The Senegal River:

Flood management and

the future of the valley

Adrian Adams

Adrian Adams has lived for twenty years in Senegal and works with a farmers' organisation in the Senegal River Valley. In her latest book (with Jaabe So)*"A Claim to Land by the River: a Household in Senegal 1720-1994"* she depicts the 20 year struggle of a farmers' organisation to defend its vision of people-centred development against the State development corporation in charge of irrigation projects in the Senegal River Valley (see *Haramata* N°32, page 23). For further information, please contact the author at the following address: BP

11, Kounghani via Bakel, Senegal. Fax: +221 983 52 56. E.mail: adrian@telecomplus.sn.

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INTRODUCTION

The River Senegal rises in the Fouta Djallon and flows northward through increasingly arid land; when it finally turns west towards the ocean, it borders on desert. In these areas of low rainfall, the river's annual flood is necessary to life. Towards the end of the rainy season, it overflows its banks and floods the broad alluvial plain of the middle valley, where crops are grown in the dry season after the waters have receded. The valley's agricultural production systems traditionally followed the seasonal rhythm of the river: rainfed cropping and pasturing on the *jeeri* uplands, followed by flood-recession farming and grazing on the *waalo* lowlands. Over the period 1946-1971, it is estimated that on average 312,000 hectares were flooded every year on both banks of the river, and 108,000 hectares cultivated; on the Senegalese side of the river, 65,000 hectares were cultivated. (OMVS-IRD, 1999).

Projects to develop the potential of the river, based since colonial times on irrigated rice-growing, have never taken this age-old production system into account. Since the 1960s, rainfall and river flooding have declined considerably, and in some years have been non-existent. The drought simplified things for would-be developers by allowing them to behave as if the valley's traditional agricultural and pastoral production systems were a thing of the past, and the future belonged to irrigation alone. When Senegal ratified the OMVS programme, this « clean sweep » policy became irrevocable. The planned dams would not stop the rains, but they would make it possible to cut down considerably on annual flooding.

THE 1970S: THE FUTURE ACCORDING TO OMVS

The Organisation pour la Mise en Valeur du Fleuve Sénégal (OMVS), the members of which are Senegal, Mali and Mauritania, was established in 1972. It replaced the Organisation des Etats Riverains du Sénégal (OERS), founded in 1968, which was broken up after the withdrawal of its fourth member, Guinea. Its appointed task was to promote and co-ordinate the development of the river basin on the territory of the three member states.

In the year of its founding, OMVS stated its aims as being: to provide a secure and steadily improving livelihood for the inhabitants of the river basin and neighbouring areas; to safeguard as far as possible the ecological balance of the river basin; to make the economies of the three member states less vulnerable to climatic conditions and external factors; and to accelerate the economic development of the member countries by the intensive promotion of regional co-operation.

In 1973 it announced its programme, based on the construction of two dams: one upstream, at Manantali in Mali, which would retain the waters of the Bafing; and one at the mouth of the river, which would stop salt water entering the Delta and lower valley. The programme included three components. The first was irrigation. The second was navigation: the river was to be made navigable between Saint-Louis and Kayes throughout the year. The third was energy, with the construction of a hydro-electric power station at the foot of the Manantali dam.

How would irrigation contribute to achieving the declared objectives? The twelve-volume *Programme intégré de développement du bassin du Sénégal* stated that the aim was to bring under irrigation between 300,000 and 400,000 hectares of land, which would yield two crops a year. Between 1975 and 1983, the area under cultivation would increase from 6,356 hectares in the rainy season and 3,250 hectares in the dry season to 72,841 and 58,776 hectares respectively. In other words, the area under cultivation would grow fourteenfold in nine years: an average annual increase of 13,500 hectares. The main crops would be rice and wheat, while the areas devoted to sorghum and maize would gradually diminish. For twenty years, the river's annual flood would be artificially maintained, to allow for traditional flood-recession farming, but the level of flooding would be reduced from year to year; by the end of the twenty-year period, it was expected that the entire population of the valley would be engaged in irrigated farming (PNUD-OMVS, 1974).

It was reckoned at the outset that the programme as a whole would extend over 40 years, with an overall budget of 800 billion CFA francs, 280 billion of which would be spent on agriculture. At the end of the 1970s, the cost of the Diama dam was estimated at 34 billion CFA, that of the Manantali dam at 102 billion. By the early 1980s, funding had been obtained for the first phase and work could begin .

Many people warned of the predictable consequences of the OMVS programme:. agronomists, economists, sociologists and journalists, most of them foreigners. Their warnings went unheard; and the people whose interests they were defending – the inhabitants of the valley – were not even consulted.

Box 1. Critics of the dams

"Just under a year ago, France asked for alternative solutions to be considered. A study was carried out, but only a few insiders got to see it… and quickly hid it away. No wonder: for it showed not only that the OMVS programme was not essential to food security in the region, but that in many respects it was the worst possible solution… (…)"

"More and more voices are being raised to demand that the project be re-examined before embarking on such a gigantic undertaking , and that the full range of conceivable solutions be considered . This would make it possible, within a reasonable period of time, to devise a programme ensuring the harmonious and productive economic and social development of a region which, after a long period of neglect, is now in danger of being handed over to sorcerers' apprentices" (Bessis, 1981).

Who will benefit from these big dams? OMVS tells us that a key objective is to "guarantee and improve farmers' incomes". Once again, the farmers are being used as a pretext. Supposedly, it is all being done for them. But if we look more closely, we find that the dams have already benefited:

- research consultancies, which have made billions of francs in fees and are hoping to make a lot more;
- the bureaucrats of the OMVS and their counterparts in each of the three countries.

Once the decision is taken, and construction work begins, the major beneficiaries will be the big public-works contractors, along with the firms that supply them with all kinds of equipment… The planned operations will be a source of considerable profit for all these vested interests. When the dams are completed, they will leave the farmers and the countries concerned to try and make the best of it all; but they will wash their hands of the failures and difficulties which are bound to occur " (Dumont, 1981).

"The development of the Senegal River is a vital task for the peoples of the River and the countries through which it flows. However, if it were to be carried out with the aims and methods envisaged at present, it would be better for them that it not be undertaken at all" (Adams, 1977).

IRRIGATED CROPPING: AN IMPASSE

There were trials of irrigated rice-growing in the Delta as early as the 1950s. But it was not until 1973 that SAED, the state corporation responsible for developing agriculture on the left bank of the river, extended its activities from the Delta to the Valley itself. At Nianga, in Podor province, it constructed dikes around 10,000 hectares of flood-plain land and, in 1975 built the first large-scale irrigation scheme, 650 hectares. In 1975, it extended its activities as far as Matam, where an agent of SATEC (a French consultancy), sent to the area in order to improve yields of sorghum production, created three small irrigated rice-growing schemes, 25 hectares in all, with 150 drought-stricken farmers; and Bakel, where irrigated rice-growing was introduced by a French agricultural technician who had come to help a local farmer improve subsistencefarming in the area .

Small village-level irrigation schemes (‘périmètres irrigués villageois’, or PIV) developed rapidly in the Valley: from 20 hectares in 1974, to 7,335 hectares (i.e. 29% of the total area brought under irrigation) in 1983, and 12,978 hectares by 1986. Should this be regarded as a success? That is how it was seen at the time. But it proved to be a dubious success, as it was based on exceptional technical, economic and social conditions. The PIV were developed during a time of drought, which devastated rainfed crops, severely reduced the areas available for flood-recession farming, and killed off much of the area’s livestock and fish. Thus for local farmers, irrigated agriculture was the only possible activity at the time. Irrigation equipment was supplied free of charge, and SAED provided inputs and services in the form of seasonal advances at subsidised prices (over 50% in some cases), to be repaid after the harvest. Irrigation networks were built on the light soils of the river bank, which were not highly valued in the traditional system of agriculture and were thus generally available for irrigation. .

If the drought and the subsidies had continued, it would have been possible to go on believing that the government and local farmers were pursuing the same objectives. But the changes which occurred in the 1980s (improved rainfall, withdrawal of subsidies and tougher conditions for access to credit, locating of irrigation schemes on flood-recession land surrounded by dikes to prevent flooding) brought latent contradictions out into the open . Structural adjustment programmes entailed new policies, such as promoting private-sector activity demanding that farmers take on responsibility for their own affairs, and reducing levels of State intervention, which heightened inequalities between poor farmers hard hit by the withdrawal of subsidies, and those with the means and connections required to take advantage of the new circumstances. Thenceforth, irrigation began to create problems for social cohesion and access to land, especially in the Valley.

At the end of the 1980s, more than two-thirds of irrigation schemes were located in the Delta, defined for our purposes as the area downstream from Dagana: large schemes built by SAED, many of which had been rehabilitated and transferred to groups of producers, and schemes belonging to the rapidly growing private sector. In this area, where there had been little farming before the advent of irrigation, irrigated farming was often undertaken by "new farmers" with other means of subsistence; it was highly mechanised, and most of the harvest was marketed. The main difficulties – declining yields, pollution and salinisation of poorly drained lands – were due to the anarchic spread of poorly-constructed private irrigation schemes,, without any proper planning of water use. There were also serious difficulties with the repayment of loans. Delta land requires a level of investment which few of its present users, whether peasant farmers or or private developers , seem able to achieve.

At the same time, less than a third of irrigation schemes – mainly rough-and-ready first-generation PIV – were located in the Valley (upstream from Dagana). In 1989-1990, only 121 of the 215 irrigated PIV in the département of Matam were wholly or even partly under cultivation. All the first-generation PIVs were run-down and no longer in use. Some of the second-generation schemes, established on flood-recession farmland, had yielded poor results. In the département of Bakel, a study of 823 hectares of PIV revealed that 40% of the total area was not being farmed in 1988-1989.

In the Valley, as opposed to the Delta, little of the harvest is marketed, and there are few non-agricultural resources apart from emigration. In a subsistence society, when production costs rise, farmers will decide to use their resources of money and labour elsewhere – because those resources are limited and essential to their survival. But what is in itself a rational choice in difficult circumstances, could have the unfortunate effect of excluding peasant farmers (defined as persons whose only resource is agriculture) from irrigated farming. And who would benefit? In the Valley, as opposed to the Delta, applications for land come mainly from local residents: traditional leaders, traders, men working abroad, who register of their family's land in their own names, thus using their traditional rights as a launching-pad for commercial agriculture, usually on fairly small irrigation schemes.

By the end of the 1980s it was clear that if poor farming families were to continue to depend on irrigated farming alone for subsistence, the only way they could make ends meet, – apart from emigration, which would deprive them of the necessary manpower – would be by working as agricultural labourers, which implies the existence of a flourishing private sector. The danger is therefore that in the absence of modes of agricultural production other than irrigation (in particular flood-recession farming), independent peasant farmers will cease to exist as a class, as a result of pauperisation and proletarianisation; whether directly, when those lacking the means to irrigate are deprived of access to water, and therefore to land; or indirectly, through dependence on jobs created by alienating a growing proportion of irrigable land, which will in turn jeopardise young men's chances of gaining access to irrigated farming .

Diama was completed in 1986, Manantali in 1988; the two dams were officially inaugurated in 1992. As we have seen, they were built during a period of growing difficulty for irrigated agriculture, with mounting debts, ecological degradation of the Delta, and irrigation schemes being abandoned in the Valley. A few years later, it became clear that the production goals put forward to justify the OMVS programme were far from being attained. Not only had the social objectives (a secure and improved livelihood for the inhabitants of the River basin) not been achieved; in at least one respect, they had been deliberately set aside. For during the first few years after the dams came into service, when there was a clear need for artificial flooding to provide the inhabitants of the Valley with a degree of food security, OMVS did not keep its promise.

ARTIFICIAL FLOODING: A BROKEN PROMISE

In 1986, the year before the Manantali dam came into commission, there was a good flood. In 1987 there was no flood at all, as the reservoir behind the dam was being filled. In 1988, there was an artificial flood of modest but satisfactory proportions: harvests would have been good but for an invasion of locusts. But in 1989 OMVS caused major losses by allowing two floods to take place. An initial natural flood, from the river's two unregulated tributaries, receded fairly rapidly, and farmers had begun to sow their flood-recession crops when a second – artificial – flood, unleashed "for technical reasons", drowned the seedlings in low-lying areas. Many farmers, lacking seed and labour, were not able to sow another crop. In 1990, despite drought and the almost total failure of rainfed crops, OMVS decided not to release any water at all, but to retain all the water to test the reservoir's storage capacity.

In 1991, with tests of the reservoir's storage capacity completed, an artificial flood might have been expected. In the Middle Valley, 1991 had been a year of drought; it was an excellent opportunity to show how the dam could benefit local communities. On September 1 and 2, approximately 1000 m3/s was released to join the natural flood of the unregulated tributaries. Two days later, the river reached a flow rate of approximately 2500 m3/s at Bakel, the minimum required to produce flooding. If the release rate of 1000 m3/s had been maintained for about a week, there would have been a good flood and good harvests on the *waalo*. But all OMVS wanted to do was keep the water level in the reservoir at around 206 metres above sea level; once this had been achieved, they reduced then stopped the release of water. The water level in the reservoir was then kept at 207 – and subsequently 208 – metres, close to its maximum capacity. Even so, so much water was flowing into the reservoir that it was necessary to make periodic releases of 1000 and even 1500 m3/s. When the flow of the river reached 2500 m3/s, part of the flood-plain was inundated and farmers sowed their fields when the water receded. A few weeks later, as in 1989, a second release from the Manantali dam drowned a large part of their seedlings.

In September 1992, OMVS released enough water to cause a flow of between 1900 and 2400 m3 at Bakel. It was enough to flood the lower-lying depressions but not enough to ensure good *waalo* harvests over the whole of the flood-plain area. The rains had been poor along much of the Valley and the releases of water had been, as the OMVS consultants freely confessed, below the minimum needed to provide a "useful flood" (Horowitz, 1993).

This failure on the part of OMVS to fulfil its commitments is all the more striking when we consider that during this period, there was a significant change in the Senegalese government's position on the issue. OMVS' position had always been that artificial flooding should be a temporary measure, lasting only ten years. But as early as 1984, the then Minister of Planning, Cheikh Hamidou Kane, suggested a more flexible position, whereby the annual flood would be maintained until such time as the farming population of the Valley had gained access to enough irrigated land to satisfy their basic needs. Moreover, he said, "It may prove necessary to maintain artificial flooding if its suppression is likely to cause the degradation of natural eco-systems and the destruction of existing agro-pastoral systems of production" (République du Sénégal, 1984).

In 1987, a team from the Institute for Development Anthropology (IDA) in the US, embarked on a research programme in Senegal known as the Senegal River Basin Monitoring Activity (SRBMA). This showed that, area for area, flood-recession farming yielded better results than irrigated agriculture for an equal investment of labour and money, while minimising risks. The work of this team, of a high scientific quality, successfully defended the idea that permanent controlled flood releases from Manantali, raising the level of the river to that attained in times of natural flooding, was justified in that it would increase levels of production, income and employment, while protecting the environment. They also claimed, contrary to OMVS consultants, that there was no incompatibility between controlled flooding and the production of electricity. Their work became a basic reference for any discussion of the future of agriculture in the Valley (IDA, 1991).

Box 2. IDA: an alternative use for the dams

The solution to these problems does not lie in giving up irrigation but in seeing it in clearer perspective as one – and not necessarily the most important – element in a complex production system. The overall productivity of this system and the manpower invested in it can be improved by appropriate management of the Manantali dam. But if people are to make the necessary investment in sustainable agriculture, they must be guaranteed on-going access to the basic factors of production, in particular land (both irrigated and flood-recession) and water (p. 23).

We recommend that the dam be managed in such a way as to support a diversified production system, in which the guiding principle is the concern to achieve equitable economic growth without damage to the environment. This would mean the dam managers releasing from the Manantali reservoir the volume of water needed to maximise production in the flood-plain area, while safeguarding the environment and taking into account the needs of irrigation and the production of hydroelectric energy (p.39).

The time has come to adopt a new approach to the development of river basins, for a number of reasons. Firstly, there is growing evidence of the ecological, economic and socio-political costs of river basin development strategies which greatly reduce annual flooding. Secondly, more and more stress is being put on development which favours the majority of rural people on low incomes. Thirdly, African governments are giving greater attention to the decentralisation of responsibility for decision-making and management. Fourthly, there is a growing awareness… that success in managing the environment depends on the participation and advancement of the rural poor. Development strategies which impoverish these groups and degrade some of Africa’s most productive eco-systems – as has happened with the development of many river basins in Africa – are really a thing of the past (p.318).

Source: Horowitz, Salem-Murdock et al, 1990

When the results of IDA's work were presented at a seminar in Dakar in November 1990, they were favourably received by the Senegalese government, which, with its Left-Bank Master Plan (Plan Directeur de la Rive Gauche), was about to opt for maintaining a yearly artificial flood. However, the then OMVS High Commissioner declared that this research was an affront to the authority of OMVS, the only body authorised to decide how the water in the Manantali reservoir should be used. Moreover, the IDA's hydrology expert was advised that it was "dangerous" to raise questions about artificial flooding, as farmers might begin to think they were entitled to it.

Introduced in this way, the issue of artificial flooding could have led to an in-depth debate on agricultural policy for the Valley, and the need to choose between two objectives: making the dams profitable as quickly as possible, and ensuring the survival of family-based farming. Fairly conducted, such a debate might have reached the conclusion that opting for the first objective would ensure that the second could never be achieved; whereas the reverse was not true. However, despite a few gestures in that direction, such a debate never took place. Although the question remains alive, its outcome seems more doubtful than ever; even though it is now widely acknowledged that of all the consequences of building a dam, changes in the river's downstream flow are the most harmful of all for the natural and human environment.

IS THERE NOW AN AGRICULTURAL POLICY FOR THE RIVER?

Thus, by the early 1990s. the development of the Senegal River was in a state of crisis, having achieved neither its economic nor its social objectives. The Master Plan for the Integrated Development of the Left Bank (Plan Directeur de Développement Intégré de la Rive Gauche / PDRG), drawn up in 1990 and adopted by the Senegalese government in 1994, seemed to recognise this fact. Its introduction presented a highly critical account of the past twenty years, and stated that "towards the end of the 1980s, so many setbacks and fears for the future caused something of a change of direction".

The text continued: "In the end, there was a rethink of the development strategy chosen, the idea of maximising irrigated areas being replaced by one of integrated and harmonious development, seeking to achieve the best possible compromise between social imperatives (self-sufficiency in food for the local people), economic imperatives (a return on investment) and ecological imperatives (restoration and protection of the environment)." And it concluded:

“The ‘Master Plan’ arose from this context, and aims to define a development strategy for the left bank over the next 25 years” (République du Sénégal, 1994). In at least one area – that of the annual flood – this strategy was indeed new.

The PDRG stated, it is true, that irrigated farming was the best way of achieving “social” objectives (self-sufficiency in food and job creation), a view which seemed to bear little relation to the prevailing situation at the time the Plan was drafted. And, “after political arbitration on the part of the Senegalese authorities, in collaboration with the Word Bank”, it opted for scenario A, out of a list of five possible scenarios (see box 3). This scenario envisaged irrigating as much land as possible without jeopardising other uses of the water (environment, flood-recession farming , hydro-electric power).

The Plan did nevertheless contain an explicit commitment, however cautious, to maintaining artificial flooding on a permanent basis. And, for the first time, it defined a strategy which gave a clear – albeit limited – place to maintaining flood-recession farming as an enduring component of the Valley’s agriculture. In fact, scenario A guaranteed 33,000 hectares of flood-recession farmland and 63,000 hectares of grazing land. The two initial phases of the PDRG were also said to be compatible with scenario B1, which would guarantee 50,000 hectares of flood-recession farming. It is worth remembering that, in the 1946-1971 period, the average area flooded was estimated at 312,000 hectares on both banks and 65,000 hectares on the Senegalese bank. The maximum area of flood-recession farming in the years 1970-1979 was 62,200 hectares; the minimum area 10,700 hectares (OMVS-IRD, 1999).

But what has become of this Master Plan? It seems to have disappeared without trace. For OMVS, it is as if it never existed. In 1994, after a good flood, the farmers had begun sowing what promised to be an extensive area. Then a second flood, caused by emptying the Manantali reservoir, killed off their seedlings and inundated the cultivable areas for several months; that year’s flood-recession farming had to be abandoned. The exceptional flood of 1995 was just as fortuitous, due to a decision not to retain water so that the dam could be inspected. An IRD aerial survey and photographs showed that, in the département of Podor, the area brought under flood-recession farming in 1995-96 was double that estimated by OMVS in 1970-71. This shows how important this form of agriculture is for the local people, and how quickly they can adapt to changed circumstances.(Le Roy, 1997). But the following year, the flood failed to materialise.

Box 3. The five PDRG scenarios

Z	The "high-productivity" scenario, aiming in the long term to develop the largest possible irrigated area (154,500 ha of food crops) and as much hydro-electric power as possible, but with no guarantees for flood recession farming or the environment if the natural flood should fail to materialise.
A	A major increase in the irrigated area (to 88,000 ha), with artificial flooding to ensure over 33,000 ha for flood-recession farming (land submerged for more than 2 weeks) and approximately 63,000 ha for grazing and forests (land submerged for less than 2 weeks).
B1	A moderate increase in the irrigated area to a total of 53,000 ha, with artificial flooding to ensure the inundation of over 107,000 ha, of which 50,000 ha for flood-recession farming .
B2	"Base-line' scenario, aiming at long-term preservation of the area so far brought under irrigation. This scenario would include artificial flooding to inundate 122,000 ha, of which 57,000 ha for flood-recession farming .
C	Maximum artificial flooding, guaranteeing 67,500 ha of flood-recession farming and 61,000 ha of grazing and forests. Where irrigation is concerned, it would represent a retreat, with only 14,500 ha allowed; it would also cut back on the production of hydro-electric power.

Source: République du Sénégal, 1994

According to SAED's own statistics, the total area covered by irrigation schemes on the left bank in 1995 was 71,751 hectares; and the area actually cultivated, both seasons included, was 29,792 hectares. (Some sources claim that irrigated farming has recently revived, but this seems to be due to a debt moratorium, and thus represents only a temporary improvement , not a lasting solution). However, SAED is pursuing an ambitious construction and rehabilitation programme for irrigation schemes, costing a total of 178 billion francs CFA. Part of this programme has already been carried out, and there is funding available for a further part. If SAED were operating within the framework of the PDRG, which advocates devoting 88,000 hectares to irrigated agriculture, should it not at least have suspended work on new schemes?

In 1995, the World Bank approved the Agricultural Sector Adjustment Programme (Programme d'Ajustement Secteur Agricole - PASA) presented by the Senegalese government, and this was used as a basis for the Agricultural Sector Investment Programme (Programme d'Investissement du Secteur

Agricole - PISA). Just like the SAED and OMVS programmes in the past, the PASA sets both economic and social objectives: while aiming at an average annual growth rate of 4%, it aims to improve food security, rural incomes, and natural resource management. But the strategies it proposes – deregulation, reducing the level of state intervention, land-tenure reform – are simply a return to the New Agricultural Policy of the 1980s. The same is true of the agricultural projects and programmes formulated as part of PISA, clearly based on the idea that food security will be ensured by massive investment in irrigated rice-growing, and that growth of 4% can be achieved by a large increase in the production of paddy (which is meant to almost quadruple by the year 2000). Similarly, it is still cash crops that are expected to create jobs in rural areas. And above all, as far as the Valley is concerned, there is no mention of the PDRG, even though it was adopted by the government only a year earlier. It was like a return to ten years before.

In fact, the government's actions gave no indication that it had in any way reconsidered the agricultural policy it had conducted in the Valley since independence – a policy based exclusively on irrigation. On the contrary, the Valley's future prospects continued to be described in terms identical to those current in the 1970s. For instance, the Minister of State for Agriculture stated in 1997: "The only solution for us is irrigation" (*Sud*, 17/11/97). It would seem that the adoption of PDRG, which at least allowed room for doubt on this issue, was an aberration.

Thus the government refused to acknowledge, despite ample evidence, that its agricultural policy for the Valley was in difficulty, let alone revise it to take account of reality. A total impasse was reached. Is this why the 1990s witnessed the promotion of other schemes for the Valley – the Cayor Canal, the Fossil Valleys, the Manantali Energy Project – which relegated agricultural development to the background ?

THE CAYOR CANAL AND FOSSIL VALLEYS PROJECTS

The Cayor Canal project was intended to divert water from the Senegal River to the Dakar region via an open canal connecting Lake Guiers with the Cap Vert peninsula. It was supposed to satisfy the region's drinking water needs and at the same time provide 8,500 hectares of irrigated land in the Louga, Thiès, Diourbel and Dakar regions. The cost of the first tranche of engineering work was estimated at 76 billion francs CFA[1], with an additional 37 billion CFA francs for constructing irrigation schemes. This project, which was the subject of a full technical and financial study, now seems to have been shelved because of reservations on the part of the funding agencies. If one compares it with the Manantali Energy Project, with its 1,400 km of power lines and overall cost of 223 billion francs CFA (for which funding seems to have been secured), the main difference appears to be that the Cayor Canal, which was to have been built by the engineering corps of the Senegalese army, did not hold out the prospect of lucrative contracts for foreign companies.

Map of the Fossil Valleys and Cayor Canal projects

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Conceived under the auspices of the Ministry of Hydraulics after the PDRG had been drawn up, the Fossil Valleys Revitalisation Programme (Programme de Revitalisation des Vallées Fossiles / PRVF) is a plan to restore water on a permanent basis to 3,000 km of former watercourses: the valleys of the Ferlo, the Saloum, the Sine, the Baobolon, the Car Car and the Sandougou. The water would be drawn from the Senegal River at two places, one situated upstream from Matam, the other at Keur Momar Sarr. The latter site has already been used, in 1994, to restore water to approximately 150 km of the lower Ferlo valley, where pilot farms have been set up. The aim of PRVF is to make better use of the water made available by the construction of the OMVS dams, by diverting to central areas of Senegal the excess water that would otherwise be discharged into the sea during the annual flood. The idea is that this would give a great boost to Senegal's economy, in particular agriculture (with 75,000 hectares to be brought under irrigation), livestock farming, inland fisheries and forestry. The estimated cost is 30 billion francs CFA.

It is only possible to draw water from the Senegal River at the time of the annual flood (15 August–15 October), but the flood is insufficient to guarantee the quantity of water needed to irrigate these 75,000 hectares without jeopardising other needs. The fact is that the water regarded as being "discharged into the sea" serves to maintain, for a minimum of 2 weeks, the water level required to submerge low-lying flood-recession farmlands. The project's promoters nevertheless claim that the volumes of water they plan to draw off are still well below the quota allotted to Senegal by OMVS. They say

[1] Equivalent to US$ 122 millions.

that this quota amounts to 6 billion cubic metres of water annually, while the main uses being envisaged (PDRG, Cayor Canal, Fossil Valleys) would only account for 5.4 billion cubic metres. However, this calculation disregards the water needs of the Manantali Energy Project.

It would seem that the decision to postpone the PRVF was due to protests from the Mauritanian government. This may be only a tactical retreat. The press reported remarks made by high-placed government officials– during an electoral period, it is true – suggesting that the project has not been shelved. As far as the lower Ferlo valley is concerned, talks are still going on with potential investors, and at the end of 1998 the Ministry for Water Development announced that a study to measure the impact of the project in terms of water use had been finalised and would be submitted to the heads of state of the OMVS countries. But it seems unlikely that this project will survive the installation of turbines at Manantali. Conceivably, in the mind of the decision-makers, writing off flood-recession farming in the Valley is one thing, but giving up the prospect of extra electricity for Dakar, Nouakchott and Bamako is quite another.

THE MANANTALI ENERGY PROJECT

The energy component of the OMVS programme, planned since 1977, languished for many years due to lack of funding. Then, at the end of June 1997, the World Bank approved a loan of US$ 38 million to help fund the installation and operation of hydro-electric turbines at Manantali dam. The Diama and Manantali dams together cost almost 200 billion CFA. The Energy Project will cost a total of 223 billion CFA, 18.7 billion of which is to be paid by the governments of the three OMVS member countries. Of the remaining 205 billion, 136 billion will be raised by loans and 67.3 billion in the form of donations. The main contributors, apart from the World Bank, are France, Germany and the European Union.

The project involves the installation at Manantali of a hydro-electric power station with a capacity of 200 megawatts (MW), capable of supplying approximately 800 gigawatt-hours (GWh) of electricity per annum in a year of average river flow. In the original version of the project, this electricity was destined for the development of the mining industry in Mali. According to the current plan, Manantali's electricity is mainly intended to supply the cities of Dakar, Nouakchott, and Bamako. It will be transmitted by a network of more than 1,400 kilometres of landlines, which alone will cost 114 billion francs CFA: 326 km for the eastern line (Manantali-Kita-Bamako) and 821 km for the western line (Manantali-Kayes-Matam-Dagana-Sakal) - with a branch from Matam to Kaédi (87 km) and another from Dagana to Rosso and Nouakchott (226 km) – joining the existing Sakal-Tobène line which supplies Dakar.

According to the World Bank, the aims of the project are as follows: to reduce the cost of electricity in each of three countries; to help service the debt incurred in building the Manantali dam; to improve the efficiency and reliability of the three countries' electricity networks; to promote private-sector participation in running the project and other future projects in the Valley; to set up an effective organisation to build and operate the project installations and to limit the negative impact of the project and the Manantali dam on the environment and health; and to support the traditional agricultural sector downstream of the dam by rational management of the Manantali reservoir (World Bank, 1997).

Manantali hydropower project: Supply lines

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As far as *reducing the cost of electricity and improving the efficiency of the networks* is concerned, the energy from Manantali (52% of which will go to Mali, 33% to Sénégal and 15% to Mauritania) will reduce the price of electricity for the Senegalese consumer by only 8%, and will supply only 15% of SENELEC's needs (present capacity 330 MW). It will merely postpone for three years the need for further investment. Moreover, the electricity generation projections used in calculating the profitability of the project are based on hydrological data for the period 1950-1994. If they had been based on data for the years 1974-94 – a period of poor river flow which corresponds more closely to present-day realities – the anticipated amount of energy generated would drop from 804 to 547 GWh; and the energy savings anticipated by the governments of the OMVS countries would fall from 22% to 17%. It would have been better to make a thorough examination of the alternatives – natural gas from Diamnadio, the hydro-electric resources of the Gambia River, reducing the price of fuel by doing away with state subsidies to the Société Africaine de Raffinage – before embarking on a project the costs of which (both direct and, as we shall see, indirect) are very high, and the profitability less certain than one is led to believe.

As for *helping to service the debt* incurred for the construction of the dams, roughly 65% of the funding was in the form of loans, and in 1996 the amount required to service the debt was around 12 billion CFA. The plan is that the Société de Gestion de l'Energie de Manantali (SOGEM – Manantali energy management company), to which OMVS has had to delegate its responsibilities in this field, will pay 43.8% of the interest on the debt out of its revenues, and the remainder will be paid for by revenues from irrigation (and navigation, if it ever gets off the ground). However, the loans to fund the Energy Project will considerably increase the debt: from 47.4 billion CFA in 1997 to 184.6 billion in 2001.

Private-sector participation in the fruits of the project is a certainty. Quite apart from all the studies carried out over the last twenty-five years, and the lucrative contracts – for the dam's electro-mechanical equipment, civil engineering, etc. – won by European companies, SENELEC (the Senegal national electricity company) has been privatised (the main acquirer being Hydro-Québec), and even the task of producing electricity at Manantali will be entrusted to a private operator. For, as regards *the establishment of an efficient organisation*, the World Bank also stipulated that the newly created SOGEM, acting through a consortium of companies, should appoint a private operator – to be known as the Société d'Exploitation de Manantali (SEM) with a renewable fifteen-year contract to manage the production of electricity and, by extension, the day-to-day operation of the dam. SENELEC and the other national companies will pay SEM, which, after deducting its share of the proceeds, will pay the rest to SOGEM.

The role of the OMVS High Commission will be limited to monitoring decisions taken in respect of water management, mitigating adverse effects on the environment and health, etc. But in this field, unlike that of electricity production where all organisational and financial matters have been carefully studied, efficiency seems to count for little: everything has been left very vague. A plan has been drawn up to minimise and monitor impacts on the environment (Plan d'Atténuation et de Suivi des Impacts sur l'Environnement - PASIE), but it explicitly states that "it only covers activities directly related to the Energy Project and which come within the remit of SOGEM", and therefore does not make OMVS directly responsible. The environmental monitoring and protection programme and the environmental health programme have been judged very unsatisfactory when compared to work already done in this field.

Even the IRD studies on optimising the management of the Manantali reservoir are relegated to the PASIE framework. Yet these studies are the only evidence of the World Bank's interest in the last of the quoted objectives: *supporting the traditional agricultural sector downstream*.

No doubt we should be happy to find, alongside productivity-orientated objectives (in this case focused on electricity), at least one objective (apart from health and the environment) presented as being of a social nature or, to use the Bank's terminology, related to "the struggle against poverty". We are assured that the Manantali reservoir will be managed as a multi-use reservoir, and that artificial flooding will revive the traditional functions of the river's flood-plain. But doubt soon creeps in. Can we really believe that, just when Manantali is about to begin supplying electricity to the three capital cities and generating income for OMVS, OMVS is going to use the dam to benefit flood-recession farming and grazing ? A closer look reveals that things are not so simple: the funding agencies' reports contradict themselves and one another.

Box 4. What should we believe in the reports published by the World Bank…

By addressing some of the key impacts of the existing dam, the project will also improve the situation of low income rural communities in the river valley… The reservoir management optimisation program, prepared under the project, will contribute to improve the artificial flood regime for purposes of traditional agriculture, which is vital for low income rural households (p.36).

Aa preliminary hydrology study conducted in 1996 by ORSTOM … indicates that there would be on average a reduction in flood-recession agriculture from 45,000 to 30,000 hectares … as compared to the situation without the power plant. (Appendix 11). (World Bank, 1997)

… and the African Development Bank?
In the long term, the construction of the two dams will make it possible to resolve population and food problems, through the stabilization of the people and the re-establishment of the balance of the ecosystem (p.1). The development strategyof the Senegal river basin aims to establish a balance between man and his environment (p.8)., The availability of water in the river Senegal all during the year has become possible, thanks to the Manantali dam. A vast campaign for the occupation of agricultural lands is underway on both sides of the river…. The significant results of the farming activity in this region which was formerly unsuitable for agriculture are drawing new populations (p.25). The results obtained at this stage are impressive: the regulation of the flows of the Bafing in order to facilitate the double cropping irrigation of the schemes, , and the supply of an annual artificial flood (p.39). A marked improvement has been observed in the health of the people living in the valley (p.36). (ADB, 1994)

Although the Energy Project *per se* will not have any major impact on the environment, it provides occasion for correcting the negative impact which the Manantali and Diama dams have had on the basin's sensitive ecosystems, traditional flood-recession crops , river fishing and the population's health. (…) The absence of or the low flood level induced by the retention of Bafing waters by the dam (nearly 60% of the river flow), seriously disturbed the basin's ecosystems and disorganized its traditional economic activities, as a result of which the region became the poorest in all three countries. The appearance and increase of social disparities and malnutrition led to the massive exodus of labour force from the basin.Moreover , the development of irrigated agriculture and the absence of salt encroachment on the delta resulted in the proliferation of habitats of endemic diseases, e.g. bilharzia. There has also been an increase in malaria cases and the appearance of new resistant strains (p.36). (ADF, 1997)

If the Energy Project's alleged benefits for traditional agriculture are being emphasised now, might this not be to allay fears until it is too late to protest? We will return later to the reservoir-management optimisation study – funded by the World Bank and conducted by IRD – which has the merit of clarifying what can be done in terms of flood support. For the time being, let us merely note that the scenario adopted represents a step backwards compared with the PDRG: the area of flood-recession farmland is smaller, and nothing is planned for regenerating flood-recession grazing , groundwater reserves and forestry resources, nor the areas in which river fish can spawn, which were eliminated by the dam.

In theory the water management plan, reconciling the three main objectives of the scheme (supplying water for irrigation, producing electricity and flood support in aid of flood-recession farming agriculture), was meant to be drawn up under the supervision of OMVS, with the participation of the local communities concerned, before the year 2000, and before the recruitment of a private operator to manage SEM. Indeed, the plan was meant to serve as the basis for a reservoir management manual to be presented to companies bidding for the contract to manage SEM, and for a Water Charter (*Charte des Eaux*) to be signed by the three countries involved. In fact, however, the reservoir management manual has already been drafted; it gives priority to electricity generation, which in times of low water flow is in direct competition with flood support. And OMVS has launched the procedure for recruiting the private operator to be responsible for the management and maintenance of the dam and the Manantali power station. The water management plan no longer seems to be on the agenda, and preparation of the Water Charter, which was supposed to be based on a consultation process involving all the local stakeholders, remains at the planning stage. The Charter is also supposed to draw on a cost-benefit study funded by the World Bank, which aims 'to determine on a socio-economic basis the order of priority to be given different types of water use.' At the time of writing, the cost-benefit study had not yet begun.

Will the authorities really wait for a water management plan, before initiating the sequence of events leading to the installation of the turbines? It would appear that work is under way at the construction site. The contractors for the eastern electricity line are already on site, and invitations to tender for the western line have already appeared in the press. Without a water management plan taking into consideration the needs of all water users, and including precise and binding instructions to the dam operator, the Valley peasant farmers will again be the losers, and this time for good. Once management of the dam has been handed over by SOGEM to a private operator, under an agreement guaranteeing a certain level of electrical power generation and with clauses penalising the countries involved in the event of failure to comply, it will be impossible to change management priorities .

FLOOD SUPPORT: WHAT IS POSSIBLE?

The importance of the annual flood for the balance of small-scale family agriculture in the Valley needs no further demonstration. In the first part of this study, we noted the negative effects of the dams on the annual flood, and the additional dangers arising from the Manantali Energy Project. What remains to be discussed is whether it is still possible to save the situation.

It will be recalled that in 1991 the research team from the Institute for Development Anthropology recommended that water be released each year from Manantali to support the annual flood, except in the few years when the level of the reservoir and the flow rate of the river are too low in August and September. It will also be recalled that the Master Plan for the Integrated Development of the Left Bank (PDRG), adopted by the Senegalese government in 1994, opted for a water management scenario (scenario A) which would allow for both the development of irrigated agriculture (88,000 hectares), and the delivery of an artificial flood guaranteeing over 33,000 hectares of flood-recession farming (land submerged for more than 2 weeks) and approximately 63,000 hectares for flood-recession grazing and forests (land submerged for less than 2 weeks). It also held out the possibility of further benefits, since the two initial phases would also be compatible with scenario B1 (53,000 hectares of irrigated agriculture, and artificial flooding guaranteed for over 107,000 hectares, of which 50,000 hectares suitable for flood-recession farming). Even today, maintaining artificial flooding is still an official objective. In 1996, the Institut de Recherche pour le Développement (Development Research Institute / IRD, formerly ORSTOM) was asked by OMVS to carry out a study on optimal reservoir management (see box 5).

It will be recalled that the Manantali dam is built on the Bafing, the main tributary of the Senegal River, which accounts for over half the Senegal's flow as measured at Bakel. The two other major tributaries, the Bakoye and the Falémé, are not regulated. This means that any artificial flood will have two components: the natural flows of the Bakoye and the Falémé, and the additional volume of water released from the Manantali reservoir. In practice, artificial flooding is the result of releases from the Manantali dam, calibrated to provide the desired rate of flow at Bakel by taking into account the contributions of the unregulated tributaries. The lower the natural flow rates of the Bakoye and the Falémé, the greater the volume of water released from the dam. In the years since the Manantali dam came into service, the major component of the annual flood has been the water released from the Manantali reservoir.

Box 5. Terms of reference of the IRD study

The Manantali dam, which can store 11.5 billion cubic metres of water, currently has a regulating role. It makes it possible to maintain throughout the year the flow rate of over 200 m3/s required for controlled irrigation , and to augment the natural flood supplied by the river's non-regulated tributaries. This flood support, the suppression of which had been envisaged earlier, is vital for safeguarding the environment of the middle valley and creating the conditions for flood-recession farming, , which is a profitable activity for farmers.

The reservoirs are currently managed by measuring water flow or water levels, on the Bafing where it enters the Manantali reservoir and on the Senegal river downstream from the junction with its unregulated tributaries. These measures, based on data collected as the season progresses, make it possible to manage the reservoirs during the dry season. But the absence of rain/water-flow forecasts for the catchment basins of the river's three tributaries prevents the dam management from co-ordinating releases from the Manantali dam with the natural flood from the unregulated tributaries.

The study consists of three distinct but closely related parts:

- research on flow rates well upstream from the dam, to improve forecasting of the natural flood of the unregulated tributaries and the Bafing itself ten days in advance. This advance warning will make it possible to calibrate flood support from the dam (artificial flooding), by making it coincide, insofar as possible, with the peak of the natural flood; or, in the case of very heavy rainfall, to level out the peak of natural flooding. In times of severe shortage of rain,, it will enable the OMVS High Commission, in conjunction with the political authorities, to decide how the available water should beused .
- research to determine the optimal flood required to maintain flood-recession farming, replenish groundwater reserves and preserve ecosystems, while minimising losses of electrical power.
- implementing reliable methods for predicting and monitoring flow rates, and for managing the dam.

Source: IRD-OMVS, 1998.

Initially, computerised simulations of the management of the dam, based on the available data for the river's natural flow over the period 1950-1993, were used to show what the results of the dam's operation would have been if it had been in existence since 1950. The flood hydrograph that emerged, almost identical in volume to that used for the PDRG, is defined as follows: 0 cubic metres of water per second at Bakel on day 0; 2,500 m3/s on day 6; 2,500 m3/s on day 11; 0 m3/s on day 55.

Three possible management scenarios were envisaged:

- *Scenario 1* gives priority to the needs of agriculture (irrigated and flood-recession),
- *Scenario 2* gives priority to electricity generation and the needs of irrigated agriculture (with no flood support),
- *Scenario 3* takes into account the three main objectives of the dam (supplying water for irrigation, generating electricity , and flood support in favour of flood-recession farming).

Comparative analysis was based on the amount of electrical energy generated and the area available for flood-recession farming . As IRDremarks : " Under the conditions of low water flow which have prevailed over the last 25 years or so in the Senegal River basin, these are the two objectives which compete with each other. Supplying water for irrigation poses few problems, since it can be provided on a permanent basis without greatly penalising the generation of electricity."

On the basis of natural flows for the period 1970-93, which correspond more closely to present circumstances, the third management option would give the following results (for the sake of comparison, we also give the results that would obtain if the dams had not been built).

Multi-use management of the dams (*Scenario 3*)	**River regimen without dams**
50,000 hectares of flood-recession farming one year in ten, 40,000 hectares every other year	50,000 hectares of flood-recession farming one year in three
Annual average of 30,000 hectares during the period envisaged	Annual average of 57,000 hectares
Two years out of three, some flood-recession farming is possible	Fewer years in which flood-recession farming is possible

Where power generation is concerned, scenario 2 of course gives the best results, but would not allow for any flood-recession farming at all. The results of scenario 1 are very similar to those for scenario 3, because when the flow of the river is weak (as during the period under study), almost all releases of water would pass through the turbines and could therefore be used for generating electricity. For scenarios 1 and 3, the same management directives are envisaged, with two additional directives in the case of scenario 3, relating to maintaining the level of Manantali reservoir (when the level falls to 195 metres or less, releases are limited in accordance with the priorities decided) and with electricity generation (release of a flow sufficient to generate 90 MW if the level of the reservoir is above 182 metres, or the maximum that can be generated if the level is above the dam's overflow threshold).

In 1997, IRD delivered an artificial flood which came close to the reference hydrograph. According to a rapid survey of SAED agents and people living near low-lying depressions, this flood was generally judged satisfactory from the point of view of the area flooded, although in the Matam area it was considered to have been of too brief duration to flood local depressions effectively. Though far better than the 1996 flood, which reached only a small area of land, it was nevertheless not nearly so good as the 1995 flood. From satellite pictures it was possible to estimate the total area under water. "*Where artificial flood support is concerned (the year 1997-1998 being taken as representative), we estimate the area available for flood-recession farming at about 70,000 hectares: 45,000 hectares on the left bank and 25,000 hectares on the right bank*" (IRD, 1998).

It should however be noted that for the 1997 flood, contrary to the recommendation in the terms of reference, it was not possible to set up a system to give ten days' advance warning of flows in the upper river basin (Bakoye and Falémé). It was therefore not possible to implement a more flexible system of flood support, even though, as the IRD report acknowledged, this "would allow for better electricity generation than a fixed-date flood, as well as a greater frequency of 'adequate' floods than would be the case under the river's natural regimen."

Nevertheless, from 1998 on, if the deficiencies of the 1997 flood be remedied, OMVS will have at its disposal the technical conditions required for delivering flood support from the Manantali reservoir. The final phase of the IRD study involves drawing up a dam management manual. "The rules to be implemented will correspond to the objectives set as part of the optimum scenario. All possible eventualities will be taken into account, to establish an order of priorities in the event of chronic deficits or conflict between one use and another."

There remains one vital problem, over and above any technical considerations. If the flood is to take place in accordance with the stated criteria, it is not just a matter of achieving the right technical conditions (as we have seen, not all of them have yet been put in place). There also needs to be the political will to implement flood support, enshrined in clear and binding instructions to the operator appointed to manage the Manantali dam. It should still be possible to achieve this last condition, since the recruitment of an operator is not due to take place until the member states have finalised the Water Charter. But there is little reason to believe that the necessary political will exists. In the conclusion to its summary report, after emphasising that "the artificial flood is a matter of vital environmental, human and economic importance", IRD notes that: "it remains doubtful whether the partner countries have the will to maintain this artificial flood over the long term " (IRD 1998).

Senegal River development schemes have not brought about development. They have not brought prosperity, except to a few artificial enclaves. The prospect of the dams becoming profitable seems more remote than ever. In the absence of massive investment, which seems most unlikely, profitability will not come from irrigated agriculture, but will depend solely on the Energy Project. Can one even speak of profitability when, to service a debt which will never be repaid, a further debt has been contracted; in what is not just a vicious circle, but a vicious spiral?

Instead of development, there has been destruction. By sweeping aside production systems which offered a degree of food security, Senegal River development schemes has made life even more precarious than before for many of the inhabitants of the Valley. Those who are excluded from irrigated farming because of the high costs involved; cannot now fall back on the *waalo*, because since the dams were built, the annual floods can no longer be relied on to provide crops and grazing and replenish fish stocks . All the future seems to hold for them is emigration to the volatile outer fringes of Dakar's urban sprawl.

Things could and should be different. It would still be possible – using these very dams – to give some security to small-scale family agriculture, the only possible basis for prosperity in a country like Senegal, by striving to make the best possible use of all the Valley's resources. However, nothing, or almost nothing, in the record of flood management since the founding of OMVS, gives any hope that those in charge will rethink their position. This raises the question of whether the real problem is not in fact political, in the broadest sense of the term. If agriculture in the Valley is in deep trouble, is it not largely because its peasant farmers, pastoralists and fishermen have had no say in the decisions affecting their future? The recent Presidential elections have for the first time brought the opposition candidate to power. It is not known whether the new President will adopt a different policy towards the Senegal River Valley. For the moment, one can only hope for the best.

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