A Project Born of Hope, Desperation

A massive program to develop the Senegal River valley epitomizes the difficulties involved in expanding irrigated agriculture in Africa, and the stakes riding on such ventures

A few kilometers inland from St. Louis, the old French colonial capital of Senegal, the paved road paralleling the Senegal River enters a landscape of bare soil and sparse vegetation typical of the Sahel region of West Africa. Swaths of green appear briefly along the river where irrigation makes it possible to grow rice and sugarcane. But farther upstream, drought has taken hold. Land once farmed on the floodplain has been abandoned, and dunes crowd the road.

This year, a new dam in the Senegal delta will begin to alter the scene. The Diama dam will block intrusion of salt water that in past years pushed upriver 200 kilometers or more during the dry season. The immediate effect will be to protect agriculture in the delta and lower valley from the salt tongue and permit some expansion of irrigated farming there. By the end of the decade, completion of a high dam at Manantali on a major tributary far upstream will allow year-round control of the river's flow and open the way to large-scale development of areas of Mali, Mauritania, and Senegal that lie in the river basin.

The Senegal River project is in a real sense a product of desperation. Governments in the drought-prone region have come to see river valley development as the only way to ensure a reliable supply of water and boost agricultural production to keep up with rapid population growth. In West Africa alone, proposals to develop the Gambia and Niger river valleys and the Lake Chad basin are being promoted by governments in the region.

On the Senegal River, Mali, Mauritania, and Senegal managed to reconcile divergent, sometimes conflicting, interests to form a regional organization (OMVS)* for development of the valley. Earlier attempts had been made to exploit the Senegal River valley with major irrigation works, but it was the drought of the 1970's that impelled the three countries to make common cause and rallied the donors behind the project.

Donor organizations, however, are showing increasing reluctance to make the heavy financial commitment necessary for dam construction and follow-up development. The history of big irrigation projects in Africa has been disappointing, sometimes disastrous. In the case of the OMVS project, skeptics question whether the return on the more than $700 million being sunk into construction of the dams can justify the investment. There is little disagreement that the major rivers of Africa, particularly in the dry zone, should be developed eventually. The main objection now is that the right technology to make irrigated agriculture successful is simply not available. And there are worries about managing the environmental effects and social dislocation caused by projects like the OMVS.

Nevertheless, the OMVS has raised great expectations in the member countries. And the United Nations Development Program (UNDP), a strong proponent of river valley development, has proclaimed the OMVS a model of aid cooperation.† Therefore, what happens when the OMVS dams go into operation—*après barrage* is the francophone phrase for it—poses not only a vital challenge to the OMVS members and donor countries but a crucial test for large-scale river basin development in Africa.

The ambivalence of the donors is illustrated by the course followed by the World Bank and the U.S. Agency for International Development (USAID). Neither organization was willing to help fund construction of the dams, but both are now heavily involved in backing projects to make the OMVS work.

World Bank official Xavier de La Renaudiere, who heads the World Bank Sub-Saharan Program, recalls that the bank took an early interest in the project. "When the idea gained momentum after the drought of '72–'73, it sounded obvious to try to find the optimal way to increase water security [in the Senegal valley] and promote regional cooperation—provided it could be done at reasonable cost."

Experience in the 1960's indicated that small irrigation projects—"perimeters" of 100 hectares or less—were unsatisfactory, says de La Renaudiere."It looked as if medium and large perimeters could be made to work." It would be possible to achieve economies of scale, provide farmers with effective extension service, control water efficiently, and supply high-quality inputs—seed, fertilizer, and pesticides necessary for higher yields. De La Renaudiere adds that, at the time, the government agencies responsible for developing irrigated agriculture "seemed to be working better than afterwards."

Several things cooled the bank's enthusiasm, however. "Engineering studies indicated the costs of the dams would be enormous," says de La Renaudiere. The bank had plumped for "a careful, gradual approach." It urged that a start be made with a single dam, Diama in the delta, to demonstrate the capability of agriculture, and that Manantali be built as a second stage.

By the late 1970's, the bank was openly opposing a large-scale project and finding new reasons to do so. De La Renaudiere notes that irrigation in the valley seemed to be regressing as the larger perimeters ran into trouble. Indeed, it appeared that more irrigated hectares were going out of cultivation than were being developed. In Senegal, the government agency responsible for agricultural development in the *fleuve* (river) region had become highly politicized and less efficient. On the other hand, small perimeter irrigation seemed to be gaining strength. The bank continued to urge the OMVS countries to take a measured approach, but the member countries "found it politically impossible to make that kind of choice," he says.

The vision of rapid agricultural development in the valley was a powerful one at a

Developing Africa

This is the second of two articles on science and technology in development in Africa. The reporting was conducted when the author was on leave from *Science* on a grant from the Carnegie Corporation. The first piece, published last week, described efforts to combat river blindness.

*Organisation pour la Mise en Valeur du fleuve Senegal.

†UNDP paper, "River and Lake Basin Development in Africa," July 1984.

time when drought was persisting and per capita food production in the OMVS countries was in serious decline. In 1981, OMVS partisans were finally successful in winning support from a group of donors. France, West Germany, and the European Community's development fund were prominent among European donors; crucial support came from Arab nations and development organizations, which, prompted by brimming oil revenues and a sense of Islamic solidarity, agreed to provide more than 40% of the $700 million required.

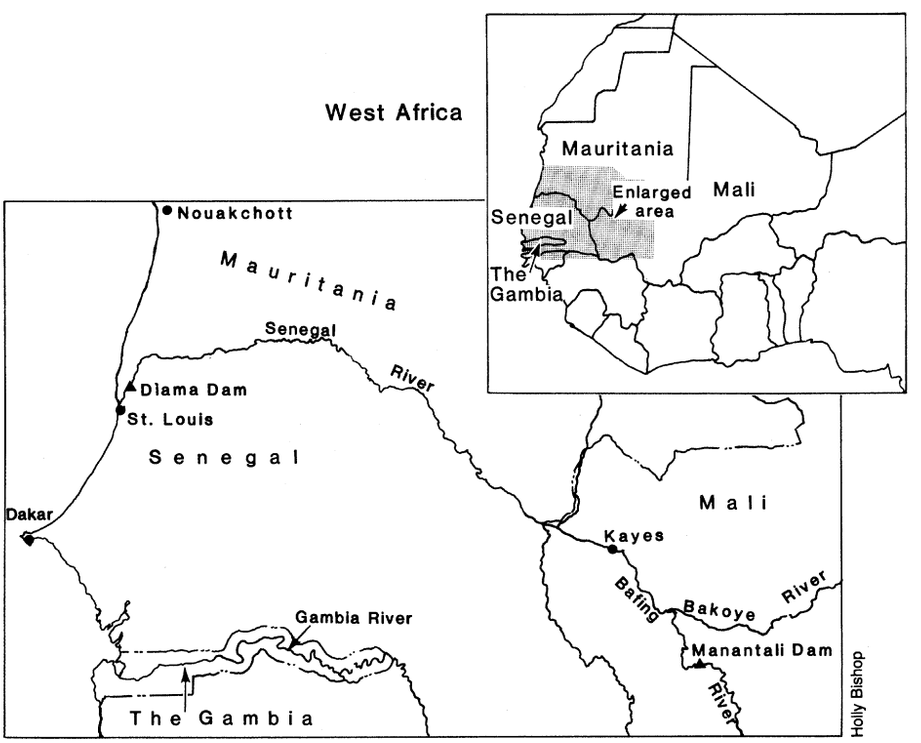
For the three member countries to cooperate, the project had to include a mix of features balancing the interests of each. *Après barrage*, an estimated 350,000 hectares will be irrigable, some 240,000 hectares of it in Senegal, which makes that country the biggest agricultural beneficiary. The dams are also intended to open the river to navigation as far as the town of Kayes in western Mali, thereby serving that landlocked country's desire for access to the sea. The Manantali dam is also designed to produce substantial amounts of hydroelectric power which could eventually supply energy for exploitation of mineral resources in the region and even provide power for Dakar, Senegal's capital. The Diama dam also had to be designed with locks to accommodate barge traffic and a roadway across it to improve highway access to Nouakchott, the capital of Mauritania.

Incorporating these features and others necessary to gain agreement required a grander, more expensive design, a kind of highest common denominator. So far, however, no additional funding has been arranged to pay the heavy costs of building ports and making the river navigable or to finance turbines for power generation, so those plans remain stymied.

The Diama dam was substantially completed by early this year on time and within budget, no mean feat in Africa. The Manantali dam has been having funding problems as the Malians and Mauritanians bridle at paying their allocated share of the costs, but it is expected to be completed by the end of the decade.

Publicly, government officials in Senegal, for example, continue to talk in terms of the original grand design of developing 4000 or 5000 hectares a year of irrigated agriculture. At an estimated cost of $10,000 per hectare, however, the investment required, compared to the resources of the OMVS countries, is enormous. The question of how money will be raised to repay the loans for dam construction also casts a shadow.

Historically, farmers in the lower and middle valley depended on flood recession agriculture—cultivating land along the river after it has been flooded by the overflow of the river or the intermittent watercourses that appear during the rainy season. The dilemma is that control of the river flow by the dams would abolish flood recession agriculture before irrigation could be developed to replace it. Economic realities appear to be dictating a revised strategy.



Map shows location of dams on Senegal River.

Jon Anderson, who manages the OMVS portfolio for USAID in Dakar, says "The donors are saying let's live within our means, not try to leap from flood recession agriculture to irrigated agriculture." Anderson acknowledges that the aid givers "don't have a neat scenario" for the *après barrage* period.

Managing the transition has become a priority concern for development agencies. California Institute of Technology professor of anthropology Thayer Scudder recently headed a team of experts who visited the OMVS countries as part of a USAID effort "to think about how to cope with the new situation."

Scudder says, "The rhetoric is still there on a rapid rate of development." But, at the technical level, government officials in Senegal, for example, "are seriously considering alternate uses of the water."

Alternatives do exist because a capacity to create a "simulated" flood was incorporated in the design of the Manantali dam. Formal plans now call for artificial flooding for 10 years after the dams are in operation to permit flood recession agriculture, but Scudder says, "They've got to think of a longer time span. It will take well over two generations to work itself out. They must lengthen the transition period, which if successful, will permit better economic and community formation."

Increasing food production in the valley requires the adoption of better agricultural technology. To succeed, this transfer of technology will have to be supported by broad-scale economic and social development.

It is hard to exaggerate the extent of the transformation that will be required. A rural economy based on subsistence farming and limited local trading must acquire crop storage, marketing, and transportation services adequate to deal with the anticipated surplus production. A functioning credit system must be established, and services to supply fuel, seed, pesticides, fertilizer, and agricultural machinery will have to be created virtually from scratch.

The social impact of development will be heavy. Increased irrigation in the tropics is typically accompanied by a worsening of waterborne diseases, notably malaria and schistosomiasis. The adoption of new agricultural technology will change the roles of those engaged in farming. In some ethnic groups along the Senegal River, for example, women have traditionally cultivated their own plots on their families' small holdings, often growing vegetables for the family and deriving some cash income from sales. Under the new irrigation regimes, male members of the family make the farming

decisions and control the income from the harvest. The changes in some cases have introduced serious conflicts into family life. A USAID technician who works in the *fleuve* region says, "Irrigation means a social revolution."

The question of who will profit from development in the valley has become a major political issue. The move to irrigation will force changes in land-use and land-tenure practices likely to cause confusion and conflict. The increase of irrigated land will restrict herders' accustomed access to pasture and to passage across the river and will heighten the tensions between herders and farmers. But the main concern is that traditional group rights to land will be eroded as the land is developed and acquires increased cash value. Populist misgivings are also being expressed that the governments might try to solve the problem of finding development funds by selling or leasing land to agribusiness, African or multinational, thus depriving farmers of promised opportunities.

To come to grips with these "constraints," as they are called in the specialized vocabulary of development, the donors are taking two main tacks. They have concluded that the problems of development in the Sahel include not only hostile climatic conditions, poor soils, and limited local resources, but a resistant political and economic environment. Under strong pressure from the major donors, most governments in the region are embarking on broad reforms of macroeconomic policies they have relied on since independence a generation ago.

The major themes emphasized by the World Bank, the principal architect of the reforms, and endorsed by USAID and other donors, are an emphasis on agriculture, particularly encouraging production of food for the domestic market, a radical scaling back of government's deep involvement in the economy, and complementary encouragement of the private sector.

The obvious catch is that privatization must take place in a setting in which entrepreneurial experience and investment capital is very limited. Not only is the rural infrastructure frail, but a strong bias against private enterprise has been built into the economic policies and prejudices of most African countries.

In agriculture, the major economic change will be higher market prices for farmers as an incentive to increase production. In practical terms, this means urban consumers will have to pay more for food. Implementation of the reforms will sharpen the conflict between rural people and urban dwellers and elites. To cushion it, the World Bank is emphasizing so-called structural adjustment loans, designed to ease the transition when subsidies for food or other things are cut and to strengthen the government's capacity to carry out reforms.

Khoi N. Le

Late stage in construction of Diama salt intrusion dam on the Senegal River. Diama and Manantali dams on the tributary will permit major development of irrigated agriculture.

Will that be enough? U.S. Ambassador to Senegal Lannon Walker acknowledges that the donors are "concerned about the link between broad economic reform and political stability," but he notes that choices are limited. "The African countries have tried other models and struck out." Now, he says, "we don't have other options. We've said this is the way to go and here we go."

Just as the donors were converted to policy reform, they have also come to recognize that they too often acted on an inadequate understanding of both physical and social conditions in Africa. As a result, the donors active in the OMVS area are putting increased emphasis on research.

USAID's operations in the valley were effectively shaped by a general congressional mandate against investment in large infrastructure projects such as the dams. USAID adopted the view that it could make its best contribution to the OMVS by emphasizing U.S. strengths—analytical capabilities and technical services. In the early 1970's, for example, AID sponsored an aerial survey of the valley that helped with siting of the dams; later in the decade it funded a comprehensive study of the environmental impact of the dams. The agency has been a principal patron of the small OMVS coordinating organization, particularly its planning and research offices.

The *après barrage* plans formulated by USAID include underwriting a master plan for the Upper Valley of the Senegal, preparing a health master plan for the region, and funding a major monitoring operation to document changes in water levels and quality in a large section of the valley. A study of land-tenure issues is also on the agenda.

The major hurdle for development in the OMVS region remains the introduction of intensive agriculture that will significantly increase national production. The director of the USAID mission in Senegal, Sarah Jane Littlefield, says that "irrigation agriculture has a substantial future when conditions are right." However, "we lack the ability to put the results of research into the hands of the farmer."

USAID and other donors are now somewhat belatedly investing heavily in research to develop technology that is right for the region and to improve the transfer process. The United States and others are also sponsoring what, in effect, are pilot irrigation projects along the river to help prepare for the expansion of irrigated agriculture *après barrage*. With the river level still uncontrolled, the projects typically operate in perimeters of 100 hectare or less served by small diesel-powered pumps. The results have been encouraging, but the hitch so far has been that the projects have not really proved economic. USAID and other donors are planning scaled-up perimeters with the aim of achieving higher productivity.

The high stakes riding on the OMVS project appear to be inspiring the donors to strive for a high level of cooperation often cited as an ideal but seldom achieved in practice. Vito Stagliano, chief of the USAID regional River Basin Development Office in Dakar, described donor joint efforts on OMVS as "the closest cooperation in Africa." Then reverting to fundamentals, he says "That's all well and good," but "to make [the OMVS] worth doing ... we need farmers who can get good yields twice a year. And we need to get a price to amortize the heavy investment. They have to stop subsidizing urban consumers."

Most of the critical decisions on how and how fast to develop the Senegal River basin—and how to pay for that development—have yet to be made. So, for OMVS member countries and donors, completion of the dams will mark the real beginning of the struggle to develop the valley. ■

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