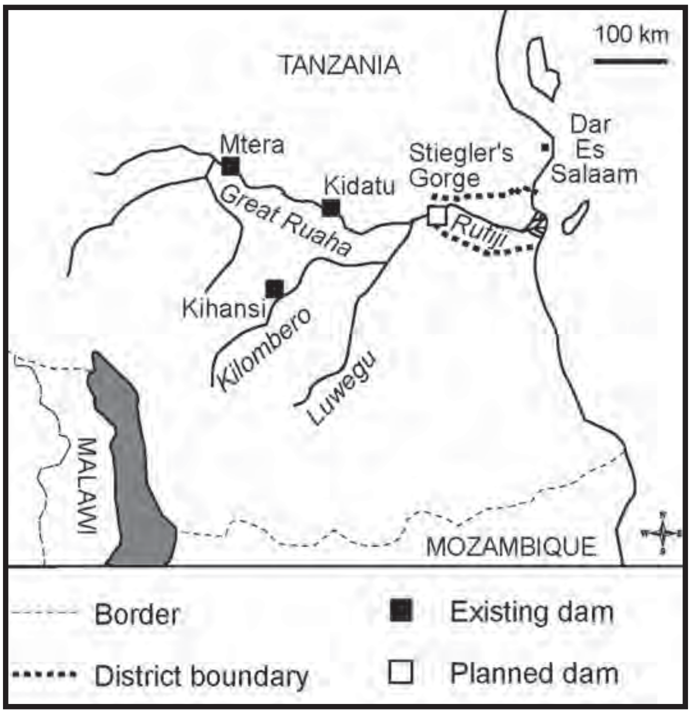
The Large-Scale Irrigation Potential of the Lower Rufiji Floodplain: Reality or Persistent Myth?

Olivier Hamerlynck, Stéphanie Duvail, Heather Hoag, Pius Yanda & Jean-Luc Paul

Introduction

The Rufiji River Basin is located entirely in Tanzania and drains some 180,000 km², about a fifth of mainland Tanzania. The river has a strong seasonal flow pattern, with a flood peak around April. With an annual mean flow of 800 cubic meters per second, it is one of Africa's largest rivers after the Congo, Zambezi, Niger, Nile, and Volta. The annual rainfall is highly variable, depending on altitude and distance from the coast and generally displays two peaks with short rains in October-November and long rains from March to May. Three main rivers: the Kilombero, the Great Ruaha and the Luwegu, join up in the Selous Game Reserve to form the Rufiji which tumbles down to its wide Lower Floodplain through the 100 m deep Stiegler's Gorge before branching out in a wide delta covered by the largest stand of mangrove in East Africa (Figure 1). Administratively, the Lower Floodplain is located entirely in the Rufiji District which has some 200,000 inhabitants.

Figure 1: The Rufiji River Basin



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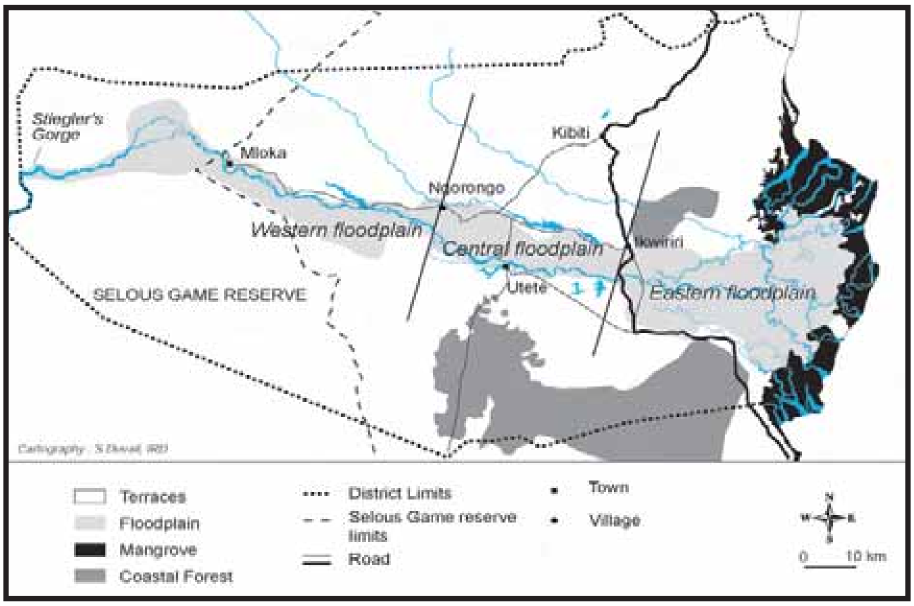
Description of Agriculture in the Rufiji District

The agricultural potential of the Rufiji District cannot be confined to the floodplain but has to be framed in a wider land-use context. Traditionally livelihoods strategies in Rufiji show a strong integration of activities between the floodplain farming system, the surrounding wooded and forested terraces and the floodplain associated lakes.[1]

In Rufiji District the agricultural potential is mainly determined by soil quality and water supply (rainfall, floods and gr oundwater). On the basis of soil type and natural vegetation cover, which is the result of the combination of soil type and the availability of water, there are four main zones in Rufiji District outside of the Selous Game Reserve (part of which covers 25% of the District but will not be considered here):

Figure 2: The Lower Rufiji Valley



• 425,000 ha of coarse sands, covered with miombo woodland and coastal forest mosaics, lying between 50 m and 150 m Above Mean Sea Level (ASL), ('the terraces')

• 270,000 ha of finer sands (predominantly red soils), covered with coastal forest, between 150 m and 700 m ASL ('the hills')

• 170,000 ha of rich fertile alluvium interspersed with sands, covered by tall grass and occasional trees lying between 5 m and 50 m ASL ('the floodplain')

• 130,000 ha of fine salty clay, covered by mangrove and grasslands below 5 m ASL ('the delta')

The Lower Rufiji floodplain starts at Mloka where the river leaves the Selous Game Reserve. At Mloka, the floodplain has a width of some 12 km and is situated at an altitude of about 50 m ASL. From there, it gradually slopes down to the Ocean, about 120 km to the east, its width varying from 7 km (Utete) to 30 km (edge of the delta).

Floods that cover agriculturally significant parts of the floodplain occur, on average, in 4 years out of 10.[2] These floods, which transport enormous quantities of fine elements, provide the natural fertiliser to the floodplain fields (*shamba* in Swahili). The coarser sands are deposited in areas with relatively high current velocities, in the various riverbeds and on the banks when the river overflows them. When the sediment-laden floodwaters enter the plains, the current velocities drop sharply and the fine elements are deposited, as a thick layer of fertile silt. Local farmers estimate that yields are halved if a *shamba* is not flooded for 3 consecutive years.[3]

The high dynamics of the river, which continuously erodes and deposits different materials, meanders or opens new braided channels, has resulted in a patchy distribution of soils.[4] This is most pronounced in the western and central parts of the floodplain. Therefore, in any single year only a relatively small proportion of the floodplain is cultivated, at present some 15,000 ha. Fallows represent about twice as much surface area which means local farmers consider that about 45,000 ha are 'worth cultivating' in a highly opportunistic and flexible system. For an individual plot, the series of years it is cultivated continuously can vary between 5 and over 30 years, depending on the flooding frequency. In the absence of floods, yields will decline strongly after 3 years but any flood that deposits silt will extend the number of years it can be cultivated. In this manner some of the low lying plots at Ndundu have been cultivated annually for more than 30 years without seemingly any loss of soil fertility. In other areas, as shown by the ground-breaking of the village maps[5], major shifts in cultivated areas occur when strong floods open up new water courses or deposit sands or clays. With these fallows the total cultivated area adds up to about 45,000 ha.

Floodplain Zoning

There are three main sub zones in the floodplain (Figure 2):

- The western floodplain between the Selous border at Mloka and Ngorongo. In this area the floodplain is essentially situated south of the river.
- The central floodplain between Ngorongo to just upstream of Ndundu bridge. Here the floodplain is predominantly situated north of the river.
- The eastern floodplain between Ndundu bridge and the delta (saline soils). There is floodplain on both sides of the river but the frequently flooded and more easily accessible lands are essentially north of the river.

All three floodplain zones have sandy levees along old branches and braided channels that are the favoured areas for habitation and home gardens with a variety of crops (pigeon pea, cow peas, okra, pumpkin, tomato, chilli, sesame, etc.), including tree crops such as mango, banana and pawpaw. Such levees become progressively scarce towards the East as the river has, by then, deposited most of the coarse sediments and meanders rather than braids. It is important to note that these levees limit the return flow of floodwaters to the river and that, even relatively short, flood peaks result in prolonged stagnation of water on the floodplain.

The Western Floodplain

The advantages of the western floodplain are the relatively coarse texture of the fertile soils, which makes them relatively easy to work and suitable for a wide variety of crops, and its good natural drainage. Disadvantages include the very patchy nature of the soil associations and the uneven topography with levees interspersed with depressions, separated by sandy ridges. Individual farmers make excellent use of this very patchy nature but there is virtually no potential for large-scale endeavours. Rainfall is relatively low (< 700 mm) and highly variable. Most of the floodplain is quite high above the river and therefore only flooded at relatively high discharge, probably over 3,500 cubic metres. The fact that the registered villages are north of river and that the fields are south of the river sets considerable constraints on the development of harmonious communities with effective access to social services and transport.

The proximity of the *shambas* to the Selous border makes the area highly prone to crop damage and interference with agricultural activities by problem animals. Between August 2002 and April 2004, at least 35 people were killed by lions mainly on the western floodplain[6]. Fields were largely abandoned and standing crops were consumed by elephants, warthogs, etc.

The Central Floodplain

In the central floodplain, depressions with heavier soils are becoming a more dominant feature and the soil units are also becoming larger. Rainfall is higher (the 77-year average at Utete is 867 mm) and also somewhat more reliable (Table 1).

TABLE 1. ANNUAL RAINFALL AT UTETE BETWEEN 1923 AND 2002

	Annual rainfall	Number of years	Occurrence
Adequate	N > 800	46	6 years in 10
Dry year	600 < N < 800	24	3 years in 10
Drought	N < 600	7	1 year in 11
Total		77	

Source: Author's Compilation

The agricultural year was defined as September 1 to August 31 of the subsequent years for 1922 to 1980. For the years 1987 to 2002, August 1 to July 31 of the subsequent year was used. The average covering the 77 years over both periods is 867 mm. Data was collected from Rufiji District sources and BRALUP studies. Years with incomplete or unreliable data were removed.

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Still, inter-annual variability is high with minimum rainfall recorded at only 484 mm (1945-1946) and maximum recorded 1,321 mm (1963-1964). Social services exist on both sides of the river and, with most of the floodplain north of the river, there are less incidents with dangerous animals, even though crop losses to problem animals (warthogs, wild pigs, baboons, etc.) are substantial.

An attempt at pumped irrigation has been made at Mbunju Mvuleni through an Iranian funded project, the Segeni scheme. The water supply comes from the outflow of the Rambo river and Lake Ruwe. Unfortunately, large flood peaks, originating from the main river, back up into this branch and have and will continue to be a substantial risk factor for any permanent hydraulic infrastructure. The scheme has therefore failed. Since 2006 a large-scale cotton farm was established at Mkongo, which is excluding access by local farmers in spite of so far not having actually planted, presumably because of low prices in world markets.

The Eastern Floodplain

The eastern floodplain comprises of the easily flooded so-called 'Ikwiriri' block on the northern floodplain. Here the heavy clay soils predominate and form near-continuous units some of which are mechanically ploughed. It is a prime area for rice growing and for *Mlao* cultivation in years of heavy or prolonged flooding. It also receives considerable rainfall (presumably over 900 mm) though at present no long-term data are available. A second major farming area on the northern floodplain is situated south of Muyuyu village.

The eastern floodplain south of the river is somewhat higher and more complex, with sandy ridges caused by the strong meandering tendency, the inflows from the Matumbi hills and the seasonal riverbeds connecting to the southern delta (Mohoro river). It is cultivated in patches. There is expansion of farms on the seasonally flooded grasslands along the new road to the bridge but the pattern is that of shifting cultivation and considerable forest clearing. Its sustainability remains to be proven. Towards the east, the floodplain grades into the inner delta. Soils become progressively heavier and more saline and cultivation is almost restricted to the levies.

The Traditional Floodplain Farming System

As from the earliest historical records, the Lower Valley of the Rufiji has been referred to as a granary for Zanzibar,[7] mainly exporting large quantities of rice and also maize. The traditional farming system is well adapted to the local conditions and rather sophisticated, though this has been recognised only by a minority of authors.[8] The floods are clearly perceived as a blessing by the local communities,[9] e.g. in the words of Mrs. Habibi Omari, one of the respected elders of Utete.[10] she '…preferred the famine caused by floods to the famine caused by drought. There is more suffering in a drought year because, after a big flood, the recession agriculture (*Mlao*) harvests are good and the fishing is good'. She also made reference to the opportunities offered by the combinations possible with two rainy seasons and the floods: '…the Rufiji floodplain has so many seasons', and finally '…the people of Rufiji have adapted to the floods'.

It is indeed admirable how the Rufiji floodplain farmers have come to grips with the interplay between short rains crops, long rains crops, floods and recession agriculture and the subtle use of the topographical variability, which defines the nature of the soils and their flooding frequency[11]. To analyse food security, under different combinations of rainfall and floods, the risk of crop failure in each of the seasons has to be examined.

Daily rainfall data are only available for a 23-year time series at Utete (1979-1980 to 2002-2003). Until more data become available from the other, recently rehabilitated, stations in Rufiji District, we have to assume that Utete is representative of the pattern over a wider area. The agriculturally relevant rainfall can be split up in the short rains 15 October to 31 January (108 days) and the long rains between 1 February and 15 May (103 days). Agriculturally adequate floods have been defined as stage board readings over 3.84m between 1926 and 1956 and peak flows of over 3000 cubic metres between 1957 and 1984[12]. 'Excessive' floods, defined as causing extensive flood damage to long rains crops, occur in about 1 year out of 7 (Table 2).

Floods	**None**	**Adequate**	**Excessive**
	0.60	0.25	0.15
Short Rains		**Long Rains**	
Inadequate	0.65	Inadequate	0.35
Adequate	0.35	Adequate	0.65

Source: Author's Compilation

These are the probabilities of the different flood and climatic events, which affect floodplain farming, occurring in any single agricultural year. For example, a 0.60 probability of no flooding means that this will occur in 6 years out of 10, adequate floods have a probability of 0.25 which means that they will occur on average in 1 year out of 4, etc. By multiplying the different probabilities, the likelihood of a combination can be calculated if the events themselves are not correlated. For example, no flood and inadequate short rains will occur in 0.60 x 0.65 = 0.39, thus in about 4 years out of 10.

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The importance of flood height is related to the topographic distribution of the soils and their aptitude for farming. The preferred floodplain farmland is on the *Mbawila* soils of the levees, consisting of loam and fine sand, relatively easy to work, well - drained and suitable for a variety of crops but in general dominated by maize. The somewhat lower-lying depressions with *Mfinyanzi* (dark heavy clay) are suitable for rice. By cultivating a number of small plots (about 0.4 ha each) with different soil types and at different topographical levels, often at dispersed locations, each household harvests from about 1.5 ha of cleared floodplain land each year with double crops in years of good rainfall and/or adequate floods. By making judicious use of their knowledge of the land they plant according to a risk - avoidance strategy, inter-cropping maize with rice on the slopes of the depressions and using different varieties planted at different times (broadly categorised as early and late). Thus, under a wide range of rainfall and flood behaviour, they are likely to achieve sustenance and in, favourable years, produce considerable surplus. Under such favourable circumstances the staple food crops are the main cash crops in Rufiji.

Land preparation, surveillance and harvesting demand considerable effort. Each household cultivates on average between 1 and 2 ha and the typical inter-cropping of rice and maize (about 60% of the rice surface area is inter-cropped) requires 367 person days per ha. Clearing and hoeing are the most demanding tasks in this. Keeping away wild animals from the cultivated plots is also very labour - intensive. The permanent presence of at least one "scarer" is required throughout the crop cycle for maize and at the early and late stages for rice. This need explains the construction of small huts on stilts called '*dungu*' at each *shamba*.

Agricultural Calendar in the Rufiji Floodplain

Crop	Season	Planting	Harvesting
Rice		January-February	June-July
Maize	Short rains	November-December	February-March
	Long rains	May-June	August-September
Pulses, pumpkins and other flood recession crops (Mlao)		May-June	September-November
Cotton		May-June	October-November

Source: Author's Compilation

The distinction between the 'food crops' rice, maize and Mlao crops and the 'cash crop' cotton is a colonial distortion as an important proportion of the cereal production was always sold for export (in good years).

In the agricultural calendar of the main crops in the Lower Rufiji floodplain, the distinction between the 'food crops' rice, maize and *Mlao* crops and the 'cash crop' cotton is a colonial distortion as an important proportion of the cereal production was always sold for export (in good years). As can be seen from Table 3, maize is sown in November-December to benefit from the early rains and harvested in February-March, just prior to the onset of the main floods. Yields are about 700 to 1700 kg per ha. Rice is planted in January-February and harvested in June-July. Yields are about 500 to 1500 kg per ha. For both staple crops farmers in general plant different early and late maturing varieties.

In years of moderate flooding in April, the rice crop can develop even if rainfall is deficient. In years of 'excessive' floods (1 year out of 7), the rice crop is lost. However this process is necessary for the regeneration of floodplain fertility. The groundwater recharge and the deposit of fertile silt by such major floods allows for the bumper harvests of maize, planted at flood recession in May and harvested in September, the famed *Mlao* cultivation. The *Mlao* also produces other crops such as pumpkin, cow peas, etc. In the past cotton was also an important mlao crop and, at times, the main cash crop of the region.

Though virtually all inhabitants using the floodplain identify themselves as farmers, agriculture, essentially directed at local consumption, accounts for only about 37% of average household income, which is supplemented by fishing, forestry (especially in drought years) and a host of other activities.[13].Rufiji floodplain farming is therefore a traditional, labour intensive but highly efficient and low capital input system, which provided adequate livelihoods to a large resident population and, in favourable years, exported substantial surplus.

A Historical Overview of the Assessment of the Irrigation Potential of the Lower Rufiji

The approach to the development of irrigated agriculture in the Rufiji can be divided into three periods: pre-World War II (1895-1945), post-World War II (1945-1985) and post-structural adjustment (1985–present). This brief overview is largely based on the detailed historical analysis by Hoag.[14]

Pre-World War II

The upbeat 19th century reports on the productivity of the Rufiji floodplain incited the German colonial administration (1895-1917) to develop a magnificent vision of the agricultural potential of the valley. As early as 1904 the German colonial administration organised a number of expeditions inland to assess the potential of the Rufiji River for navigation, irrigation and hydropower. It was on the 1907 mission that one of the participants was killed by an elephant in the proximity of the gorge that was to be named after him: Stiegler's Gorge.[15]

The German colonial administration (and its British and post-independence Tanzanian successors) thought the valley was under-utilised and that it could be a prime production area for cash crops and especially cotton. However, the bottleneck for cotton production is the availability of labour at certain times of the year and the conflict between its crop cycle and that of traditional food crops.[16] Cotton prices need to be sufficiently high to compensate for reduced food production and high food prices.

Schematically, cotton needs to be planted when the 'long rains' rice is being harvested and needs to be harvested when the 'short rains' maize needs to be planted (Table 3). This incompatibility between 'food' crops and 'cash' crops was at the origin of the first large-scale agricultural revolt in colonial history, the Maji Maji rebellion of 1905, which started after a drought year. Three elders of the Wamatumbi symbolically pulled up cotton plants, signalling that the obligation to cultivate the cash crop was interfering with their livelihoods. The rebellion quickly spread and was brutally crushed by a war of attrition which substantially reduced the population of South-eastern Tanzania, possibly by some 30%.[17] The abandoned land to the south and east of the floodplain was colonised by vegetation and Tsetse flies. The impact of the emptying of the land is still visible today as it made possible the creation of one of the largest protected areas on the planet, the 48,000 km² Selous Game Reserve.

During the British Protectorate (1918-61) several schemes were thought up to make the Valley more productive. Telford,[18] rich with experience from the Sudan irrigation schemes, travelled widely through the Rufiji, mostly on foot.[19] He expresses some frustration with the ease with which the Rufiji people could feed themselves and really had no need for 'cash' crops. He notes that, in general, the farmers tend a miniscule plot of 0.1 ha of cotton just as a means to pay for their hut tax. He also states that, in general, there is enough rain for two crops a year and that therefore irrigation is not a necessity and can only be successful (as a supplement in bad years) if the water can be provided at a relatively small cost.

The flood hazard is, according to him, the main risk for any large - scale irrigation scheme (and also to a large - scale pumping scheme). He notes that, because of the meandering and shifting nature of the river, the distribution of the suitable soils is not continuous which would mean investing into large aqueducts, siphons and numerous cross-drainage works. He therefore concludes that 'a large scheme for irrigating the main Rufiji plains by gravity flow from a dam is unsuitable and inadvisable'. According to Telford's detailed studies, only about 40,000 to 45,000 ha could be economically developed. He thought a mechanised ploughing scheme would be most beneficial, though he warned against the maintenance costs and also put emphasis on the patchwork nature of the soils and on the numerous secondary waterways which would pose serious problems.[20] He was proved right in 1956 when the Rufiji Mechanised Cultivation Scheme collapsed after a protracted flood[21]

The views of Telford were strengthened by the analysis of Gillman:[22] 'One is therefore, forced to conclude that large-scale irrigation schemes should be left severely alone and that in the light of a recent fuller understanding of the complications of climate, soils, hydrography and markets the early optimism of the Germans regarding the possibilities of such schemes can no longer be upheld'.

Post-World War II

With the economic and political supremacy of the United States established through the proven effectiveness of its scientific and manufacturing capacity during the war and with the technocratic enthusiasm which followed the establishment of the United Nations and its specialised agencies, notably the Food and Agriculture Organisation (FAO), the approach to the Rufiji river basin underwent a fundamental change.

The pessimistic reports of the 'feet in the mud' colonial administrators and technicians were ignored as a new breed of engineers and scientists swept down on the valley, or rather started studying it from their bases in Rome or Washington. The multi-volume FAO report (1961) found 115,000 ha of irrigable land (essentially on the basis of soil type and including part of the delta on the assumption that the salt could effectively be removed). The report also stated that the Lower Rufiji could only be developed if and when a high dam would be constructed at Stiegler's Gorge. The priority areas for the development of irrigated agriculture were therefore shifted upstream to the Kilombero and Usangu floodplains.[23]

Still, decision makers have focussed ever since on the figures of the irrigable areas and have ignored the caveats that were subtly woven into the report e.g., in the conclusions of the Lower Rufiji chapter[24]: 'In wet years practically the whole of the irrigable land of the Lower Rufiji is flooded' which means irrigation infrastructure will not add any new land currently not in use.'The present population depends on the natural flooding for their rice and cotton crops and prevention of flooding would destroy their agricultural system. Irrigation in the Lower Rufiji is therefore all or nothing' which means there might be some social dimensions to deal with and there is no gradual way of accommodating this. What the people would need to do while the infrastructure was being constructed is not specified. 'Irrigation would be most appreciated in the low rainfall zone in the upper part of the valley but here the population is low. On the delta there is a high population but, with over 40 inches of rain, little demand for irrigation', which echoes Telford's[25] conclusions.

Also, the conclusion that there could be no development without a major dam stopped any further investment into the agricultural development of the Lower Rufiji. Moreover, the large floods of 1968 and 74 were used as a pretext to remove the population from the floodplain and resettle them in pilot villages of the new *Ujamaa*, the effort to restore the communal African values that, according to Nyerere, had been replaced by colonially induced individualism.[26] The dispersed habitation in the floodplain was prohibited and communal dryland farming of food crops (sorgho, cassava) and cash crops (cashew, coconut, etc.) was promoted. For the central and eastern floodplain the Ujamaa villages were in general comparatively close to the shambas so people could still continue to practice some floodplain farming after 1973 but with constraints due to time wasted in travel, etc. In the western floodplain people now had to cross the river for access to their fields, which reduced their options for combining dryland and floodplain farming. Most commonly people split their households in two during the agricultural season with women and small children predominantly attending the floodplain farm and men going back and forth. This is one of the main reasons why primary school enrolment, attendance and completion are so low in Rufiji District (less than 2% enter secondary school).

After independence a second wave of technocrats[27] started pushing the Tanzanian government for implementation of the FAO report, basically by transplanting the Tennessee Valley Authority experience.[28] In the 1970s and early 1980s a series of studies were conducted by its pendant, the Rufiji Basin Development Authority (RuBaDA), mostly funded by Norwegian aid. Their technocratic vision and lack of attention to the environmental and socioeconomic impacts of the Stiegler's Gorge dam was soon being questioned by a group of young researchers at the University of Dar es Salaam Bureau of Resource Assessment and Land Use Planning (BRALUP), as summarised in Havnevik.[29]

It is symbolic that the report by the Bureau of Reclamation for USAID[30] chose to ignore the hydrometeorological data collected by the colonial administration since the 1920s and states that the study (of the hydrology) of the Rufiji Basin starts with the FAO surveys of 1954. Sadly, the stageboards, put in place by the colonial administration and carefully monitored by local recorders several times a day, were never linked topographically to the new network of equipment established by the FAO team. The old data therefore were not used in the statistical analysis of flood height and frequency. As a result, all the engineering studies (bridge, dam) have been based on the relatively short time series of 1957 to 1984. Moreover the data set was fraught with errors.[31]

Post-Structural Adjustment (1985–present)

With structural adjustment (1985), the hydrometeorological network fell into disrepair and there were neither funds nor staff to follow up. The 1997-1998 El Niño floods, probably the largest in at least 50 years,[32] was therefore a very major surprise to the builders of the first bridge over the Rufiji (completed in 2003). As the bridge is supposed to resist the 50 and 100 year-floods with moderate to major but reparable damage, some 29 M $US had to be added to the original price to accommodate for the revised peak flow estimates. Should the Stiegler's Gorge dam have been built according to the design of the 1970s and 1980s, it would very likely have been severely damaged or even destroyed during the 1997-

1998 floods, which would have caused enormous damage and probably major loss of life downstream. Indeed, the report by Agrar- und Hydrotechnik[33] for the Rufiji Basin Development Authority points out that the blueprints for the dam developed by Hafslund of Norway did not attempt 'to route the 100 year flood through the reservoir', which they considered a design flaw. The 1997-1998 flood is estimated to have a 1 in 500 year return time,[34] therefore not only would the 3.4 billion $US dam have suffered major damage but any flood protection and/or irrigation infrastructure would have been swept away, destroying the 2.5 billion $US capital outlay.

The economics of the irrigation scheme are staggering: Assuming that the 3.4 billion $US hydropower dam would pay for itself through the sale of electricity, the investment needed for irrigated agriculture, estimated in the 1980s at 1 billion $US or currently 2.5 billion $US, would still imply 29,000 $US per ha under the, perhaps optimistic, FAO estimate of 85,000 ha or 55,000 $US per ha should the more conservative estimate of the colonial administrators and the local farmers be proved correct. The high cost is mainly explained by the need for high and solid embankments to prevent flooding of the irrigation scheme.[35]

Large-scale irrigated agriculture of the floodplain, using water from a reservoir at Stiegler's Gorge was therefore not an economically viable option. Indeed, the report states explicitly that: 'there can be no (large scale) irrigation upstream of Kipo', because of the patchy nature of the soils and this is precisely the part where rainfall tends to be deficient; even assuming double cropping, which is rarely achieved in African large - scale irrigation systems, the 'potential agricultural benefits will not be of any significant influence on the economic viability of the Stiegler's Gorge dam', even under the most optimistic scenario of irrigated surface areas, including the desalinisation of the delta; when comparing the dam with 'no dam', the effect of the dam on agricultural production in the project area 'could even be defined as insignificant'.

With such negative outcomes it is amazing that the high irrigation potential of the Lower Rufiji floodplain is still being upheld by FAO,[36] RuBaDa, the official Rufiji District development plans and in the National Irrigation Master Plan,[37] which again states that 85,000 ha of the Lower Floodplain of the Rufiji is highly suitable for irrigation.

The Linkage between High Estimates of Irrigation Potential and the Stiegler's Gorge Dam

It seems likely that the irrigation potential myth has been created and is possibly being sustained as a lobbying tool to facilitate national and donor community support for a hydropower dam by presenting it as a multipurpose dam. By raising expectations, high estimates can also be a political tool to mobilise support for high-cost development schemes. By adhering to high estimates, the concerned technical departments can attempt to increase their political clout by influencing development priorities and by raising expectations of inflow of donor funds or private investment.

Still, the attempts of the Norwegian hydropower lobby to sell the Stiegler's Gorge dam as a multipurpose dam, to accommodate for the World Bank's criticism of the project, had failed and the project was shelved. An estimated US $ 59M (US $ 24M, 1980) was spent by the Norwegian Development Aid Agency alone on the Stiegler's Gorge dam engineering studies[38] and to that would have to be added the large sums of money spent on the successive technical appraisals by other donors (FAO, USAID) and on EIAs.[39]

A Different, More Modest Vision

Alternatively, small scale irrigation, by pumping from existing secondary waterways, could possibly be developed on an estimated 4,000 ha of the Lower Floodplain. This would be especially useful in the drier western floodplain where rainfall is often inadequate. The installations would need to be mobile so they can be moved out of the floodplain prior to major floods. A thorough analysis of the social and economic aspects would be required.

The expenditure that has been committed to date on the technical studies for the large dam could easily have covered the recent building of the Rufiji bridge, the testing the viability of small-scale irrigation, the financing of a village - based land - use planning exercise for the whole of Rufiji district and even the initial implementation of those plans with the provision of microcredit.

The FAO option may be technically feasible under a very expensive scenario, but the question is whether developing such an irrigation scheme is appropriate when the current farming methods proved to be economically efficient and well -adapted to the hydrological regime of Rufiji.

Besides hydropower and irrigation, the third function of the dam would be flood control. However, floods are essential for the sustenance of the farming system, for the productivity of the natural resources on which some 150,000 people depend and also for the maintaining the biodiversity of a variety of terrestrial and aquatic ecosystems. For the local communities (the vast majority of) the floods are perceived as a blessing. In contrast, droughts are perceived as the main threat to their livelihoods. The flood risk is especially emphasised by administrators who have their origins outside of Rufiji District and was used in the 1960s and 1970s to pilot the *Ujamaa* villagisation policy. Arguably, hazardous floods could be more effectively mitigated by flood control measures in the Luwego catchment, which could possibly also benefit the wildlife that, through trophy hunting, is at present the most economical use of the southern part of the Selous Game Reserve. Some soft engineering solutions could create a series of infrastructures to slow down flow and create improved habitat for wildlife.

Conclusion

It is amazing that the myth of a vast irrigation potential in the Lower Rufiji has survived for so many decades after the thorough and pessimistic assessments by

Telford[40] and Gillman.[41] Hoag[42] has convincingly argued that, in contrast to the colonial scientists who were in close contact with the valley and its inhabitants, the post-WW II development science approach turned the valley into an abstract entity which could easily be dominated. A bottom-up development approach to small-scale irrigation supported by a microcredit scheme and targeting the driest western floodplain where food insecurity is highest is likely to be a more realistic option. It goes without saying that the recently promoted large-scale, agro-fuel development projects, in particular of sugar cane, in the same floodplain are bound to be just as hypothetical as their rice and cotton-based forebears.

Notes

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