



Rivers at Risk

Dams and the future of freshwater ecosystems

Summary



prepared in cooperation with the World Resources Institute



Global challenges

The world faces a huge challenge to supply the water and energy needs of a rapidly growing population, as well as reducing poverty. Currently, 2 billion people have no access to electricity, while around 1.1 billion people lack access to safe drinking water and 2.4 billion to adequate sanitation services. As the pressure to solve water and electricity needs grows, dams are being considered by many decision-makers as one of the key solutions.

Globally, there are more than 45,000 large dams operational in over 150 countries and another 1500 or so are currently under construction. There is little doubt that dams have improved agricultural output by making more land suitable for cropping through the provision of water for irrigation. They have provided flood control and hydropower for millions of people.

However, dams have also caused considerable environmental damage and, together with associated activities such as irrigated agriculture, have been a major culprit in the decline of freshwater biodiversity observed in recent decades. Over 60% of the world's major rivers are now fragmented, wetlands have been drained and many fisheries have been decimated.

Today, most dam construction has shifted from the developed to the developing world, with some countries such as China and India implementing large dam construction programmes. While water and energy needs in developing countries are real and need to be addressed, the risk to ecosystems is acute and some unique species and habitats are threatened. Freshwater fish, river dolphins and water birds are particularly vulnerable. People are equally vulnerable, and not only those who are displaced by dams, but also those who depend on these freshwater ecosystems for their livelihoods, for example through fisheries.

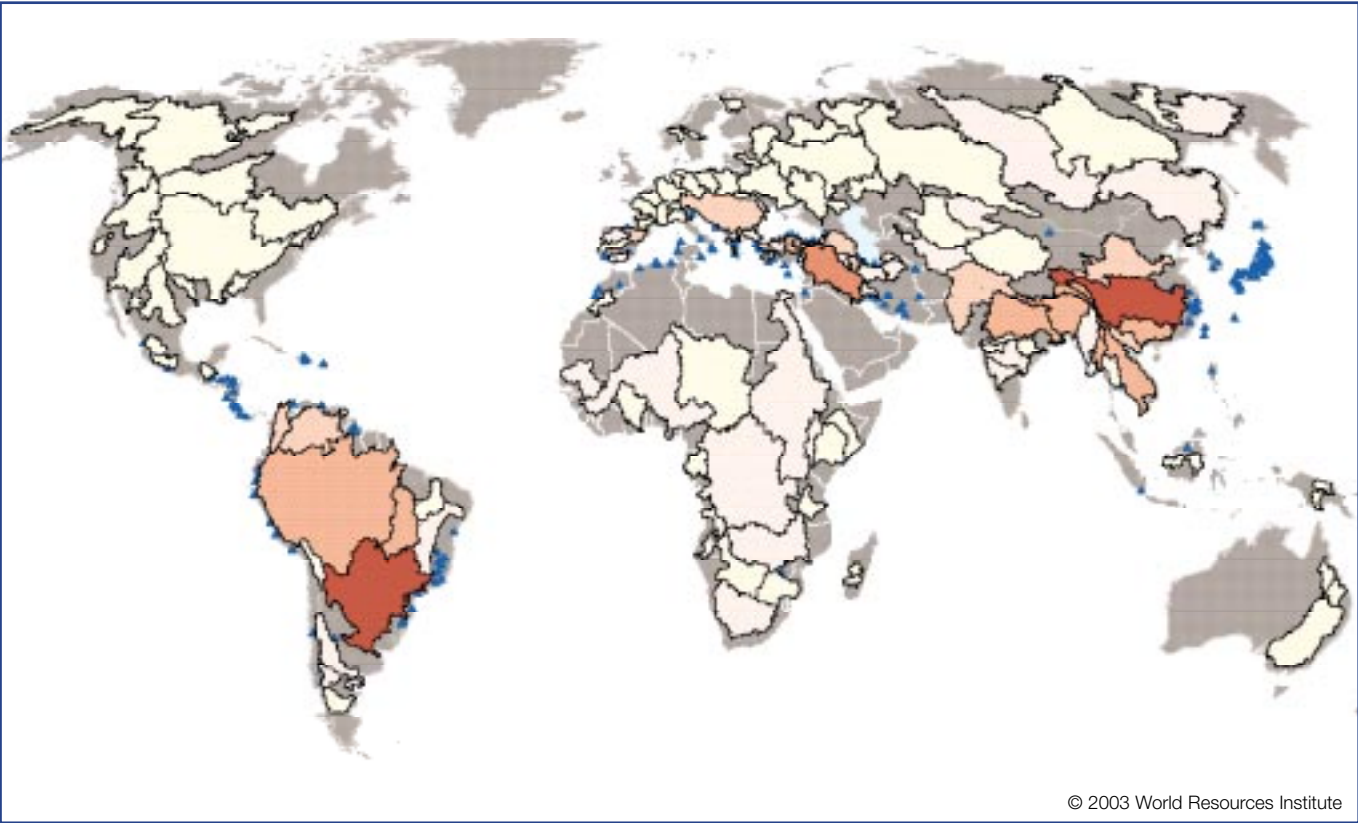
Those most affected by dams still do not necessarily benefit directly and often remain without access to power and clean water.

River basins under threat

The Rivers at Risk analysis presented here examines the present state of dam building in the world's major river basins. It is based on dams currently under construction that are over 60m high, as well as on data on dams that are being planned that are either higher than 60m or will have an installed hydropower capacity of more than 100 MW as of 2003. The analysis includes dams of all types: hydropower, irrigation, water supply, flood prevention as well as multi purpose dams. The analysis demonstrates how vulnerable river basins are, as more and more dams get built within the same basins or even on the same river.

Valuable habitats and species are at risk of disappearing from the combined effects of not only one large dam but many.

The analysis shows that the Yangtze River basin in China has by far the highest number of new large dams planned or under construction, 46 new dams, followed by the La Plata basin in South America with 27, and the Tigris and Euphrates Basin in Turkey, Syria and Iraq with 26. The next top three rivers are the Salween in China, Thailand and Myanmar, the Kizilirmak in Turkey, and the Ganges in China, Nepal, India and Bangladesh.



KEY

Number of large dams planned or under construction, 2003

0

1 - 3

4 - 6

9 - 16

17 - 26

27 - 46

 New dams outside major river basins

Table 1. River Basins with Highest Number of Large Dams Planned and Under Construction
(Includes dams >60 m and >100 MW)

Basin Name	Basin Size ('000 sq. km)	Countries within Basin	Number of Large Dams	Types of Risk
Yangtze	1,722	China	46	Large basin under stress from population pressures. Loss of habitat threatens bird species as well as endangered Yangtze River dolphin
La Plata	2,880	Argentina, Bolivia, Brazil, Paraguay, and Uruguay	27	River basin with high biodiversity; threats to Pantanal and other internationally important wetlands
Tigris & Euphrates	766	Turkey, Iraq, Syria, Iran and Jordan	26	Arid basin; potential for conflicts over water withdrawal between Turkey and downstream countries
Salween	272	China, Myanmar, Thailand	16	Relatively pristine river with high biodiversity values
Kizilirmak	78	Turkey	15	Small heavily fragmented basin; Ramsar site located in Delta
Ganges	1,016	India, Nepal, China, Bangladesh	14	Endangered Ganges River dolphin; Sundarbans mangroves in delta
Tocantins	764	Brazil	12	Relatively developed river basin; further dam development and improved navigation will exacerbate degradation for use of farmland
Amazon	6,145	Brazil, Peru, Bolivia, Colombia, Ecuador, Venezuela, Guyana, Suriname, Paraguay and French Guyana	11	One of most important basins for biodiversity; lower dams may affect coastal areas
Mekong	806	Thailand, Laos, China, Cambodia, Vietnam and Myanmar	11	Basin with high biodiversity and very productive fisheries; droughts and low water levels are current threats
Brahmaputra	651	China, India, Bhutan, Bangladesh	11	High biodiversity in upstream areas; high population pressure in delta
Zhu Jiang (Pearl River)	409	China, Vietnam	10	Highly developed basin; some important sites for amphibians
Danube	801	Germany, Austria, Slovakia, Hungary, Croatia, Serbia & Montenegro, Romania, Bulgaria, Moldova, Ukraine	8	68 Ramsar listed sites as well as UNESCO biosphere reserve in delta
Hwang He (Yellow River)	945	China	8	River basin with severe water shortages; 4 endemic bird areas, 1 Ramsar site
Kura-Araks	205	Azerbaijan, Iran, Georgia, Armenia, Turkey	8	Biodiversity hotspot with 4 Ramsar sites, 1 Endemic Bird Area and 21 IBAs
Yesilirmak	36	Turkey	8	Delta designated as IBA
Büyük Menderes	25	Turkey	7	River delta protected as National Park, protected bird areas
Çoruh	19	Turkey	7	Fast flowing river with significant tourist industry based on rafting
Susurluk	22	Turkey	7	Highly developed basin. Delta is a candidate Ramsar site.
Ebro	83	Spain and Andorra	6	High economic importance of delta; important bird sites
Indus	1082	Afghanistan, Pakistan, India, and China	6	Endangered Indus River Dolphin; loss of mangroves and sea water intrusion in delta
Qezel Owzan	60	Iran	6	Endangered sturgeon species

EBA's are avian centres of endemism defined by BirdLife International as sites where the ranges of endemic bird species overlap. IBAs, Important Bird Area, denote sites of international significance for the conservation of birds at the global, continental and sub-continental level (BirdLife International, 2003). A Ramsar site is an area designated as a wetland of international importance under the Convention on Wetlands signed in Ramsar, Iran in 1971.



Construction site of the Three Gorges Dam on the Yangtze River.

Yangtze

The Yangtze basin is a rich centre for biodiversity, both terrestrial and freshwater, with about 322 species of fish and 169 species of amphibians. But many species are under threat, as the Yangtze basin is densely populated and the demands for water and energy, from both within and outside of the basin, has led to intensive dam building that continues at a rapid pace. Today 46 dams over 60m high are either under construction or planned, including the Three Gorges Dam. Some species at risk from further alteration of river and riparian habitats include the Chinese alligator, the most threatened crocodile species in the world, the finless porpoise, the only freshwater-adapted porpoise in the world, whose population is reported to be declining rapidly, and the Yangtze River dolphin or baiji, which is the most threatened cetacean in the world, with only a few tens of individuals remaining. Many bird species, such as cranes, are under threat as well and the decline of many fish stocks has been affected the livelihoods of people in the basin.

La Plata

The La Plata River basin is the second largest basin in South America, (after the Amazon), and is home to more than 110 million people. It is shared by Brazil, Bolivia, Paraguay, Uruguay and Argentina, and has three major sub basins: the Paraná, Uruguay and Paraguay. The Paraná is already a strongly fragmented river, with many dams and hydraulic works. Fortunately, the other two major rivers in the basin, the Paraguay and Uruguay, have as yet few dams. The Paraguay is the central artery of the Pantanal, the world's largest tropical wetland ecosystem. The Pantanal wetlands are a complex system of marshlands, floodplains, lagoons and interconnected drainage lines. The flora and fauna of the area is extremely diverse and includes 80 species of mammals, 650 species of birds and 400 fish species. This is threatened by plans for the Hidrovía, which includes the channelisation of more than 3,500 kilometres of the Paraná and Paraguay Rivers. It is possible that, with increased access, the upper Paraguay basin will become more susceptible to dam development, further threatening the integrity of the basin. Besides the Hidrovía, six large dams are now under construction and 21 more are planned in this river basin, including the Corpus dam on the main stem of the Paraná, which will flood an area of 380 km².



Paraguay River, Pantanal, Brazil.



Tigris and Euphrates

This river basin is shared by Turkey, Iraq, Syria, Iran and Jordan and its vulnerability lies in its water scarcity and high risk of desertification. Since the 1950s, when the riparian states entered a self proclaimed "age of dams", dam development has featured prominently in the economic and social development of the region and land-use changes have resulted from these major hydraulic works. Degradation of the water sources in this basin is of particular concern for the biologically rich wetlands, such as the Mesopotamian marshlands in Iraq, that host a myriad of important species. The decline in fisheries alone will have a severe impact on the livelihoods of people who depend on them. Overall the basin is already highly altered by dams and irrigation canals, and with the new dams planned upstream, downstream water supply and hydrological regimes will be considerably altered. Water shortages in downstream countries are a distinct possibility. The Tigris and Euphrates basin also has 62 wetland-dependent Important Bird Areas . With a total of 26 large dams under construction or planned in this vulnerable area, there is cause for alarm and immediate action is needed to assess cumulative impacts and to mitigate the loss of species and habitats, particularly migratory birds and wetlands.

Species at risk

Looking across the basins, in terms of freshwater biodiversity impact, it is clear that some species are highly at risk. For example, river dolphins and porpoises are among the most threatened mammals in the world, and in the rivers at risk analysis, the 6 basins where these species live are all included among the top 'at risk' basins. Four out of the 5 species of Asian freshwater cetacean are either critically endangered or endangered according to IUCN's Red List of Threatened Species. These include the Yangtze River dolphin, the Yangtze River finless porpoise, the Indus River dolphin, and the Ganges River dolphin. The fifth species, the Irrawaddy River dolphin, is listed as data deficient, but is found mainly in the Irrawaddy and the Mekong, both of which are among the rivers at risk from dam development according to this analysis. Finally, the single South American freshwater cetacean species, the Amazon River dolphin, which is listed as vulnerable by IUCN, is found in the Orinoco and Amazon River basins, both also listed as rivers at risk in this analysis. While it is not dams alone that are bringing these species close to extinction, the altered flows and habitat degradation induced by dams are a significant threat to these species.

Other common patterns across the at risk basins, include endemic species of migratory fish, as well as important wintering and breeding sites for migratory birds, many of which are threatened with extinction. Of concern are several species of sturgeon, in Europe (Danube Basin), as well as in the Caspian (Qezel Owzan Basin and other smaller basins in Iran), and several species of endangered cranes (Siberian crane in the Yangtze basin in China) and other wetland-dependent bird species. Again, it is not dams alone that are threatening these species but the cumulative pressures from dams and other developments, as well as pollution. In the case of freshwater fish, the decline in fish population has serious socio-economic implications. In many of the basins identified in this study, freshwater fisheries have both a high commercial value and are important as a food source for the poor that is often underestimated.

The way forward

Dam technologies have improved over time. A large dam today can be more ecologically accommodating than past projects. Good site selection, such as avoiding building dams on the main stem of a river system, and better dam design can play significant roles in minimising impacts. Fish passes (where effective), the use of hydrological data (when available) to improve the replication of natural streamflow, and also emphasis on appropriate temperature and oxygenation of water released downstream can significantly improve the operation of large dams. Unfortunately, the lack of sound hydrological and biological data for many regions of the world can lead to unreliable predictions and inadequate mitigation measures.

Efforts by governments and industry to improve standards are welcome. However, the sheer scale of some dam construction schemes, with numerous dams in a river basin of high biodiversity value, makes the avoidance of major cumulative impacts virtually impossible, especially downstream and in the river deltas.

Best practice examples from around the globe demonstrate that it is possible to strike a balance between water and energy needs and environmental protection. To avoid large-scale damage, decision-making needs to include comprehensive needs, options and impacts assessments, including cumulative assessments of planned dams by river basin. Integrated River Basin Management (IRBM) provides the tools to assess and avoid basin wide impacts and meet the needs of a range of stakeholders, yet is still far from commonly applied. The World Commission on Dams (WCD) has provided a set of recommendations to improve decision-making, but these are still not being implemented in most countries. WWF is calling on governments and dam developers to apply the recommendations of the WCD and ensure that water and energy needs are met in a sustainable manner, without the destruction of the very ecosystems that provide the basis of a clean and stable water supply.



WWF's mission is to stop the degradation of the planet's natural environment and to build a future in which humans live in harmony with nature, by:

- conserving the world's biological diversity
- ensuring that the use of renewable resources is sustainable
- promoting the reduction of pollution and wasteful consumption

Taking action for a living planet

This report was prepared in cooperation with the World Resources Institute
www.wri.org

The full 'Rivers at Risk' report can be downloaded from:
www.panda.org/dams

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DamRight!

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