60 Harnessing Africa's rivers

Water is the critical resource of Africa. Large areas of the continent are deficient in water to the extent that cultivation is impossible. Other areas have a marked excess of water, often seasonal, leading to waste of a scarce resource and sometimes to destruction of life and land: drought and flood are characteristic of much of Africa. Yet irrigation and hydroelectric potential is very high. Therefore there is a premium on controlling and harnessing Africa's rivers.

Irrigation is most effective in those areas of Africa lying between the high rainfall equatorial zone and the deserts, an 'irrigation belt' from Senegal, through the Sahel, the Sudan, the Horn and east Africa, and most of southern Africa. Over this vast area low rainfall and high evapotranspiration conspire so that cultivation is made possible or at least is greatly improved by irrigation. Availability of water is critical: some small schemes use pumped ground water but the overwhelming majority of irrigation projects use water from rivers and lakes. The largest schemes are to be found where great rivers such as the Nile, Niger and Orange flow through the irrigation belt.

The high plateau surfaces of Africa, often saucer-like in structure, present an escarpment to the sea. Over and through this escarpment the rivers of Africa plunge, their volume and head of fall providing the continent with the world's greatest potential in hydroelectric power, much of it in the same great river valleys that also have high irrigation potential.

Most African rivers have a highly seasonal regime. River courses are often completely dry in one season, full of raging torrents in another. River mouths are sand-dune blocked lagoons for most of the year but then, in flash floods, spew out vast quantities of liquified topsoil to discolour the sea for miles from the shore. River flow is erratic, river flood is devastating. Protection can only come from careful control, an integrated system which involves not only the massive concrete structures of Aswan and Kariba but also small earth dams on minor streams and headwaters. Some idea of the scale of river control that is needed in Africa may be gained from the fact that in South Africa alone there are over half a million dams of all sizes. The process of controlling Africa's rivers has a long way to go.

Many large dams have been built in post-independence Africa but few since the 1970s. Most were primarily to produce cheap electricity, but some were also for irrigation and other purposes. Dams are beloved of politicians, national plan-makers, financiers and aid-donors alike. They are potent symbols of economic virility and political prestige; they are clearly visible,

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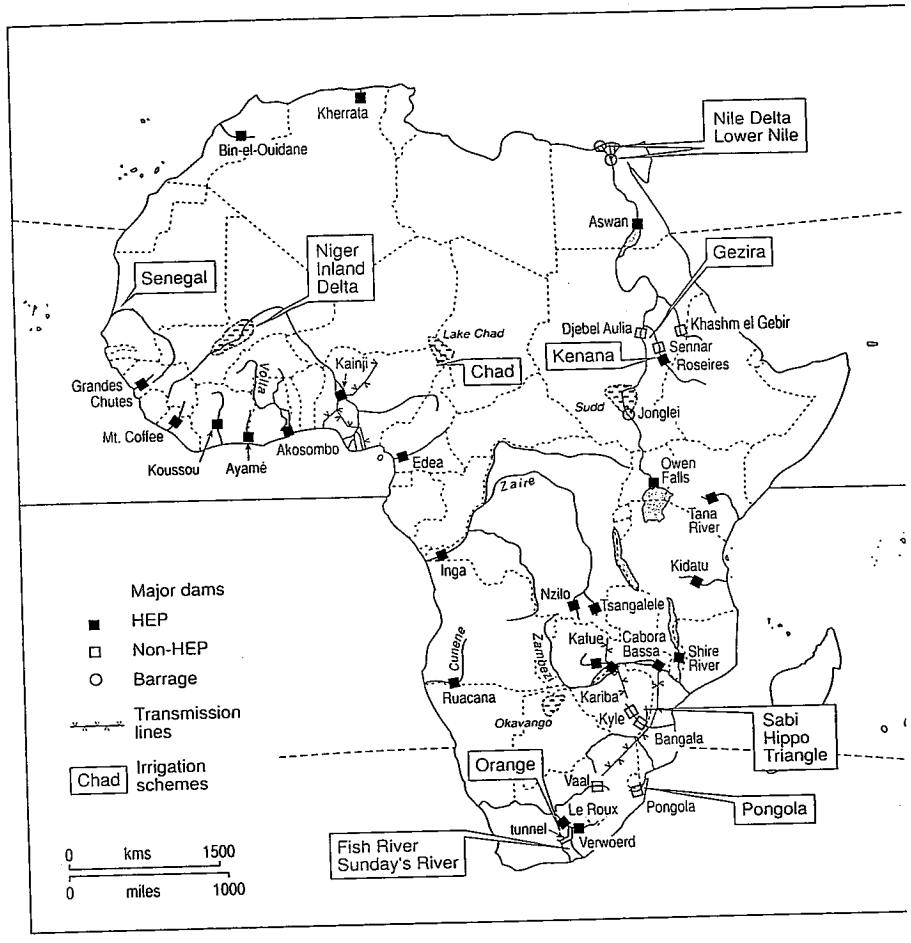


concrete and finite projects, demonstrably a basis for future economic and social development.

Not surprisingly, decisions to build dams often have been highly political and controversial. The Kariba dam was a symbol of federation between the Rhodesias, because it straddled the boundary between them, and so the technically superior Kafue site, near the copperbelt consumers, was passed over. Cabora Bassa, built in Portuguese Mozambique, was a manifestation of South Africa's outward-looking policy. Completion of the project coincided with the independence of Mozambique, but electricity flowed along the long transmission lines to Pretoria despite that. Kwame Nkrumah of Ghana was overthrown just before his great Akosombo dam was completed in 1966. The

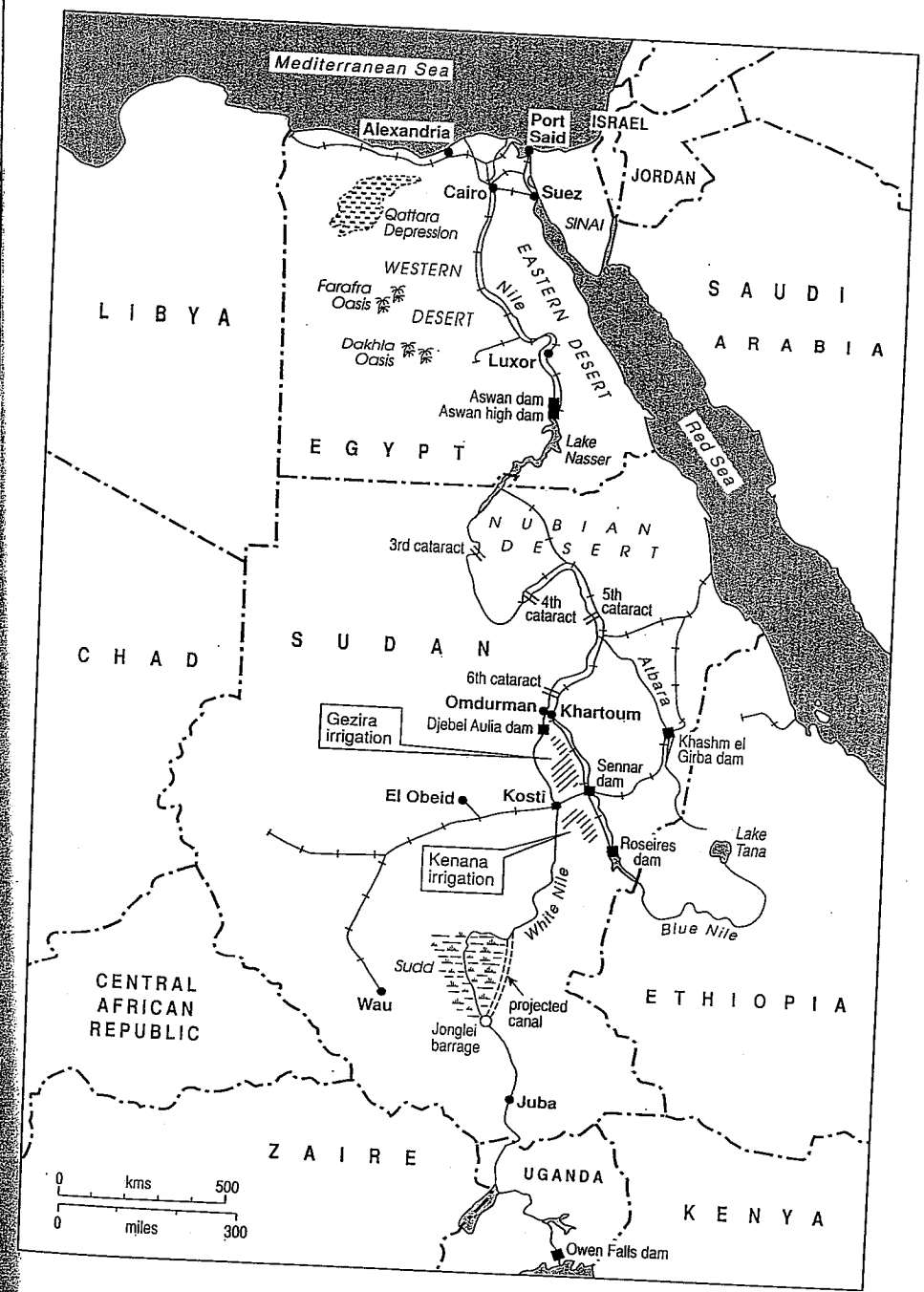
then high cost of the dam helped to cause his fall. Western reluctance to finance the Aswan high dam in Egypt opened the door to Soviet influence in Africa and precipitated the Suez crisis of 1956. Although many African dams have been one-off projects, some do form the basis of international co-operation. Akosombo electricity is supplied to Togo and Benin as well as Ghana, and Kariba supplies both Zambia and Zimbabwe. Yet the only river basins to have been harnessed on anything approaching a fully co-ordinated system are the Nile and the Orange.

For thousands of years people have understood the character of the Nile and have used it to create a great civilization based on intensive cultivation in an area surrounded by desert. Today, from the Owen Falls dam near Lake Victoria to the delta, people have sought to control and harness the Nile through modern technology. The first modern dam on the Nile was completed at Aswan in 1902 to store water for additional irrigation in the lower Nile valley and delta. It was designed to help to control the Nile's flood, which saw the September discharge of the river at about ten times the volume of the April discharge.

The flood comes mainly from the Ethiopian highlands via the Blue Nile which has an annual discharge about twice that of the White Nile. In 1925 the Sennar dam on the Blue Nile was completed to control that flood and to start the Gezira irrigation scheme, the largest in Africa. The first water agreement between Egypt and the Sudan in 1929 gave 5 per cent of the Nile's water to the Sudan. A new post-independence agreement in 1959 adjusted the Sudan's share to 20 per cent following a major expansion of the Gezira scheme, the Managil extension, which opened in 1958. Meanwhile a further measure of flood control and water conservation was achieved by the construction of the Djebel Aulia dam on the White Nile, 30 miles (48 km) above Khartoum. This dam was to pond back the more regular flow of the White Nile when the Blue Nile was in flood, so flattening out the flood peak to give Egypt the opportunity to conserve more water at Aswan.

Such international co-operation was largely a benefit of almost all of the Nile valley being under British influence, if not direct colonial rule. It enabled a detailed plan for water conservation and control, irrigation and hydroelectric power to be drawn up for the whole of the Nile basin and laid the basis for the co-operation and co-ordination which has characterized water development in the Nile valley in recent years.

In 1959 the Owen Falls hydroelectric dam near the Nile's exit from Lake Victoria was completed in order to provide cheap electricity for economic development in Uganda and also Kenya. The Aswan High Dam, which was completed in the late 1960s 4 miles (6 km) above the first Aswan dam, was both controversial and symbolic. Doubts were expressed at the wisdom of creating



the world's second largest man-made lake in one of the hottest, sunniest places on earth, at a site where the shallowness of the lake would add to the ratio of evaporation to storage capacity. Other experts confidently forecast that the dam would silt up very rapidly. But the real controversy, and perhaps the real source of at least some of the technical doubts, concerned its cost, over £400 million, and the source of the funding. The West turned down the opportunity to finance and build the project, anticipating Nasser's fall rather than that the Soviet Union would step in. Not for the last time in modern Africa was the West to misunderstand the motivation and determination of African leaders, and to fail to appreciate the political significance of a project which, assessed in narrow economic terms, might not appear to be a viable proposition. The High Dam became as much a symbol of Egypt's revolution and independence as Egypt's control of the Suez Canal itself. Aswan became the gateway for the Soviet Union's entry into African affairs, though it remained their only venture of that kind in Africa. The Aswan High Dam was

Selected major dams in Africa

Country	*Dam*	*River (basin)*	*MW*	*Date*
Angola	Cambambe	Cuanza	260	–
Cameroon	Edea	Sanaga	270	1966
Egypt	Aswan High	Nile	2100	1970
Ghana	Akosombo	Volta	792	1966
Ivory Coast	Kossou	Bandama	180	1973
Mozambique	Cabora Bassa	Zambesi	2000	1974
Nigeria	Kainji	Niger	960	1968
South Africa	Vaal	Vaal (Orange)	–	1928
	H.F. Verwoerd	Orange	320	1971
	P.K. Le Roux	Orange	220	1977
Sudan	Sennar	Blue Nile	–	1925
	Djebel Aulia	White Nile	–	–
	Roseires	Blue Nile	–	1968
	Khashm el Girba	Atbara (Nile)	–	–
Tanzania	Kidatu	Nkulu (Rufiji)	100	1975
Uganda	Owen Falls	Victoria Nile	150	1954
Zaire	Inga I	Zaire	350	1972
	Inga II	Zaire	1000	1977
Zambia	Kafue	Kafue (Zambesi)	750	1972
	Iteshiteshi	Kafue (Zambesi)	–	1976
Zambia/Zimbabwe	Kariba	Zambesi	1600	1960

Note: The installed hydroelectrical capacity (MW) shown is the latest known capacity, which may not be the original installed capacity.

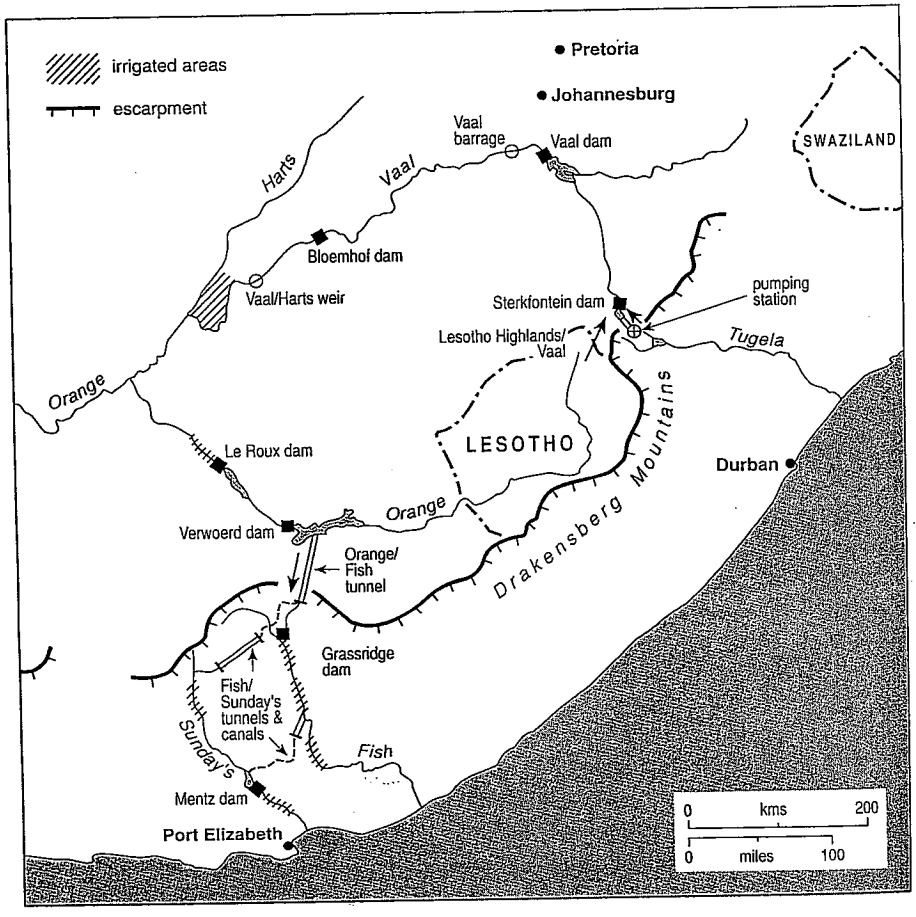
completed ahead of schedule to become the linchpin of the Egyptian economy. It has permitted a 20 per cent more intensive use of the previously irrigated land and has allowed 5–10 per cent more land to be brought under irrigation. It provides more than half of Egypt's electricity and protects the country from flood. Evaporation loss from Lake Nasser is high, about 10 per cent of annual flow, but silting is less than anticipated. Salinity has not been a major problem in the irrigated lands but imports of fertilizer have increased. Erosion of the delta coast is experienced with the attendant dangers of sea-water pollution but, on balance, the project has been an outstanding success.

An interesting offshoot of the High Dam project, which underlines the co-operation between Egypt and the Sudan, is the new dam and irrigation scheme at Khashm el Girba on the Atbara tributary of the Nile in the eastern Sudan. Here, people displaced by the creation of Lake Nasser from the Sudanese area around Wadi Halfa have been resettled around New Halfa at a cost, borne by Egypt, of £15 million. At Roseires a new dam was built across the Blue Nile in 1968 to provide additional water storage, flood control and a hydroelectric capacity. It also enabled the creation of the Kenana irrigation scheme of about 1 million acres (400,000 ha). Originally planned for commercial cotton production, the irrigation schemes are the economic heartland of the Sudan and are now also producing groundnuts and wheat as well as subsistence crops for the farmers themselves. In addition to the dams and barrages the Nile is also harnessed to many pump irrigation schemes, the possibilities for which have increased where water levels have been raised by the dams. Plans to increase the flow of the White Nile through the swamps of the Sudd have been set back by the continuing civil war in the southern Sudan. Much remains to be done before even the Nile is fully harnessed, but the need for river basin planning is amply demonstrated and the benefits from international co-operation are plain to see.

The only other African river basin whose potential has been realized to a similar degree is the Orange in South Africa. Its major tributary, the Vaal, flowing westwards from the eastern plateau edge, has long been carefully conserved to provide water for Johannesburg and the other Reef towns and, lower down, for the Vaal–Harts irrigation scheme. By 1974 the long-feared water supply constraint on the growth of the Witwatersrand approached as demand for Vaal water equalled reliable yield, but in the same year a project designed to augment the water yield of the Vaal came into operation. East of the Drakensberg escarpment water is in plentiful supply in the Tugela river basin, so the Tugela has been linked to the Vaal by a pumping scheme which raises Tugela water through a 1660 feet (506 m) vertical lift to the Vaal basin. There the water is stored in the new Sterkfontein earth dam. The project is designed to increase the net yield of water from the Vaal by about 25 per cent.

Future plans to enhance further the water supply in the Vaal basin are contained in the Lesotho Highlands water project, which was agreed between the governments of South Africa and Lesotho in late 1986. This allows for water to be dammed near the sources of the Orange river in Lesotho and then taken by tunnel to the headwaters of the Vaal.

The Orange River Project also transfers large quantities of water from one river basin to another. This project extends irrigation in the lower Orange river valley, gives greater control over a river where peak flow is sixteen times minimum flow, provides hydroelectricity and transfers water from the Orange to both the Fish and Sunday's rivers below the south-eastern escarpment for



the purposes of irrigation and of supplying the Port Elizabeth/Uitenhage urban-industrial complex. Although the main dams and tunnels were completed by the late 1970s, work continues on irrigation canals and smaller tunnels.