap between rich and poor countries globally (see Table 2.1 in the

textbook). Canadian households use 800 litres per person per day, although there are problems with increasing water bills and leakages. In Ethiopia, the figure is 1 litre per person per day, much of it fetched daily from a shared source. Water problems here relate to water shortages, dirty water and the risk of disease. The presence of widely dispersed rural villages and overpopulated urban slums can aggravate the problems.

(b) Water insecurity means not having access to sufficient, safe water. People in developing countries have few opportunities to escape from economic poverty and water poverty. This concerns the quantity and quality of water and the level of access to it. Again, as in (a), there is much to be gained from an LIC–HIC comparison. The latter countries command the technology and capital to make good water deficiencies directly related to climatic regimes.

Assessment

Level 1 Makes simple statements about water and development or poverty; little evidence provided.

Level 2 Shows some understanding of water development and water demand or water insecurity and water poverty; refers to some examples.

Level 3 Explains links between water development and water demand or water insecurity and water poverty. Uses evidence; well written.

3 Using examples, show how disputes over water can create tensions between countries.

Tensions between countries can result from disputes about water. If there are no suitable water agreements in place, conflict is likely to occur. It is only when demand for water overtakes supply that the resulting water stress triggers a more aggressive stance. Another situation in which conflict can happen is where several players wish to use the same resource, perhaps for different reasons, which may affect the quantity or quality of the supply. Often it is the upstream or more powerful country that is the 'winner'. Water storage and abstraction for power or irrigation are common issues which spark tension with downstream countries.

Students will find a large number of case studies which fit this question, and perhaps two contrasting examples could be used. Rivers such as the Mekong, Ganges, Jordan, Euphrates, Nile and Colorado all illustrate these international conflicts. The middle east is one such region, where Israel and its Arab neighbours have already been to war over limited natural resources, including water. The Golan Heights, the Jordan valley and the Gaza/Palestine aquifers are key water sources in the region.

In southeast Asia, some 60 million people live in the Lower Mekong Basin, using the river for drinking water, food, irrigation, hydropower, transportation and commerce. Upstream, China's new Manwan dam provides the HEP and water needed for the development of Yunnan province. A second project, the Dachaoshan dam, will be completed in 2012; a further eight dams are planned. The flow of the river in Laos and Cambodia has already been reduced considerably. Falling water levels have resulted in a rapid decline in both rice production and fish stocks, which are needed to support 1.5 million people.

Assessment

Level 1 Makes simple statements about international water issues; little evidence provided.

Level 2 Shows some understanding of disputes between countries over water supplies; refers to some examples.

Level 3 Shows why and how water disputes lead to international tension. Uses evidence; well written.

4 Examine the risks associated with water transfer schemes.

Many regions and countries faced with increasing population and food shortages need to find water for urban and agricultural use. One solution to water shortage is to divert water from one basin to another. Large-scale transfers of water can be achieved by diverting the course of a river, or by constructing a large canal. Both of these alternatives have important social and environmental impacts.

Impacts on people may of course be positive, bringing economic advantages through increased water supply for agriculture, industry, navigation, HEP, employment and recreation. However, there are negative impacts, including migration, resettlement, reduced welfare and health risks. Biological risks may also increase, affecting wetland, fish stocks and the spread of diseases. Terrestrial habitats, flora and fauna may also suffer. Microclimate and evaporation rates may also change. Dams and other hard engineering schemes may reduce discharge, retain sediments and alter water chemistry.

High costs, water losses, environmental impacts and changing circumstances make investment in large-scale water transfer a high-risk strategy. The Aral Sea river diversions show how past attempts have gone wrong. The Colorado illustrates how circumstances change. The massive project in China to move water from the flood-prone south to the drought-ridden north has yet to be evaluated. In the UK plans to link water surplus areas in Wales and northern England with the deficit zone of the southeast via a water grid remain on the drawing board. Potential transfer developments exist in the Nile basin and in Canada, exporting water to the western USA.

Students should be encouraged to use two different case studies to illustrate the risks of water transfer.

Assessment

Level 1 Makes simple statements about water transfer schemes; little evidence provided.

Level 2 Shows some understanding of the risks involved; refers to some examples.

Level 3 Examines a range of different types of risks associated with water transfer. Uses evidence; well written.

5 Explain why there is so much uncertainty about future water demand and supply.

By 2025, water withdrawal is projected to have reached 5,295 km^3, with considerable impact on food production, human welfare and the natural environment. However, predictions about future water supplies and demand are highly uncertain.

First, there are uncontrollable factors such as climate change. The impact of global warming on finite, even shrinking, supplies will be considerable. Higher global temperatures are already leading to earlier snow melt and increased discharge in some river basins. The melting of Himalayan glaciers could threaten the water supplies of nearly half the world's population in Asia. Water shortages brought about by the increased frequency and intensity of drought will have the most devastating impacts. Dried-up rivers, irrigation failure and depleted aquifers threaten the lives of millions of people in Asia and sub-Saharan Africa.

Secondly, other possible 'futures' relate to the resources available, population growth and patterns of consumption, as well as political decisions and options in water management. These may relate to increasing water supply or reducing water demand. There are perhaps three alternatives:

- The *business as usual* scenario will be unsustainable in the long term as water supplies are finite and water scarcity reduces food production. Consumption of water will have risen by more than 50% by 2025.
- The most worrying scenario is that of *water crisis*, which shows how mismanagement of water resources or climate change could threaten our water and food supplies and lead to wider geographical problems, including conflict. Alarmingly, some features of this scenario may already be starting to occur.

➤ A *sustainable* option would require governments to allow local management of resources. Although this strategy may conserve water and reduce demand, if it is to succeed, the option will mean an end to new large-scale projects. Industrial development may suffer in this scenario.

Students will find that a range of case studies from countries such as India, China, the USA, Australia and the UK can be used to illustrate some of these scenarios.

Assessment

Level 1 Makes simple statements about future water shortages; little evidence provided.

Level 2 Shows some understanding of the possible impacts of increasing water demand, refers to some examples.

Level 3 Describes and explains the uncertainty of water 'futures'. Uses evidence; well written.

6 Evaluate the view that reducing water demand is better than trying to increase water supply.

Water management for the future will require action at a variety of levels ranging from large-scale projects funded by governments or agencies down to changing consumers' attitudes to water use at a local level. Possible actions include hard engineering to increase water storage and transfer, for example China's Three Gorges Project and the South–North Transfer Project. More sustainable schemes for the restoration of rural water supplies are another option, such as the Aral Sea rescue plan or wetland schemes such as that in the lower Danube. Water conservation by means such as rainwater harvesting and water recycling are also deserving of greater investment.

Increasing water supply is a less attractive proposition, as we know that it is a globally finite resource, perhaps shrinking. However, it remains possible to move water to where it is needed. This is the essence of water storage and transfer. But the impacts of this type of engineering can be serious, as seen in the Three Gorges scheme. Water will eventually cover valuable arable land, inundate 13 cities and displace 1.9 million people. There are risks from dam failure, earthquakes and heavy rains. The ecological risks to fisheries, biodiversity and habitats are considerable. Pollution will increase, as mines and factories will be flooded, tourist sites will be lost and the river's sediment load will perhaps damage turbines or become trapped behind the dam and reduce soil fertility downstream. At a local level, water harvesting for home or garden use is an economical way to increase supply.

Reducing demand is a more natural way to change the water balance. Conserving and recycling water should be a more sustainable and achievable objective. The use of grey water to flush toilets, water parks and even irrigate some crops is one obvious development. Recycling of water using filtration rather than chemical techniques is another. Water consumption in factories, amenities and households can be managed (even manipulated) by pricing, using subsidies and caps.

Cyprus and Australia are good case studies from which to illustrate these ideas: **www.cyprus.gov.cy/moa/wdd/WDD.nsf/index_en/index_en** and **www.environment.gov.au/water/index.html** make good starting points.

Assessment

Level 1 Makes simple statements about water supplies and water use; little evidence provided.

Level 2 Shows some understanding of how to increase water supply and reduce water use; refers to some examples.

Level 3 Tries to weigh evidence about how best to manage water supply and water demand; well written.

7 Using examples, evaluate the economic and environmental benefits of different types of water technology.

Water technology includes a range of different approaches at differing scales, from massive storage dams and transfer schemes to community water harvesting. All have economic benefits, but environmental gains may also occur. Modern techniques such as desalination and recycling are increasingly being used. Students could draw a contrast between these approaches in China, Spain or the UK.

To redistribute its water resources China began a gigantic south-to-north water diversion project in 2003. It is expected to take 50 years to complete and will cost an estimated $62 billion. The project involves building three canals linking the country's four major rivers. The scale of engineering involved in this scheme is huge, diverting a total of 44.8 billion m^3 of water per year. Central government will provide 60% of the cost. Plans for water conservation, improved irrigation, pollution treatment and environmental protection are included, to deal with the untreated wastewater and agricultural runoff. Some experts, however, fear an ecological disaster.

Desalination is another way to provide fresh water suitable for human consumption or irrigation. As the price of this technology falls, countries are turning to it as part of their future water strategies. Many relatively well-off, technologically developed and increasingly water-stressed countries in the middle east are making growing use of their cheap energy to distil freshwater from seawater. In the USA, California and Florida use reverse osmosis to filter salt from brackish water and rivers.

Water conservation and recycling are becoming part of many countries' water strategies. They are seen as sustainable technologies with relatively few negative environmental impacts. Using less water lowers the supply costs and conserves resources. Recycling water is a key step in manufacturing and services where the use of grey water is increasingly important. Water harvesting and intercepting runoff have ecological benefits too, and reafforestation is one way to achieve this.

It is, however, worth pointing out that many commentators have serious doubts about the environmental credentials of some so-called improvements in water technology.

Examiner's comment

Students should not neglect this last point, as the alternative question – 'Using examples, evaluate the economic benefits and environmental costs of different types of water technology' – is equally likely to appear in the examination.

Assessment

Level 1 Makes simple statements about differing water technologies; little evidence provided.

Level 2 Shows some understanding of the strengths of some water technologies, refers to some examples.

Level 3 Tries to assess evidence of the economic and environmental benefits of differing water technologies; well written.