Zambezia (2001), XXVIII (ii).

DOMESTICATING A WHITE ELEPHANT: SUSTAINABILITY AND STRUGGLES OVER WATER, THE CASE OF CAHORA BASSA DAM*

ALLEN ISAACMAN
University of Minnesota

Abstract

This article explores the socio-economic and environmental impact of Cahora Bassa Dam and South Africa's destabilisation campaign on the communities and ecology of the Zambezi River valley in Mozambique. It argues that the historical memories and lived experiences of these riverine communities provide important insights into the history of the area and must take centre stage in any scholarly analyses of the history, role and impact of the Cahora Bassa Dam and that concerns with "development" must not be allowed to obscure some of the real negative effects of big dam construction on the lives and livelihood of the inhabitants and the damage to the surrounding environment in areas where such dams are constructed.

Since the end of the Cold War policy makers and students of international relations have begun to shift their attention from the threat of global conflicts to regional crises precipitated, in part, by the inequitable access to scarce natural resources. Fresh water is a particularly precious commodity. Besides air it is probably the single most critical ingredient in sustaining life and is integral to all societal and ecological activities. Recurring tensions between Turkey, Iraq and Syria over the Tigris and Euphrates rivers, the Hungarian-Czech dispute over the management of the Danube, South Africa's controversial appropriation of the waters of the Lesotho Highlands and the saber-rattling between the Koreas following Kim Il-Sung's plans to build a hydro-electric project on the Han River, underscore the political as well as symbolic importance of water (Gleick, 1999). Given the growing realization that competition for water resources is a volatile issue, scholars in the burgeoning field of "environmental security" have sought to map out the linkages between water allocation and conflict. They stress that inter-state tensions over fresh water resources or over their use have a long history and are not unique to a particular geographic or cultural region (Gleick, 1993).

* The research and writing of this article was funded by a Grant for Research and Writing from the John D. and Catherine T. MacArthur Foundation, as well as by a grant from the Graduate School of the University of Minnesota. The author wishes to express his gratitude to both institutions for their invaluable support.

Few water resource systems, if any, have been the object of more sustained military activity than Mozambique's Cahora Bassa hydro-electric project located on the Zambesi River. From the later 1960s when the Portuguese colonial regime announced that it was going to build the dam, until the 1992 peace accords between the Mozambican government and the South-African-backed RENAMO guerrillas, Cahora Bassa and its transmission lines were the target of repeated attacks. Initial opposition to the dam came from FRELIMO (The Front for the Liberation of Mozambique). The nationalist forces contended that Cahora Bassa was an integral part of a military and economic alliance between Portugal and South Africa designed to provide cheap energy to South Africa and perpetuate white rule in the region. For almost seven years, FRELIMO waged an unsuccessful guerrilla campaign to block construction of Cahora Bassa which was completed in December 1974. Six months later Mozambique gained its independence.

But independence merely intensified the conflict over Cahora Bassa between the new government and the apartheid regime. Stuck with the dam, the newly installed FRELIMO government had little alternative but to discard its long-term opposition to the hydro-electric project. In a radical departure from its previous stance, it hailed Cahora Bassa as a symbol of liberation which would help the people of Mozambique achieve economic prosperity, transform the strategic Zambesi valley and bring the impoverished nation a new source of hard currency by exporting energy to markets throughout the region, not just to South Africa.

But Pretoria had a different agenda. Concerned about FRELIMO's historic ties to the African National Congress (ANC) and its non-racial socialist agenda, South African security forces began a sustained military and economic campaign to destabilize the Mozambican government and destroy the country's infrastructure. High on its list was Cahora Bassa. For more than a decade, South African backed RENAMO guerrillas repeatedly sabotaged the dam's power lines effectively paralyzing the hydro-electric project, while simultaneously terrorizing hundreds of thousands of peasants who lived adjacent to the Zambesi River. Ironically, tensions over Cahora Bassa have persisted even after the dismantling of the apartheid regime and the ascension to power of the ANC. In 1998 South Africa refused to purchase electrical energy from Cahora Bassa without a rollback in prices that had been agreed upon the preceding year. As the new millennium approaches no energy from Cahora Bassa is being exported to South Africa — the dam's raison d'ētre.

Two themes dominate the literature on Cahora Bassa. Predictably, much has been written on the strategic dimensions of the hydro-electric scheme. This literature has been framed within the broader political economy of the region, the struggle to liberate Southern Africa and the

apartheid regime's efforts to maintain its hegemonic position. The other theme which has attracted a fair amount of attention is the engineering accomplishments of building Cahora Bassa. Set within the discourse of high modernism, colonial planners, civil engineers, hydrologists and a number of journalists hailed the dam's technical complexity and the skill required to construct the world's fifth largest hydro-electric power installation in a region which lacked the most basic economic infrastructure. The completion of Cahora Bassa, they contended, demonstrated that through scientific knowledge and modern technology, capricious natural forces could be harnessed and biophysical systems transformed to serve humankind. For all the concerns about human progress and national security, there has been a conspicuous absence of serious research and public debate on the socio-ecological transformations which Cahora Bassa has precipitated and its impact on human security and environmental sustainability within the riverine zone.

By shifting the principal angle of vision from a state-centric approach, which privileges military security and water resource development to one which explores the interconnection between livelihood security and national security consequences, this article addresses many of the silences in the literature. We know little about the lived experiences of the thousands of peasants forced to relocate from their historic homelands. Their story remains hidden in the opaque shadows of the dam. We know even less about the impact of Cahora Bassa on down-river communities, whose river-fed gardens and grazing lands are no longer seasonally irrigated by the Zambesi River and whose fishing lagoons have been greatly reduced. Similarly, we need to explore the impact of South Africa's destabilization campaign on the social and ecological resiliency of the diverse communities inhabiting the riverine zone.

Addressing these issues, even in the most preliminary way, does more than simply fill in a gap in the literature. It creates the possibility of writing an alternative history of Cahora Bassa,[1] one which stresses that human security and environmental health and security are inextricably intertwined (Adams, 1990; Chambers and Conway, 1992; Isaacman, 1997). This article examines how the socio-economic and ecological changes brought about by Cahora Bassa affected people's access to resources, their ability to utilize these resources effectively and their long term security and survival. It highlights the critical issue of what is being saved and for whom and in doing so links transnational and national factors to questions of sustainable local livelihood and who benefits from

[1] Allen Isaacman and Arlindo Chilundo are currently undertaking such a project.

the dam. It stresses that environmental policies and practices cannot be separated from issues of power and control over scarce resources and the two-way interaction between ecological transformation and human behaviour.

Because this article is concerned, above all else, with the sustainable livelihoods of communities affected by the dam, their accounts figure prominently. These oral testimonies not only challenge the prevailing colonial formulation but offer an alternative narrative — a detailed interior view of life before and after the construction of Cahora Bassa. They also provide important insights about how peasants perceived, explained and coped with ecological changes in the river basin over time and open up new areas of inquiry about the environmental impact of the dam.

THE HYDROLOGY OF THE ZAMBESI AND INDIGENOUS AGRONOMIC PRACTICES: AN OVERVIEW

Three hydrological factors are critical in understanding the rationale for constructing the dam and its relatively vulnerable geographic position. First, although the Cahora Bassa dam and reservoir are contained entirely within Mozambican territorial boundaries, the vast bulk of the Zambesi drainage basin, the third largest river system in Africa, lies outside of the country. Since Mozambique is at the end of the stream, it is dependent on its neighbours for access to the river's water. Second, there are only a few locations in the Zambesi basin suitable for reservoirs or hydro-electric plants. In most of the basin, located on the Central African plateau, the waters flow slowly through low plains and swamps providing few potential sites for dams. Third, and most relevant for this study, was the pronounced seasonality of Zambesi flows and the serious impact of annual floods on the riverine communities and their natural habitat as well as for the European sugar plantations located near the mouth of the river. Indeed, flood control was one of the presumed advantages of building the dam.

There is, however, another dimension to this story. Waters from the flooding river typically inundated the banks of the Zambesi during the rainy season months from December through March. When the waters receded, they left a rich deposit of nutrients along the shoreline. In lowland areas this spillover often extended over a several-kilometer stretch of land. Peasants throughout the valley considered these rich dark *makande* soils of the floodplains to be the most desirable agricultural sites in the region. Beatriz Maquina, an elderly women who had farmed her entire life, stressed that the "*makande* land located near the banks of the river always gave us good production. We cultivated a great deal of

sorghum as well as some corn".[2] All the elders with whom we spoke distinguished *makande* from the more common sandy, rocky *ntchenga* soils which did not retain water and were difficult to farm.[3]

Given the low and irregular rainfall in the Zambesi Valley, access to the *makande* river-fed soils was critical to insure household food security. Much of Tete district and the Lower Zambesi Valley has a semi-arid climate and savanna-like environment. The average annual rainfall in much of Tete is only 600 millimeters (Davies, 1986, 233). Droughts occur regularly, often with devastating consequences to the crops. Without *makande* lands peasant households faced the prospect of periodic crop failures on a regular basis and, even in the best years, little likelihood of producing a second annual crop. This vulnerability was true down river as well, where rainfall was more appreciable, but still erratic.

Peasant cultivation of river-fed land constituted a critical feature of the complex and highly adaptive indigenous agronomic system. Drawing on a rich repertoire of farming practices, born out of years of trial and error and detailed micro-ecological knowledge, local communities creatively adapted to the uneven soil quality, fluctuations in rainfall and challenges of flooding. Carlos Soda Churo, who was forced to relocate because of the dam, described farming practices prior to the impoundment, in some detail:

> Before Cahora Bassa each family had several fields. The number and size varied depending on strength of a person and the size of his family. The land near the river was very good. It was called *makande*. When the river rose and then receded in June, the area that had been covered with water was very good for farming. There we first planted maize. We cultivated beans in the same field as the maize. Beans needed something to rest on and the maize stalks served well. Nearby we cultivated a second small plot with sweet potatoes, tomatoes, cabbage and more beans. We harvested our gardens in September and October before the rains and flooding. By November we were working in our larger fields away from the river. On the *ntchenga* soils we planted sorghum, which does not require as much water. The mixed *ntchenga-makande* soils were better for maize, which needs more moisture than sorghum. Some people planted peanuts in their maize fields. We harvested these crops in June and July and then returned to our gardens.[4]

---

[2] Interview with Senteira Botão, Eliot Jumbo Muatisembero Sargento and Beatriz Maquina, Chipalapala, 26 May 1998

[3] *Ibid*; Interview with Senteira Botão *et al*; Interview with Supia Sargent and Carlos Soda Churo, Estima, 22 May 1998; Interview with Sene Simico, Mauzene Dique and Mzwengane Mafala-Njala, Nyatapiria, 27 May 1998; Interview with Bento Estima and Joseph Ndebvuchena, Estima, 19 May 1998.

[4] Interview with Supia Sargent and Carlos Soda Churo, Estima, 22 May 1998.

Churo's account underscores three important features of the indigenous agronomic system. First, and foremost, the food production systems of local agriculturalists co-evolved with the seasonal cycle of the river's flooding patterns. Decisions regarding the spatial and temporal patterns of food production — including selection of the most appropriate crops and amounts planted, with reference to the season and different micro-ecological zones — were finely tuned to changes in the river's discharge rates as well as variations in soils and sunlight. Second, intercropping was an effective labour saving device, since several crops could be tended simultaneously. Cultivating peanuts in maize fields had the added advantage of restoring badly needed nutrients to depleted *ntchenga* soils. Finally, households spent most of the year engaged in agricultural production in order to minimize labour bottlenecks and to ensure an adequate supply of food.

To be sure, February and March were the "hungry months". It was a period in the agricultural cycle when typically peasants had less to eat, having consumed much of the previous year's grains which were the mainstays of the diet. But unlike other regions of Tete, where Africans did not have access to rain-fed fields, the situation of peoples living in the river valley was never precarious (Jackson and Rogers, 1976, 377).

The free flowing Zambesi provided sustenance to riverine communities in two other important respects. Before Cahora Bassa, approximately 60 species of fish inhabited the river (Jackson and Rogers, 1976, 377). While the density of most species varied, elders recalled that the Zambesi provided an abundance. They relied on a variety of fishing techniques. Some used nets, made from sisal and cord, which they laid in the main channel of the river. Others paddled their canoes to rich fishing grounds, where they deposited poisons from local plants into the water.[5] Most fishermen used locally produced weirs (*mackonga*) which they placed at strategic points near the shoreline.

> We fished with *mackonga* in which we placed bits of *massa* [porridge]. The fish, attracted by the *massa*, would enter the *mackonga* and they would be trapped. The next morning we would return. The *mackonga* would be filled with fish, some of which we traded with our neighbors for sorghum, maize or even a chicken. People who had nothing to trade could buy a large fish for five escudos [about 17 cents].[6]

The river also attracted large herds of animals from the nearby forests. Impala, gazelle, elephants, buffalo and eland regularly watered

---

[5] Interview with Supia Sargent and Carlos Soda Churo.

[6] Interview with John Paul and Khumbidzi Pastor.

on the banks of the Zambesi and adjacent wetlands, where they became easy prey for skilled hunters.

> Not everyone hunted, only those who were good with *gugudas* [muzzle-loading rifles]. Those hunters we called *Nkumbalume*. There was a lot of game, so they did not have to go far to find it. The hunters traded most of the meat for maize. Sometimes they sold a piece for sixpence. These hunters also had fields. They gave some of the game to the people who worked in their gardens.[7]

Game was an integral part of the local diet. As a relish accompanying the evening porridge, it provided an important source of protein. Peasants also consumed meat in larger amounts at important social occasions and at rituals propitiating the ancestor spirits. All of this changed, however, with the construction of Cahora Bassa.

THE STRUGGLE TO BUILD THE DAM

For centuries, the majesty of Cahora Bassa Gorge, located 400 miles from the mouth of the Zambesi River, had awed colonial officials. But it was only in the 1950s, after the British had constructed a dam 100 miles up-river at Kariba, that Portuguese colonial planners began to contemplate a similar undertaking at Cahora Bassa Gorge. In 1956 the Overseas Minister, Raul Ventura, dispatched a team of hydrologists to Cahora Bassa. The scientists surveyed the Zambesi region in May and June 1956 and issued a highly influential and optimistic report.

> It is clear that the utilization of those possibilities, accompanied by a well-defined policy of industrial development and mineral prospecting and mining could completely transform the economic prospects for the Province of Mozambique and, in consequence, for metropolitan Portugal. Rarely have conditions occurred which are so favorable for the economic development of a region.[8]

Within a year the Salazar regime had established a river basin authority whose mandate was to develop the Zambesi basin. The Missão de Fomento e Povoamento de Zambeze (MFPZ) was modeled on the Tennessee Valley Authority. Five years later the MFPZ produced a voluminous fifty-six volume final report, which confirmed the previous assessment.

What is most striking in these documents is the scale of the project and how radically different it was from its British counterpart. Kariba was designed simply as a hydro-electric scheme to provide cheap energy for

---

[7] Interview with Supia Sargent and Carlos Soda Churo.

[8] Quoted in P. Bolton (1983), 'The Regulation of the Zambezi in Mozambique' (Unpublished Ph.D. Thesis, University of Edinburgh), 445-446.

the copper mines in colonial Zambia and for the European farming and industrial sectors in colonial Zimbabwe. By contrast, Portuguese planners conceived of Cahora Bassa as a multipurpose project designed to expand agricultural productivity, develop mining and promote forestry, reduce Mozambique's dependence on foreign imports and enhance the living conditions of the indigenous populations.

Unlike Kariba, Cahora Bassa also had two important security dimensions. Portuguese officials believed that the project would help blunt guerrilla advances south of the strategic Zambesi river in two important ways. They hoped that the lake behind the dam, stretching from Songo to Zumbo, would impede the relatively easy access FRELIMO forces had to the heart of Mozambique from its bases in Zambia and Malawi. Lake Cahora Bassa, projected to be 500 kilometers in length and, at places, several kilometers in width, would be a formidable geographic barrier. Moreover, they predicted that the anticipated economic development which the hydro-electric project stimulated would dramatically increase the size of the white settler community in the region who would provide the first line of defence against the exiled African guerrillas. Colonial planners estimated that as many as 80,000 immigrants would settle in the Zambesi Valley, including many former soldiers. The Portuguese Chief of the General Staff General V. Deslandes was unequivocal about the strategic role which these armed communities would play.

> It is urgent that we settle in the overseas territories the biggest possible number of former military people. The collaboration and mutual support between the civilian and military populations, the absolute coordination between the military, political, social and economic actions, is the only way to achieve the desired victory (Quoted in Marchant, 1971).

Economic realities, however, compelled colonial officials to scale back their ambitious plans. With little prospect of investment in the project from metropolitan investors and little evidence of settler interest in this malarial-infested region, a multiple purpose seemed less viable. Mozambique's inability to consume even ten percent of the anticipated 2 075-megawatt output from Cahora Bassa made the project even more problematic.

Military pressure and growing international opposition further complicated matters. FRELIMO had vowed to sabotage Cahora Bassa. In 1968 they initiated a guerrilla offensive in Tete, district home of Cahora Bassa. By the end of the decade a sizable force was operating in the area adjacent to the proposed dam site. One senior Portuguese military official estimated that at least 1 800 well-armed guerrillas had crossed the Zambesi from Zambia and Malawi and were beginning to pose a serious threat

(Nussey, 1971). FRELIMO's anti-dam strategy benefited from a well-organized and highly visible international campaign to block western financing and construction of the dam. "What happens at Cabora Bassa" declared the Programme to Combat Racism of the World Council of Churches, "is central to the fight for Mozambique and to the future of Southern Africa" (World Council of Churches, 1971, 2). Moral outrage and threats of boycotts, motivated a number of Italian and Swedish companies to withdraw their support for the project (UN Conference Room Paper, SCI/71/5, 38).

The security threats and economic uncertainty compelled proponents of the dam within the Portuguese state to lobby for an energy and military agreement with South Africa which would guarantee a market for Cahora Bassa's surplus power and incorporate Mozambique into South Africa's security zone. Based on projections that its power requirements would double between 1967 and 1980, the apartheid regime needed a secure supply of cheap energy and was anxious to blunt the "black onslaught."

In 1969 Lisbon signed a $515 million agreement with ZAMCO — a South African-dominated consortium with partners in West Germany, France, Italy, and Portugal — to build the dam. This agreement reconfigured the Cahora Bassa project into a single purpose hydro-electric scheme financed by the sale of cheap electrical power to South Africa.[9] Like the export of Mozambican labour to the South African gold mines, it was an example of the power of the apartheid regime to capture Mozambican resources.

While colonial officials focused on the financial and security dimensions of the dam, state planners paid scant attention to the impact of the hydro-electrical scheme on African peasants and their environment. They presumed that increased economic activity would have a trickle-down effect on 'subsistence' African cultivators living in the Zambesi basin. Authorities expressed confidence that the riverine communities would benefit from the introduction of new farming techniques, new markets for their commodities and new job opportunities and being regrouped into modern villages (Vidigal, 1970, 158).

State planners gave even less consideration to the ecological consequences. In 1973, the Missão de Ecológia Aplicada do Zambeze (MEAZ) commissioned a pre-impoundment survey of water quality, vegetation, soils and climate (Hall, Valente and Davies, 1977). The following year a small team of researchers affiliated with the University of Lourenço Marques conducted a biophysical survey of the Lower Zambesi Valley

[9] For a detailed discussion of these negotiations see Middlemas (1975), 20-30.

(Davies, 1996). Underfunded, poorly conceived, and often of shoddy quality, these investigations yielded few insights into the Zambesi's ecosystems (Davies, 1996). One scientist closely associated with the project decried

> the lack of ecological specialists with local knowledge who should be dealing with the interdependence and interrelationships of the whole Lower Zambesi as one integrated system. This danger is compounded as authority in both land-use planning and decision-making is vested in non-ecological experts (Tinley, 1975, 24).

Economic planners and civil engineers committed to completing the construction of the hydro-electric project without delay simply ignored the research from scientists that ran counter to their grand design (Davies, 1996).

Elsewhere I have written about the actual construction of the dam (Isaacman and Sneddon, forthcoming). Suffice to say that the colonial regime built the hydro-electric project on the backs of 3 000 African labourers who constituted the bulk of the work force.[10] Although nominally free, the Africans were recruited into a highly regimented and racialized labour regime. It was a regime in which (1) Africans were assigned the most gruelling and dangerous tasks, (2) work obligations were often secured through coercive extra-legal methods, (3) Africans were prohibited by custom and practice from holding supervisory positions, (4) the living and working conditions of black labourers was distinctly inferior to that of their European supervisors, and (5) Portuguese officials brutally stifled any dissent. Júlio Calecoetoa described the unrelenting pressure to work longer and harder.

> The Africans who broke the boulders were organized into groups of six men, each with its own capitão [overseer]. The capitão was African. The boss over all of them was Silva. The Africans worked very hard. The capitães were chosen because they could speak Portuguese. They told the workers what to do; they did not do the work themselves. From time to time the capitão would beat people he did not think were working hard enough. There were never any strikes. If people had struck, they knew they would be beaten with the *palmatoria*. When Africans were angry they worked more slowly, but if the boss noticed that he would tell the capitão to whip them.[11]

Harsh conditions and the pressure to meet deadlines created a precarious work environment. On November 19, 1973, six African workers were killed and eight others seriously injured when a stabilizer collapsed

[10] There were approximately 750 Europeans who held all the technical, administrative as well as most clerical positions.

[11] Interview with Júlio Calecoetoa, Songo, 18 May 1998.

in one of the pressure release tunnels (*Rhodesia Herald*, November 17, 1973, 2). To this day, memories of industrial accidents remain etched in the minds of many former workers. Listen to words of Pedro da Costa Xavier.

> At the intersection of two tunnels a large rock, larger than this house, fell, collapsing the tunnels and trapping the men and machines inside it. Company officials were unable to rescue the men and they ultimately had to seal off the tunnel. Many people died. It was more than twenty. There were smaller accidents as well. When the ropes, which were harnessing men working on the edge of the dam broke, people would fall to their deaths. Sometimes, when we were working in the tunnel, there would be rockslides and people would be killed. Others would suffer serious injuries. It was very dangerous work, not only for the Africans, but for the Europeans who worked with them.[12]

In addition to such catastrophes and occasional labour unrest, colonial authorities faced a concerted campaign by FRELIMO to subvert, harass and impede construction of the dam. Although senior nationalist leaders made bold pronouncements about sabotaging the project which helped to fuel the international boycott, this was never a realistic option. The colonial regime had erected three heavily armed defensive rings around Songo enclosed by doubled barbed wire fences and one of the world's largest minefields, making it virtually impossible for the guerrillas to get within striking distance of the dam. Instead small bands of insurgents mined the dirt roads and railroad lines and ambushed trucks carrying essential equipment to the dam site. To minimize these attacks the Portuguese tarred the mail road between Songo and Tete, cleared the bush adjacent to the roads, organized daily convoys and patrolled the train tracks more aggressively. Nevertheless these defensive tactics did little to dislodge the insurgent forces. In November 1972 FRELIMO forces launched their boldest initiatives, highlighted by a mortar attack on the provincial airbase at Tete and eleven attacks on trains bringing critical material from the Indian Ocean port of Beira to Cahora Bassa (*Rhodesia Herald*, November 17, 1972, 3). During the next two years they continued to ambush lorries, attack trains and periodically blow up roads and bridges. There is also some evidence that they began to target power lines built to transmit energy to South Africa which were particularly vulnerable. Despite FRELIMO's efforts, by 1974 the widely acclaimed dam was virtually complete. Lost in the shuffle were the thousands of Mozambican peasants who had been forcibly relocated from the flood plains.

---

[12] Interview with Pedro da Costa Xavier, 23 May 1998, Songo.

THE IMMEDIATE CONSEQUENCES OF CAHORA BASSA: DISRUPTING RIPARIAN COMMUNITIES

Colonial planners stressed that the long-term benefits of the dam would far outweigh any short-term inconveniences in the lives of the riverine communities. Despite such assurances, Cahora Bassa had immediate, multiple and far-reaching consequences for the displaced communities whose homelands and farms were flooded to create the massive lake behind the dam. Yet it was not simply being evicted from their homes and ancestral lands that proved so devastating. Unlike other powerless groups around the world displaced by hydro-electric schemes, the Zambesi peasants were herded into strategic hamlets with few basic amenities. These *aldeamentos* were an integral part of Portugal's broader counterinsurgency programme designed to cut FRELIMO off from its rural base of support[13] (Jundanian, 1974). A South African journalist who was one of the few foreign reporters allowed into the war zone noted the close linkages that FRELIMO had already forged with the peasantry. "It is axiomatic that guerrillas cannot be beaten if the local people support them from fear or desire. Strong local support is shown by how little information Africans here give the Portuguese about FRELIMO" (Nussey, 1972, 1).

Claiming to protect the peasantry, Portuguese officials began to evict communities near the damsite in 1972, two years before the actual impoundment of the river. Local authorities, facing the pressure of an expanded war and construction deadlines, rarely even bothered to pay lip service to the notion that peasants should be persuaded to move voluntarily. Pezulani Mafulanjala, Maurício Alemão and Bernardo Tapuleta Potoroia of Masecha remembered what happened the day they were told to move:

> They came and told us that the water was going to rise and that we would have to leave . . . Among us there were people who complained and did not want to move. They were very angry because they had fields and houses here and their whole life was here. But they had no choice.[14]

Although colonial authorities initially claimed that only 25,000 Africans would be displaced, by the end of 1973 the number had jumped to over 42,000[15] (GPZ, 1974, 28). Conditions in the camps were rudimentary at

[13] For a broader discussion of this policy see Brendan Jundanian, 'Counterinsurgency in Mozambique'. *World Politics* (1974), 519-540.

[14] Interview with Pezulani Mafulanjala, Maurício Alemão and Bernardo Tapuleta Potoroia.

[15] This figure includes Africans relocated down river at Caia. It is difficult to determine the actual number since there was a great deal of secrecy surrounding the forced villagization programme. One author estimated that upwards of 200,000 peasants in Tete district were interned (Jundanian, 1974).

best. A typical *aldeamento* contained between one thousand and fifteen hundred residents. They lived in mud and wattle huts laid out in a grid enclosed by a barbed wire fence. The original plans called for each *aldeamento* to include a school, health clinic, water pumps, grist mills, warehouse for food reserves, social hall and football field costing more than $9 million (Bolton, 1983, 363; GPZ, 1971, 46; GPZ, 1972, 20). Except for a handful of model encampments, few of the "protected villages" had all, or even most, of these amenities (Jundanian, 1974, 527).

Peasants were effectively held captive. Their only access to the outside world was through a military check point manned around the clock by local militia. Pezulani Mafulanjala described the sense of being under constant surveillance:

> We started working in our *machambas* [fields] at six in the morning and we were required to leave the fields between twelve and twelve thirty. We had to be back in the *aldeamento* by one. We were always accompanied by the patrol. They guarded us to make sure that we did not have any contact with strangers in the bush. If you came back late you were interrogated about where you were and what you were doing. The militia then handed over the tardy individual to PIDE and they were charged with secretly providing food to FRELIMO. The accused were severely beaten and threatened before they were allowed to return home. Some even died in the interrogation.[16]

As Mafalanja's account suggests, the designated lands which the government had cleared were rocky, hard to work and not very fertile and often far from the strategic hamlets. They stood in sharp contrast to the lands left behind. Jack Sobrinho, who was forced to relocate to an *aldeamento* in Estima summed up the general consensus: "The land at Chicoa Velha was good land. The land here was hard and full of rocks, so it produced nothing."[17] The arid conditions and absence of rain-fed lands dramatically reduced agricultural yields. So too did the colonial policies which limited each household to one small plot — typically less than a hectare in size. Peasants were forbidden to farm two or three fields strategically located in different ecological zones in order to take advantage of variations in soils, sunlight and moisture availability and to minimize risks. Government agronomists, by discouraging intercropping on the grounds that it created "messy" fields, exacerbated the problems of productivity.

In light of the restrictive government policies and the harsh environment, it is hardly surprising that the displaced communities

---

[16] Interview with Pezulani Mafulanjala, Maurício Alemão and Bernardo Tapuleta Potoroia.

[17] Interview with Jack Sobrinho and Wiseborn Benjamin, Estima, 20 May 1998.

experienced increased food shortages and malnutrition. The elders were right. Without rain, good lands and sufficient time to work the fields, there could be no corn or sorghum.[18] There were also fewer opportunities to make up food deficits through hunting and fishing. Despite government plans to protect the herds which roamed in the river valley and adjacent forests,[19] large numbers of animals drowned when the Zambesi was impounded. Even in those areas where game survived, Portuguese military authorities prevented peasants from carrying rifles and severely restricted their movement.[20]

Food shortages were not the only social problem these uprooted communities experienced. As in other dam projects throughout the world, sickness and death rates seem to have increased markedly especially among the very young and very old (McCully 1997, 80). It is important to stress that the evidence before and after the impoundment is fragmentary and that health and sanitary conditions varied from one strategic hamlet to another. Moreover, the colonial regime did try to inoculate at-risk populations to prevent tuberculosis and yellow fever and provided medication to limit the debilitating effects of malaria (GPZ, 1974, 59-63). Nevertheless, the data suggest that inadequate rural diets, combined with problems caused by poor sanitary conditions regularly exacerbated by heavy rains in January and February, left many rural communities reeling from cholera. In *aldeamentos* located near Lake Cahora Bassa water-borne parasitic illnesses such as schistosomiasis and malaria posed new health threats (Bolton, 1986, 161-162). Bernardo Tapuleta Potoroia recalled that time with anguish:

> There was a great deal of hunger and many people also suffered from diseases during this period. There were serious problems with cholera, small pox, and malaria. Many people died. No one knew why or how this happened, just that many people were dying.[21]

The commonly held explanation for these misfortunes — that the flooding of sacred shrines and burial sites had alienated powerful royal ancestor spirits (*mhondoro*) — underscores the sense of cultural obliteration and vulnerability experienced by the uprooted peasants. Most *mhondoro*, through their earthly spirit mediums (*svikiro*) opposed the impoundment because sacred sites would be inundated and lost to

---

[18] Interview with Pezulani Mafulanjala, Mauricio Alemão and Tapuleta Potoroia.

[19] For a discussion of this ill-fated plan see A.H.M., Governo Geral, Cota 864, 'Plano Base Para Salvamento e Transferencia da Fauna Brava da Albufeira de Cahora Bassa em Moçambique', K. L. Tinley, March 1973.

[20] Interview with John Paul and Khumbidzi Pastor.

[21] Interview with Pezulani Mafulanjala, Mauricio Alemão and Bernardo Tapuleta Potoroia.

posterity. Many spirit mediums also objected to their subjects being moved outside of their spiritual domain.

> When the people were forced to move, the *svikiro* left as well. The *svikiro* wanted to live elsewhere, but the government forced them to live in the *aldeamentos*. The *svikiro* became angry and warned of calamities. When the *svikiro* died, the *mhondoro* disappeared and never returned.[22]

Other *svikiro* refused to move and fled into the bush where they were never heard from again. Their absence was devastating. "There were no spirits to make it rain."[23]

In the final analysis, displacement adversely affected everyone, but it did not necessarily affect them equally. Chiefs, who received housing (Overseas Companies of Portugal, n.d.), state subsidies and choice tracts of land, suffered less than their subjects. Peasant women probably suffered more than their male counterparts. Certainly the demands on their labour were greater. Most were forced to cope as best they could with the hardships of daily life inside the strategic hamlets. This meant caring for children, walking long distances to gather firewood and fetch water, assisting the sick and the elderly and performing a wide array of other household chores in addition to working on their household plots. By contrast, most men simply farmed. Others clandestinely fled to Zimbabwe or found employment at the dam site. However difficult the living and working conditions of these male labourers, they were appreciably better than being penned up in the *aldeamentos*.[24]

The profoundly negative social effects were mirrored and exacerbated by their devastating impact on the hydrology and ecology of the riverine zone. While many of these changes became apparent only after several years, some of the detrimental processes that the dam's construction set in motion occurred almost immediately. Following completion of the construction phase, state officials — disregarding the suggestions of environmental scientists contracted to study the dam's likely ecological impacts — rushed to fill the reservoir as rapidly as possible. Their mandate was to begin generating electricity as originally scheduled, regardless of the consequences. "Lake" Cahora Bassa began to rise from the river bed on 5 December 1974 and reached nearly-full capacity approximately four months later at the end of March 1975. The extreme

---

[22] *Ibid.*

[23] Interview with Sene Simico, Mauzene Dique and Mzwengane Mafala-Njala, Nyatapira, 27 May 1998.

[24] Interview with Vernácio Leone, Estima, 22 May 1998; Interview with John Paul and Khumbidzi Pastor.

haste of the operation is clear when compared to the filling of Lake Kariba, which took nearly four years to reach full capacity (Bond *et al.*, 1978, 445). In an extraordinarily short period of time the dam generated a lake where before there had been a river, destroying lands and animals critical to the local human ecology of riverine communities and creating a drastically different ecological setting.

The most immediate effect was the permanent inundation of 2,700 square kilometers of land under the reservoir. These lands were highly productive floodplains effectively used by peasant communities for centuries. Pezulani Mafulanjala, Maurício Alemão and Bernardo Tapuleta Potoroia recalled the high moisture retention capacity of the river-fed *makande* soils which made it ideal for the culture of a variety of foodstuffs in the Masecha region. "All the crops grown on the *makande* had a good supply of water and nutrients. In some lowland areas the river deposited sediments on banks for 2-3 kilometers from the river."[25] Other residents remembered stretches of the river where floodwaters would extend for seven to nine kilometers on either bank during the flood season.[26]

The inundated floodplain habitats also constituted some of Mozambique's most diverse ecosystems. The dry savanna near the river had supported numerous trees whose leaves would fall and act as natural fertilizer upon decomposition. Some idea of the diversity of tree species in the region is provided by accounts of people who, during times of drought, would forage for wild fruit.[27] These riparian ecosystems also supported substantial numbers and types of animal species, including elands, bush pig, buffalo, nyasa, gazelle, elephant and rhinoceros.[28] Despite the government's highly publicized plan (termed "Noah's Ark") to protect wildlife,[29] officials did little. The effects were devastating. Bento Estima and Joseph Ndebvuchena remembered that,

> After the flooding began many animals were stranded on Tanzwa and Manherere which are islands in the Zambesi. Some died on these islands because they could not get enough food. As the water kept coming higher, many animals were swept away if they couldn't swim to the other side of the river.[30]

Supia Sargent and Carlos Soda Churo of Estima evoked a similar scene, describing how "after the lake rose, animals fled to the islands and

---

[25] Interview with Pezulani Mafulanjala, Maurício Alemão and Bernardo Tapuleta Potoroia.

[26] Joint interview with Supia Sargent and Carlos Soda Churo.

[27] Interview with Vernácio Leone, Estima, 19 May 1998.

[28] Joint interview with Jack Sobrinho and Wiseborn Benjamin, 20 May 1998.

[29] A.H.M., Governo Geral Cota 804, 'Base plan for rescue and translocation of wildlife from the Cahora Bassa Dam in Moçambique' K. Tinley, March 1973.

[30] Interview with Bento Estima and Joseph Ndebvuchena.

died of starvation. Others, who could swim, swam to the banks of the rising lake and ran away."[31]

In addition to the rapid and permanent inundation of ecologically important riverine lands, the decision to fill the Cahora Bassa reservoir at break-neck pace also had far-reaching consequences for human communities and ecological systems downstream. Despite the hydrologic fact that the portion of the river below Cahora Bassa was highly dependent on the main channel for continued flows, dam operators refused to allow compensatory releases through the dam during the filling of the reservoir. The flow rate of less than 60 cubic meters per day for over three months had catastrophic results below the dam.[32] The river was stopped in December precisely when the annual inundation of floodplains for agricultural production typically occurred. This was also a time when many fish species of the Lower Zambesi begin to spawn in adjacent floodplains. With closure of the dam and discharge reduced to ten percent of its average, the fish were stranded as flood waters receded. Local farmers who depended on fish for supplemental protein harvested them in large numbers during this period, placing further pressure on fish populations. Commenting on the reckless pace of filling, one scientist lamented, "Our work was ignored by the very people who requested the [ecological] survey in the first place" (Davies, 1975, 27).

In April, with construction of the dam and turbines almost complete, HCB engineers discovered a small defect in one of the turbines deep in the water of the almost full reservoir. Without any warning or consultation, they opened the turbines and sluice gates to full capacity and delivered an unnatural coursing of floodwaters downstream from the dam. Numerous small-scale farmers, at the time residing close to the river's edge to take advantage of the fertile soils, lost significant numbers of cattle and small poultry, and, in many cases, almost lost their lives. Upon repair of the fault, the dam operators again shut off the river's water causing a severe water shortage in the city of Tete and everywhere else downstream (Jackson, 1997). By May and early June, the gates of Cahora Bassa were

---

[31] Interview with Supia Sargent and Carlos Soda Churo, Estima.

[32] This decision was made in spite of recommendations from the environmental research team, particularly Davies, that the filling of the reservoir occur at a pace to ensure a minimum discharge rate from the dam of between 400 and 500 cubic meters *per second*. Davies and Dr. Luis Bareto, then Director of the Instituto d'Agronomia in Laurenço Marques, strongly requested (in Davies' words "almost demanded") several measures in addition to a minimum flow rate to head off what they believed would be the disastrous effects of the planned releases. These included: a two-and-one-half year minimum filling period; releases from the dam timed to match dry and wet season flows in the river; and no filling during the next summer flood (December-January). None of these suggestions was implemented (Davies, 'Rehabilitation programme').

being opened and closed on a daily basis, timed to the power generation schedules of HCB engineers. At no time in the first six months of the dam's operation were the waters of the reservoir stagnant, and the pattern was "that of a vast mass of raw floodwater in constant, though very slow, motion down the dam" (Jackson and Rogers, 381). The transformation of the river's annual cycle from a punctuated, highly seasonal flow regime to one characterized by constant flows throughout the year was complete. The Lower Zambesi had become a regulated river whose principal function was to provide cheap energy to South Africa.

SOUTH AFRICAN DESTABILIZATION AND THE FAILURE TO DOMESTICATE A WHITE ELEPHANT

With independence and state power, FRELIMO was theoretically positioned to set in motion policies which, over time, might transform Mozambique's distorted economy and reduce the new country's dependence on the apartheid regime. Cahora Bassa figured prominently in their new agenda. Mozambican state planners, committed to large scale social engineering, were confident that the hydro-electric project would play a pivotal role developing the Zambesi Valley and improving the lives of millions of Mozambicans across the country who lacked electricity. Together with the organization of a network of state farms and communal villages, Cahora Bassa would, in the Marxist parlance of FRELIMO, be instrumental "in the socialization of the countryside." President Machel was adamant on this point.

> We cannot irrigate without energy. The electrification of the central area of the north and of the south of our country is fundamental for us to be able to meet the needs of agriculture. We must domesticate the "white elephant" Cahora Bassa. This "elephant's" ivory — electricity and irrigation — should go to our agriculture and industry . . . Within the next decade the north bank power station [at Cahora Bassa] must begin functioning and numerous dams must be built for irrigation and electrification (Agência de Informação de Moçambique [A.I.M.], "Information Bulletin", 38, 1979, 6).

Domesticating the "white elephant" was not an easy task. Under the 1974 Lusaka Peace Accord, Lisbon assumed responsibility for the massive debt incurred in building the dam. Until it was repaid, Portugal rather than the Mozambican state, retained effective control over Cahora Bassa.[33] That Mozambique's total energy requirement was less than ten percent

[33] Portuguese interests retained 82% ownership of Cahora Bassa and appointed the directors of HCB.

of the dam's output further complicated FRELIMO's efforts to harness the hydro-electric project for domestic purposes. Moreover, the cash-starved nation lacked the capital to develop the agricultural and industrial sectors that could utilize the cheap energy.

Despite these constraints, the government did undertake a number of new economic initiatives so that Cahora Bassa would not simply be a source of cheap energy for the apartheid regime. In 1978 it began building power stations to provide energy from the dam to the provincial capital Tete and the nearby coal mines at Moatize, the largest in the country. Two years later, Cahora Bassa started supplying electricity to Tete, whose obsolete thermal power station burned up to 20,000 tons of coal annually, and to the colliery, which had relied on imported diesel for its generators (A.I.M., "Information Bulletin", 47, 1980, 18). At the same time, the National Water Commission announced plans to use the dam's energy to help irrigate more than 210,000 hectares of choice farmlands in the lower Zambesi Valley (A.I.M. "Information Bulletin", 63, 1981, 16). In the early 1980s, Mozambique signed an agreement with India to process bauxite from that country at an aluminum plant using power from the dam (A.I.M., "Information Bulletin", 70, 1982, 2). State planners also proposed developing commercial fishing, tourism and a shipping industry on the lake behind Cahora Bassa. In 1981 they signed an agreement with Bulgaria to help fund these projects (A.I.M., "Information Bulletin", 58, 1981, 16).

All of these proposed projects paled in comparison with the plans to build a second set of power lines and sub-stations on the northern banks of the Zambesi. The new grid was designed to provide cheap energy to the densely populated provinces of Zambezia and Nampula. Both were major agricultural zones producing most of the country's cotton, tea and sugar for export. Zambezia was also a major food producing area. The two provinces assumed strategic political importance, as well, because FRELIMO had mounted a very intense campaign to pressure reluctant peasants to join communal villages (Geffray, 1991). One of the incentives that the state held out was the promise of electricity (Isaacman and Isaacman, 1983, 155). In 1980 the government signed a multi-million dollar agreement with France and Italy to begin the first phase of the project, which was to be completed two years later (A.I.M., "Information Bulletin", 47, 1980, 18).

Before most of these projects could get under way, South Africa intensified its destabilization campaign, effectively paralyzing them. The apartheid regime's undeclared war against Mozambique and RENAMO's role as South Africa's principal weapon are well documented (Finnegan, 1992; Hall and Young, 1997; Hanlon, 1990; Isaacman, 1991; Vines, 1991). It was part of a broader strategy to ensure Pretoria's hegemony over the Southern African region in order to defend the political and economic

interests of the apartheid state and to insulate the African National Congress.

Within six months of Mozambique's independence in 1975, South African security forces working with their Rhodesian counterparts had created RENAMO and trained and armed the insurgents (Winters, 1981, 545). Between 1976 and 1979 Mozambique suffered from more than 350 RENAMO and Rhodesian attacks. Although the dam was left unscathed, anti-FRELIMO forces regularly targeted regions adjacent to Cahora Bassa and periodically sabotaged power lines and sub-stations (A.I.M., "Information Bulletin", 45, 1980, 27).

With the fall of the Rhodesian government in 1980 and the independence of Zimbabwe, the apartheid regime transferred RENAMO headquarters and bases from Rhodesia to the Transvaal, a northern province of South Africa adjacent to Mozambique. South African security treated the guerrillas as a surrogate army. Pretoria provided RENAMO with large supplies of war materials, including rockets, mortars and small arms, critical logistic support and instructors. The latter, according to the guerrilla leader Alfonso Dhlakama would "not only teach but also participate in the attacks" (Dhlakama, 1980). By 1981 RENAMO forces were being transported into Mozambique by South African helicopters and resupplied by airdrops and naval landings along Mozambique's expansive coast (Isaacman, 1991; Hall and Young, 1997). RENAMO's renewed offensive was part of a broader campaign that South African security forces orchestrated to destroy Mozambique's infrastructure, paralyze the economy and bring the young nation to its knees (Hall and Young, 129). The guerrilla forces sabotaged bridges and railroad lines, mined roads, burned warehouses and attacked state farms.

Cahora Bassa's power lines were a particularly inviting target. At first glance such a strategy might seem counter productive since the pylons were transporting energy to South Africa. But set within Pretoria's broader destabilization strategy designed to punish Mozambique for its support of the ANC, it made perfect sense to military planners. After all, FRELIMO had placed great importance on the Cahora Bassa's potential to transform the countryside. Paralyzing the hydro-electric scheme underscored the country's vulnerability. These attacks also enabled both the RENAMO leadership and the apartheid regime to claim that the guerrillas were a legitimate nationalist movement opposed to the Marxist policies of FRELIMO and not simply a puppet of Pretoria (Vines, 1991, 26-28; Domingos, 1980). That Cahora Bassa power lines provided only 8% of South Africa's energy, meant that domestic consequences for the apartheid regime were relatively minor (Vines, 1991, 27).

The results of the attacks on power lines were both predictable and devastating. The Mozambican government lacked the capacity to protect

the 4 000 pylons which cut across 900 kilometers of remote country. As early as 1981 RENAMO forces had dynamited pylons near Espungabera reducing electricity exports by 50%. It took six months to repair the lines (A.I.M., "Information Bulletin", 58, 1981, 13). This pattern was repeated on a regular basis. Guerrillas destroyed power lines and towers and mined the adjacent areas making it virtually impossible for the government to repair them. These attacks did not cease even after the South African government promised that they would as part of the 1984 Nkomati Peace Accord and in subsequent bilateral negotiations (Vines, 1991, 28-30). In fact, RENAMO, which had begun to take on a political life of its own, escalated its attacks as a way of pressuring the Mozambican government to enter into direct negotiations. By 1988, 891 pylons had been destroyed and that number doubled again over the next three years (Gebhardt, "Switching into Cahora Bassa", *Mail and Guardian*, December 19, 1997; Vines, 1991, 28-30). The cost of repairing the power lines was estimated at $500 million — almost three times the total value of Mozambican exports. RENAMO's military campaigns in Tete and Zambezia provinces, moreover, had effectively blocked plans to develop the Zambesi Valley and electrify the northern part of the country. The dam remained a white elephant.

In addition to paralyzing Cahora Bassa and destroying many other strategic economic targets, RENAMO initiated a reign of terror throughout the riverine zone particularly in areas considered loyal to the government. Among the most vulnerable communities were the peasants who had been displaced by the dam and been herded into strategic hamlets during the colonial period. With independence, the barbed wire surrounding their villages was taken down and the guards were removed, leaving them defenseless. Since their original homes were under water, most had little alternative but to remain where they were. They were easy prey. According to Vernácio Leone,

> When RENAMO would come into a village, they would call all the people together. Then they would go into the house and steal all that was inside. They ordered the people back into their homes and set them on fire. People elsewhere heard these stories, so when RENAMO was coming, they would flee to Estima (an administrative center).[34]

Vernácio's neighbours Supia Sargent and Carlos Churo remember that many able-bodied men and women fled to Zimbabwe.[35] Others were forced to take even more extreme measures to survive.

> After Independence people from Chinyanda Nova returned to their homelands in Chinyanda Velha, but could not remain there for a long

[34] Interview with Vernácio Leone.

[35] Interview with Supia Sargent and Carlos Churo.

> time because the Rhodesians started to attack. So we had to return to Chinyanda Nova [near a government base] and have remained here ever since. But we were not free from war because RENAMO began to attack. They burned our houses, raped our wives and daughters and robbed our goats. We were forced to live in the mountains for four years. We slept there and only returned at daybreak to cultivate our fields.[36]

Peasants downriver from the dam suffered similar abuses from marauding bands of RENAMO guerrillas. Listen to the words of Faminsani Chenje who lived in the village of Mushenge in southern Tete province.

> The first time they came was in 1986. They were looking for food. It was a small group of about fifteen men. They took cattle, chickens and goats. A lot of villagers started fleeing to Tete[town] then because the war had come to Mushenge. But most of us stayed in the village. It was our home. Then, in June 1986, the Matsange [RENAMO] came again early in the morning. It was still dark. This time they came right into the village. They called for everyone to come out of their houses. Then they killed ten people and mutilated ten others, including myself. Two soldiers cut off my ears with knives. They said we were working for FRELIMO (Quoted in *Africa Watch*, 1992, 47).

South Africa's destabilization campaign had devastating consequences on the riverine communities. Many villages were obliterated, fields destroyed and health clinics burned. It is hardly surprising that thousands of peasants who survived these attacks experienced food shortages and malnutrition. Many starved. Death rates from yellow fever, tuberculosis and malaria soared. Throughout the region, the social fabric of society was destroyed (*Africa Watch*, 1992).

THE REGULATED RIVER: SOME LONG-TERM EFFECTS OF IMPOUNDING THE LOWER ZAMBESI

It is difficult to distinguish the environmental and social disruptions that the dam precipitated from those caused by the war, and the extent to which they were interconnected. What is certain is that the construction of Cahora Bassa adversely affected the economic security of hundreds of thousands of peasant households and irrevocably altered the biophysical relations of the Lower Zambesi from the reservoir to coastal regions. According to a recent United Nations report, "Cahora Bassa has the dubious distinction of being the least studied and possibly least environmentally acceptable dam project in Africa" (Beilfuss, 1999).

---

[36] Interview with Peter Size and Fedi Alfante.

Prior to construction, the mosaic of ecological systems that comprised the Lower Zambesi (e.g., river channel, floodplains, delta, estuary) was adapted to large fluctuations in river flows. Following the arrival of rains in December, the river would swell to several times its normal flow until March and then recede to fairly low rates during the dry season from May through October (Davies, 1986). In the area near Cahora Bassa gorge and in the floodplain zones stretching from the gorge to the delta, the rising waters triggered breeding among a substantial portion of fish species and these inundated zones provided critical habitat for fish reproduction and survival. Subsequently, the moisture and sediment left behind by receding floodwaters stimulated plant growth and hence supported diverse animal populations in the riverine ecosystems.

Peasant communities residing near the river derived sustenance from these environmental resources through fishing, agriculture, gathering and hunting. The construction of Cahora Bassa sounded a death knell for this particular set of socio-ecological relations by regulating the river. Flow rates became much lower than normal during the former flood season and much higher than normal during the dry season. Moreover, the river was subject to erratic, unseasonal flooding as a result of dam operators' manipulation to generate hydro-electricity (Jackson, 1986). The consequences led one ecologist, who had periodically worked in the valley for the past three decades, to conclude that the Lower Zambesi "has been abused to a degree that has, fortunately, few parallels anywhere else in the world" (Davies, 1986, 258).

Many of the long-term biophysical changes witnessed in Lake Cahora Bassa — for example invasion of the reservoir by the Lake Tanganyika sardine, or *kapenta*, in the late 1970s[37] — were not predicted by project planners and consultants. Other long-term effects associated with the reservoir include the growth of invasive weed species, development of a fishery involving greater types and numbers of fish adapted to lacustrine conditions, and nutrient enrichment of the lake via the accumulation of agricultural pesticides from upstream sources (Davies, 1996). The precise impacts of these changes on the long-term integrity of the reservoir ecosystem are difficult to pinpoint — a situation made even more problematic by the extreme unpredictability of fluctuations in water levels due to unscheduled releases by dam operators (Davies, 1986, 256).

What is clear is that the management of the reservoir's water levels has already produced adverse ecological and social effects. Most studies predicted drawdowns of between four and six metres whereas actual drawdowns have frequently exceeded 12-14 metres, a pattern that has not followed the course predicted in pre-impoundment studies (Bolton,

[37] Interview with Padre Claudio Gremi.

1983, 219-220). The resultant large annual fluctuations in reservoir water level have impeded the growth of riparian vegetation resulting in lower fish productivity and have led to pools of stagnant water that provide ideal conditions for diseases (Bolton, 1983, 389-391). Preliminary evidence suggests the likelihood of an increase in debilitating water-borne diseases, particularly schistosomiasis and malaria, typically associated with dams and reservoirs (Bolton, 1983, 379). Moreover, communities situated on the edge of the reservoir to take advantage of fishing opportunities are unable to effectively utilize the fertile margins of the lake for agriculture due to the unpredictability of reservoir level changes. Whole villages, built near the high water mark of the lake, suddenly find themselves over two kilometers from the shoreline after unannounced drawdowns (Bolton, 1986, 163). Agricultural production in the area around the lake had plummeted. Senteira Botão, an elder from Chipalapala put it starkly:

> In those times [before the dam], occasionally there was hunger but not like the hunger of today. There were shortages of maize, but then we had sorghum. If the rains were poor and we had a shortage of both, we ate sweet potatoes and other foods from our gardens. Hunger never threatened our community. No one ever died from hunger.[38]

RENAMO attacks exacerbated matters.

Even the introduction of the *kapenta* sardine has proven to be a mixed blessing. Because the fish is in great demand in neighbouring countries, South African and Zimbabwean fishermen, using large boats and nets, have come to dominate the reservoir's sardine fishery. They displaced local fishermen, many of whom have been forced to work on these boats for minimal wages in order to survive.[39]

With the construction of Cahora Bassa, the lifeblood of the floodplains, delta and estuary regions was placed in the hands of the Portuguese-dominated HCB.[40] The consequences have been profoundly negative. Flows that once reached rates of 28,000 cubic meters per second during the flood season and averaged 2,000-3,000 cms during the rest of the year were eliminated and replaced with flow rates of 900 cms that varied little from month to month.[41] A recent assessment concluded that erratic and

---

[38] Interview with Senteira Botão, Eliot Jumbo, Mautisembero Sargento and Beatriz Maquina, Chipalapala, 26 May 1998.

[39] Interview with Padre Claudio Gremi; Interview with Vernácio Leone; Interview with Senteira Botão, Eliot Jumbo, Muatisembero Sargento and Beatriz Maquina.

[40] We distinguish the delta (the typically broad, flat zone near the mouth of a river where there are high levels of deposition) from the estuary (the zone where the river's plume extends into the ocean and where fresh and salt waters mix).

[41] The Kariba Dam also had some effect on the flooding regime of the Lower Zambesi, but not nearly the drastic impact of Cahora Bassa. See Davies, 'Zambezi River', 235-242 and A. Muhai, 'Cahora Bassa and Lower Zambezi workshop' (Unpublished manuscript prepared for Workshop Sobre O Uso Sustentavel da Barrágem de Cahora Bassa e do Vale do Rio Zambese (Songo, 29 Sept-2 Oct, 1997), 4.

mistimed discharges have been "catastrophic" for downstream wetlands where vegetative growth and animal populations depended on annual flooding that brought nutrients and sediments (Beilfuss, 1999). By 1996, the geomorphology of the Lower Zambesi itself — formerly a wide river system with "open mosaics of marsh, pond, oxbows and shallow wetlands" — had been converted to a system with "choked wetlands, tree and bullrush encroachment along margins" and impoverished marshlands. The overall result is less diverse, less productive riverine ecosystems (Davies, 1996). A disinterest in the downstream hydrological effects spurred by the dam also reflected a tacit disregard for the peasant and fishing communities for whom the floodplain system was a critical resource. According to the current director of the Zambesi Valley Authority,

> Pre-dam livestyles [sic.] of hundreds of thousands of local residents were dependent on annual flooding which sustained a diversified production system that incorporated flood recession agriculture, livestock management, fishing, gathering and hunting. Flooding was especially important for providing otherwise unavailable grazing during the latter months of the dry season and for maintaining the productivity of the riverine fishery (Muhai, 1997).

The impacts on riverine fish populations are especially pernicious, due to the apparent loss of biological diversity and to the drastic reduction of an important food source for riverine communities. While information concerning the dam's effects on other aspects of downstream floodplains is sketchy, the impacts on fish have almost certainly been devastating.

> In the Lower Zambesi valley, floodplain regions have, in the past, been a more important source of fish than the river itself, despite the fact that the floodplain is much smaller than might be expected from a river this size . . . the seasonal inundation of the Zambesi floodplain created large areas of warm shallow water which were rich in nutrients and provided ideal breeding grounds for fish (Bolton, 1983, 395).

The breeding cycle of many fish species, triggered by early flooding, has in all likelihood been irretrievably interrupted (Bolton, 1983). The large numbers of fishing camps and drying racks that were clearly present in the 1970s no longer operate, indicating a general, if not disastrous, decline in the delta freshwater fisheries (Chande and Dutton, 1997). According to one anthropologist who has worked in the region, "Villages correctly attribute ... a drop in the productivity of their fishery to dam construction" (Quoted in Beilfuss, 1999).

Even the predicted benefits of the dam in terms of downstream flood control did not materialize. Despite the apparent regulating effect of Cahora Bassa, a massive flood in 1978 resulted in over 40 lost lives and

200,000 homeless and destroyed more than 60,000 hectares of crops. The estimated damage was over US$60 million. This devastation stands in stark contrast to the claims made in early documents of the Kariba and Cahora Bassa projects, touting the period of "total control" over discharges that the dams would usher in (Bolton, 1983, 397-398).

Some of the most far-reaching and difficult-to-measure ecological impacts of large dams have occurred in the delta and estuary zones of impounded rivers where there has been a marked reduction of biological diversity, simplified landscapes and continued threats to ecologically and economically important biota. The delta region's vast populations of large mammals have been devastated by the effects of the dam. The Zambesi Delta, a massive zone of flooding and silt deposition, covers 18,000 square kms, stretches almost 300 kms along the coastline of Mozambique, and extends 100 kms inland to the Zambesi's confluence with the Shire River. Before the dam the floodplain supported large herds of Cape buffalo, waterbuck, zebra, and reedbuck. The desiccation of the floodplain made the region accessible to commercial poachers as well as to RENAMO and government soldiers. As a result the buffalo population declined by upwards of 90% and other mammal species including zebra, hippopotamus, and waterbuck and several bird species have experienced a similar reduction (Beilfuss, Allan and Bento 1997; Beilfuss and Davis, 1999).

The lack of flooding in the region, creating a generally drier environment with less vegetation had other devastating effects as well (Chande and Dutton, 1997). Grassland burning has intensified through the dry season. It is estimated that 90% of the lower Zambesi floodplain now burns every year. Moreover, the irregular flooding patterns have disrupted the breeding cycles of many delta species, including the endangered water cranes (Beilfuss, 1999).

The adverse effects of Cahora Bassa extend to the very mouth of the Zambesi. The sharp decline in silt transported downriver has hampered the Zambesi's important delta-building function.[42] As deposition of silt decreases with unknown implications for the coast's vulnerable communities of natural vegetation, the estuary is subject to greatly increased wind and sea erosion. This in turn almost certainly generates negative impacts on the estuarine fisheries that evolved under more stable conditions and depended on the annual flooding cycle that brought nutrients and sediments (Tinley, 1975). Mangrove forests and shrimp

[42] As rivers transport sediments to their mouths year after year, the slow flowing water of the delta allows the silt to settle, thus typically widening and extending the semi-terrestrial area of the delta itself.

fisheries, critical elements of the delta and estuarine system, have been particularly degraded at least in part if not wholly by the altered character of Zambesi flows. The full effects of the decrease in sediment transfer to the Zambesi delta on the coast's mangrove ecosystems are little known, although a recent survey showed that only a single channel of the Zambesi exhibited healthy mangroves. Throughout the rest of the coastal region there are large gaps in the mangrove forest with evidence of dried-out areas, dead mangroves and severe coastal erosion (Davies, 1996).

What is clear is the devastating effects of the reduced wet season water flows of the Zambesi on Mozambique's strategic shrimp industry. The Sofala Bank, a broad and shallow shelf just outside the mouth of the Zambesi, is the site of a productive shrimp fishery that is one of Mozambique's most important sources of foreign currency. Since the early 1980s, catches of the coastal fisheries' two most important shrimp species (*Penaeus indicus* and *Metapenaeus monoceros*) have declined substantially due to both environmental factors and increasing fishing effort (Gammelsröd, 1992; Hoguane, 1997). There is a high degree of correlation between wet season river runoff and the abundance of these economically important shrimp species. The dam at Cahora Bassa both reduces the amount of water discharged by the river and alters the seasonal pattern of runoff. After the dam, the wet season runoff was reduced by about 40 percent (Gammelsröd, 1992; Hoguane, 1997). Significant decreases in the amount of water released, particularly during the onset of the flood seasons when shrimp normally migrate towards the ocean, could drastically reduce the shrimp population by impeding an important stage in their life cycle.[43] This would be disastrous for commercial shrimping operations that depend on continued shrimp production. For local fishermen as well as for the impoverished nation hard-pressed for foreign currency, this loss of shrimp revenue is highly significant.

CONCLUSION

Too often forgotten in the discourse on water, development and national security are the people whom large dams are purported to help. This article has explored the deleterious socio-economic and environmental

[43] Freshwater stimulates recruitment of shrimp to the shelf area and provides nutrients to the coastal waters. The shrimp spawn at sea, but require brackish water to serve as nursery areas. At an early stage in their life cycles, the immature shrimp move inshore, most likely during the dry season. As river runoff and/or rainfall in the area increases at the onset of the flood season, older juveniles that are unable to tolerate increasing amounts of freshwater migrate offshore where commercial fishing interests are able to take advantage of this seasonal increase in abundance (Gammelsröd, 'Improving shrimp').

changes brought about by Cahora Bassa dam and South Africa's destabilization campaign. It is part of an alternative history of Cahora Bassa which argues that the historical memories and lived experiences of these riverine communities must figure prominently both in any scholarly analysis of the effect of Cahora Bassa and any new initiatives to remedy the situation. That serious consideration is being given to building a new dam at Mepanda Uncua, fifty miles downstream from Cahora Bassa, suggests that lessons of the past are still being obscured in the name of development.

References

ADAMS, WILLIAM M. (1990) *Green Development: Environment and Sustainability in the Third World* (London and New York, Routledge).

AFRICA WATCH (1992) *Conspicuous Destruction* (New York, Human Rights Watch).

AGÊNCIA DE INFORMAÇÃO DE MOÇAMBIQUE [A.I.M.] (1979) "Information Bulletin" 38.6.

— (1980) "Information Bulletin" 45, 27.

— (1980) "Information Bulletin" 47, 18.

— (1981) "Information Bulletin" 58, 13-16.

— (1981) "Information Bulletin" 63, 16.

— (1982) "Information Bulletin" 70, 2.

BEILFUSS, RICHARD (1999) "Can This River Be Saved: Rethinking Cahora Bassa Could Make A Difference for Dam Battered Zambezi", *World Rivers Review*, 14, 8-11.

BEILFUSS, R., D. ALLAN, AND C. BENTO (1997) "Waterbird and wetland surveys in the Zambezi-Pungue floodplain system, Mozambique", in *Workshop Sobre O Uso Sustentavel da Barrágem de Cahora Bassa e do Vale do Rio Zambese*, 19 Sept.-2 Oct. Songo, 4.

BEILFUSS, R. D. AND B. R. DAVIES (1999) "Prescribed Flooding and Wetland Rehabilitation in the Zambezi Delta, Mozambique", in W. Streguer (ed.), *An International Perspective on Wetland Rehabilitation* (Kluwer Academic Press), 145-158.

BOLTON, P. (1983) "The Regulation of the Zambezi in Mozambique" (Edinburgh, University of Edinburgh).

— (1986) "Mozambique's Cabora Bassa Project: An environmental assessment", in E. Goldsmith and N. Hildyard (eds.), *Social and Environmental Impacts of Large Dams, Volume 2: Case Studies* (Cornwall, Wadebridge Ecological Centre), 156-167.

BOND, W., N. COE, P. JACKSON, AND K. ROGERS (1978) "The limnology of Cabora Bassa, Moçambique, during its first year", *Freshwater Biology*, 8, 445.

CHAMBERS, ROBERT AND GORDON R. CONWAY (1992) *Sustainable Rural Livelihoods: Practical Concepts for the 21st Century* (Institute of Development Studies, Discussion Paper 296, February 1992).

CHANDE, B., AND P. DUTTON (1997) "Impacts of hydrological changes in the Zambeze Delta to wildlife and their habitats with special attention to the large mammals", in *Workshop Sobre O Uso Sustentavel da Barrágem de Cahora Bassa e do Vale do Rio Zambese*, 29 Sept-2 Oct Songo, 4.

DAVIES, B. (1975) "They pulled the plug out of the lower Zambezi", *African Wildlife*, 29, 26-28.

— (1986) "The Zambezi River system", in B. Davies and K. Walker (eds.) *The Ecology of River Systems* (Dordrecht, NL), 233.

— (1996) "Rehabilitation programme for Cahora Bassa and the Lower Zambezi" (International Crane Foundation /Ford Foundation).

DHLAKAMA, A. M. M. M. (1980) "Relatório Referente a Sessão do Trabalho de R.N.M e do Representativo do Governo Sul Africano" (MNR Document, October 25).

DOMINGOS, R. M. (1980) "Untitled Summary of Conversations with Orlando Christina" (RENAMO document, Zoabostad, November 4).

FINNEGAN, W. (1992) *A Complicated War* (Berkeley, University of California Press).

GABINETE DO PLANO DO ZAMBEZE (1971) *Relatório de Actividade* (Lisbon).

— (1972) *Relatório de Actividade* (Lisbon).

— (1973) *Relatório de Actividade* (Lisbon).

GAMMELSRÖD, T. (1992) "Improving shrimp production by Zambezi River regulation", *Ambio*, 21, 145-147.

GEBHARDT, M. (1997) "Switching into Cahora Bassa", *Mail and Guardian* (December 19, 1997).

GEFFRAY, C. (1991) *A Causa das Armas* (Porto, Afrontamento).

GLEICK, P. H. (1993) "Water and Conflict", *Fresh Water Resources and International Security*, 18 (1), 79-112.

— (1999) "Conflict and Cooperation over Fresh Water", The 49th Pugwash Conference, *Confronting the Challenge of the 21st Century* (Unpub.).

HALL, A., I. MARIA, C. VALENTE, AND B. DAVIES (1977) "The Zambezi River in Moçambique: The physico-chemical status of the Middle and Lower Zambezi prior to closure of the Cabora Bassa Dam", *Freshwater Biology*, 7, 187-206.

HALL, M. AND T. YOUNG (1997) *Confronting Leviathan, Mozambique Since Independence* (London, C. Hurst and Co.).

HANLON, J. (1990) *Mozambique: The Revolution Under Fire* (London, Zed).

HOGUANE, A. (1997) "Shrimp abundance and river runoff in Sofala Bank — The role of the Zambezi", *Workshop Sobre O Uso Sustentavel da Barrágem de Cahora Bassa e do Vale do Rio Zambese* (29 Sept-2 Oct., Songo), 4.

ISAACMAN, A. (1991) "Conflict in Southern Africa: The Case of Mozambique", in R. Hunt Davis (ed.) *Apartheid Unravels* (Gainesville, University of Florida Press), 183-212.

— (1997) "Historical Amnesia, or the Logic of Capital Accumulation: Cotton Production in Colonial and Post-Colonial Mozambique", in *Environment and Planning D: Society and Space*, 15, 757-790.

ISAACMAN, A. AND B. ISAACMAN (1993) *Mozambique from Colonialism to Revolution, 1900-1982* (Boulder, Westview).

ISAACMAN, A. AND C. SNEDDON (Forthcoming) "Towards a social and environmental history of the building of Cahora Bassa Dam", *Journal of South Africa Studies* (Oxford).

JACKSON, P. (1986) "Fish of the Zambezi system", in B. Davies and K. Walker (eds.) *The Ecology of River Systems* (Dordrecht, NL), 269-288.

— (1997) "Ecological studies on the Middle Zambezi prior to Kariba and Cahora Bassa and the need for surveys of the Lower Zambezi prior to the creation of further hydro-electric dams", in *Workshop Sobre O Uso Sustentavel da Barrágem de Cahora Bassa e do Vale do Rio Zambese* (29 Sept-2 Oct., Songo)

JACKSON, P., AND K. ROGERS (1976) "Cabora Bassa Fish Populations Before and After the First Filling Stage", *Zoologica Africana*, 11, 377.

JUNDANIAN, B. (1974) "Counterinsurgency in Mozambique", *World Politics*, 6, 519-540.

MARCHANT, D. (1991) "The Dam at Cabora Bassa", *Venture*, 23, 28-31.

MCCULLY, P. (1997) *Silenced Rivers: The Ecology and Politics of Large Dams* (London, Prometheus).

MIDDLEMAS, KEITH (1975) *Cabora Bassa: Engineering and Politics in Southern Africa* (London, Weidenfeld and Nicolson).

MUHAI, A. (1997) "Cahora Bassa and Lower Zambezi Workshop", in *Workshop Sobre O Uso Sustentavel da Barrágem de Cahora Bassa e do Vale do Rio Zambese* (29 Sept-2 Oct., Songo), 4.

NUSSEY, WOLF (1972) "The War in Tete a Threat . . . to All in Southern Africa", *Johannesburg Star*, July 1.

OVERSEAS COMPANIES OF PORTUGAL (n.d) "The Other Face of Cabora Bassa" (Lisbon).

RHODESIA HERALD (1972) "FRELIMO misses airfield at Tete" (November 17, 1972), 3.

— (1973) "Cabora hot lines may be next target" (August 20, 1973), 11.

— (1973) "Six men die in Cabora Mishap" (November 17, 1973), 2.

SECRETARIO DE ESTADO DA INFORMAÇÃO E TOURISMO (n.d) *Cabora Bassa on the Move* (Lisbon).

TINLEY, K (1975) "Morromeu: wrecked by the big dams", *African Wildlife*, 29, 24.

UNITED NATIONS, (1971) Conference Room Paper SCI/71/5 "Economic Conditions in Mozambique with Reference to Foreign Interests".

VIDIGAL, M (1970) "Cabora Bassa: História Perspectivas. Justificação. Aspectos Económico-Financeiros. Interesse Nacional do Empreendimento", *Electricidade*, 14:7-20 (Lisbon).

VINES, A. (1991) *RENAMO: Terrorism in Africa* (London, James Currey).

WINTER, G. (1981) *Inside Boss* (Harmondsworth, Penguin).

WORLD COUNCIL OF CHURCHES (1971) *Cabora Bassa and the Struggle for Mozambique* (London).