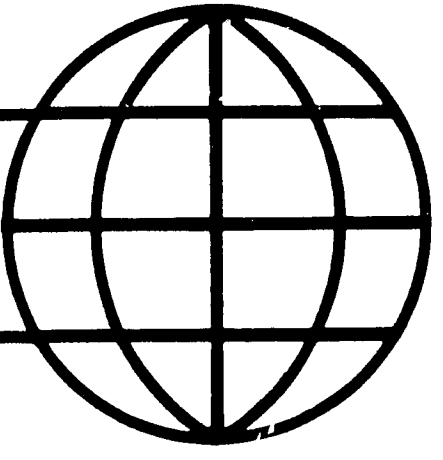
COOPERATIVE AGREEMENT ON HUMAN SETTLEMENTS AND NATURAL RESOURCE SYSTEMS ANALYSIS



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SENEGAL RIVER BASIN
ACTIVITIES REPORT FOR FY 86

To USAID/DAKAR

by

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Cooperative Agreement on Human Settlement
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Institute for Development Anthropology

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1 INTRODUCTION

In March and April 1985, USAID/Dakar Director Sarah Jane Littlefield, River Basin Development Officer Vito Stagliano, and IDA Director Thayer Scudder discussed how the expertise of the Institute for Development Anthropology might contribute to development of the Senegal River Basin in Mali, Mauritania and Senegal. Initially it was felt that this expertise would be restricted to the Upper Senegal River Valley (Bakel to Bafoulabe plus the lower portions of adjacent tributaries), and that IDA would play an advisory role to a contractor to be selected to complete an Upper Valley Master Plan. As discussions proceeded with USAID officials in Senegal, Mauritania, and Mali, with OMVS and with host government personnel, a wider role was seen as desirable, including the Middle and Lower Senegal River Basins as well as the Upper Valley. More specifically, IDA would assist USAID, the OMVS, host country agencies and contractors in recommending, appraising, monitoring and evaluating policies, programs, and projects for utilizing waters stored behind the Manantali Dam for development purposes, including the enhancement of local production systems (farming, herding, fisheries), the development of marketing networks and rural-urban linkages, and environmental betterment.

This report summarizes IDA activities and recommendations for Fiscal Year 1986. Although the report is written mainly for

USAID personnel familiar with IDA's scope of work, it is also intended to facilitate liaison and coordination among present and future USAID-funded contractors. Subsequent reports will be translated into French since they will be directed more at OMVS member country agencies.

2 SETTING

Before proceeding with a summary of IDA activities and recommendations, it is important to emphasize the unfavorable setting against which development and environmental betterment must proceed within the Senegal Basin. In his analysis for OECD and CILSS of impending system breakdown in the Sahel, Valaskakis[1] formulates a Sahelian Triangle in structural disequilibrium in which he groups various developmental barriers under three headings: the External System, the Sahelian System, and the Ecological System. These are the factors that need to be dealt with if net incomes of Senegal Basin households are to move beyond subsistence, if agricultural surpluses are to be produced and exported, and if environmental degradation is to be slowed and eventually reversed. A brief listing of the factors illustrates the magnitude and pervasiveness of the developmental barriers involved.

External factors that constrain development include unfavorable international terms of trade, and inappropriate, inconsistent, and uncoordinated donor (and, we would add, contractor) policies. The major Sahelian factor constraining development is the effect of unfavorable national development

[1] "What Future for the Sahel?" Interim Report on the Future Prospects Studies, 1985.

policies---a problem that can be generalized for Africa as a whole. Hence the World Bank[2] notes that

> A reordering of postindependence priorities is essential if economic growth is to accelerate... Now it is essential to give production a higher priority... Three major policy actions are central to any growth-oriented program: (1) more suitable trade and exchange-rate policies; (2) increased efficiency of resource use in the public sector; and (3) improvement in agricultural policies.

Though Senegal, in particular, has made tentative steps in the recommended directions, adverse national policies and inconsistent policies between countries continue to be a constraint throughout the basin as, of course, does environmental degradation.

In addition to the above barriers, it is important to mention the growing debate on the appropriateness of large dams for developmental purposes and environmental amelioration. For example, several participants at the June 1986 Seminar on River and Lake Basin Development in West Africa (organized by IDEP in collaboration with OMVS) critiqued the construction of mainstream dams on West African rivers. Especially critical were Tetteh Kofi, in his paper on 'Economics of Capital Intensive River and Lake Basin Development Projects and Underdevelopment in West Africa," and Klaus Voll, in his paper on "The Political Economy of River and Lake Basins with Special Reference to West Africa." The following paragraph from Klemm's[3] short commentary on

[2] Agenda for Accelerated Development in Sub-saharan Africa, 1981.

[3] "Manantali: A Dam for West Africa." Development and Cooperation (1983) no. 3, pp. 12-14.

Manantali, which Voll quotes approvingly in his paper for the IDEP/OMVS Seminar, demonstrates the extremes criticism can reach:

> During the next ten years, the population of the Senegal Basin will not experience any significant change in its standard of living... It is certain that the population will have greatly increased, and that the sahel will expand further due to continuous deforestation.

We mention the above setting not to be be defeatist but to emphasize the difficulties that must be overcome if the development of the Senegal Basin is to benefit local populations, the countries in which they live, and the environment. The Diama Dam has been built and the Manantali Dam is scheduled for completion within the next two years. It is futile to lament their existence. Considering them sunk costs, the IDA team is especially interested how their storage capacities, and especially that of the Manantali Dam, can be beneficially used.

Furthermore, there is a positive factor that must continually be kept in mind. While the goals of hydropower generation, pump irrigation, and navigation were the rationale behind the decision to build the Manantali Dam, the planners realized that some years must pass before households practicing recession (décrue) agriculture would be able to shift to more intensive irrigation. During the interim---estimated as a period of ten to fifteen years---a controlled flood would be released that would enable villagers to continue recession cultivation. The Manantali dam is the first mainstream dam built during the post World War II period that is designed to allow a controlled downriver flood for the benefit of river basin residents.

Funding and organizational constraints for prompt realization of the power generation, pump irrigation, and navigation goals have led OMVS and member state planners to place far more emphasis on how this controlled flood can be used to increase the production and net incomes of Senegal Basin households, for reforestation, and to recharge aquifers for other programs of environmental and social betterment. This is especially the case in Senegal where there is an active interministerial council on the post-barrage situation, meetings of which may be chaired by the Head of State himself (as on 24 July 1986).

The challenge during the next ten to fifteen years is to learn the effects of different controlled flood conditions on production, incomes, and the riverine ecosystem. Though it is recorded that 110,000 ha were farmed after the floods of 1970 receded, no one knows how many hectares local populations would be willing to farm today if the risks associated with décrue cultivation were reduced through controlled flooding. Nor is it known how much water must be released from the Manantali dam to flood-irrigate a given hectarage, the optimum number of days that land should be inundated for cropping and pasturage purposes, or the extent to which production can be increased through improved water control and agricultural practices. Still less is known about how a controlled flood can best be used to re-establish a viable riverine fishery, to contribute to reforestration, and to recharge aquifers. Finally, nothing at all is known about the potential employment generated in response to the flood or the

income that will accrue from recession cultivation at local, regional, and national levels.

It is crucial that such topics be carefully and quantitatively studied during the coming decade so that there will be sufficient knowledge for future decision-making regarding the trade-offs between a continued downriver flood possibly resulting in lower levels of potential hydropower generation, and smaller hectarages under irrigated perimeters. Only then can intelligent decisions be made as to whether a controlled flood should become a permanent feature of the Senegal River's regulated regime or should be phased out. It is equally crucial that such decisions be promptly tested in carefully selected pilot projects and programs.

While the OMVS, the Mauritanian Department of Agriculture, and coordinated Senegalese units in at least ten ministries are all addresssing the après-barrages issue, it will be essential to coordinate donor assistance involving research, training, the planning and execution of pilot projects, and monitoring and evaluation. The IDA team is especially interested in assisting these efforts.

3 ANALYTICAL FRAMEWORK

While a river basin may be a natural physiographic unit, it is rarely a self-continued development or regional unit. This is especially the case in the Senegal Basin, for several reasons. First, the basin lies in four countries. Second, significant numbers of people from the basin migrate to the major cities of West Africa, all of which lie outside the basin, or to France (especially the Soninke). Third, most of whatever hydropower is eventually generated will also be exported.

Policies, programs, and projects can and do, however, impact upon the entire basin and interbasin areas. The Manantali Dam is a case in point. A major task of the IDA team will be to help assess ways in which released flows from the dam can serve the interests of local populations and member nations in an environmentally sound fashion, and to formulate scenarios for utilizing these flows for the development of specific areas which could serve as development prototypes for the Upper, Middle and Lower Basins.

We are particularly interested in the development of three areas: the Middle Basin, the Senegalese, Mauritanian and Malian Upper Basin, and the Manantali area. The first two areas focus on the towns of Kaedi and Bakel in Mauritania and Senegal, respectively, and around Kayes in Mali. The third area focuses on the Manantali Dam and reservoir, and the riverine zone

immediately below the dam. Our approach to the development of these regions is multi-objective. While economic efficiency as measured by benefit/cost analysis is a major component of multi-objective analysis, there are three other components: regional growth, socio-economic effects on local populations (including hosts and immigrants), and environmental impacts. Whereas economic efficiency is concerned mainly with national accounting and direct benefits, the other components relate more to regional and local accounting viewpoints, to multiplier effects, and to other indirect impacts.

Concern with regional growth, for example, must deal with the possible multiplier effects of different development scenarios. The high costs per household and per hectare that are associated with irrigation projects are usually justified only if subsequent increases in agricultural production catalyze a process of area development. This process should ultimately generate nonfarm employment, from which would emerge a hierarchy of service centers, including regional marketing and transshipment centers.

Region-based development requires not only increases in production but increases in the disposable income of thousands of households living within the Senegal Basin. As such households move beyond subsistence, their increasing demand for a widening range of goods and services can be expected to generate more enterprise development and nonfarm employment than the processing of agricultural produce. Hence there is a need to address

socio-economic issues such as land tenure, net incomes at the household level, and income distribution within and between households, as well as local availability of the types of goods and services desired by farm owner/operators, farm laborers and nonfarm employees, and employers as their incomes rise. Additionally, since benefits will be only temporary if they are acquired at the expense of the river basin ecosystem, environmental impacts of different development scenarios must be carefully assessed as they relate to land and water resources, and to local flora and fauna.

The central issue is the integrated development of prototype areas that include both rural and urban populations. The global experience with such development is mixed at best. Attempts by governments with inadequate management skills to make too many radical changes in too short a time period represent a major problem. A more successful strategy would involve the gradual intensification of existing production systems and the expansion of existing marketing networks through a prioritized set of carefully monitored and evaluated interventions.

Our approach will be to focus on several areas in which known development opportunities exist. After resources adjacent to those areas are assessed, we would examine agglomeration economies that could warrant infrastructural development (e.g. telecommunications, roads, municipal water and waste facilities, medical and educational facilities). We would then attempt to

construct three development scenarios for evaluation via multicriteria methodology:

(a) 3 pilot areas and minimum infrastructure;

(b) pilot areas, adjacent areas and minimum infrastructure;

(c) pilot areas, mining and electricity, and more infrastructure.

4 REVIEW OF ACTIVITIES

4.1 MARCH - SEPTEMBER 1985

Following a visit by Thayer Scudder to Dakar and the Senegalese portion of the Senegal Basin in March - April 1985, IDA submitted a five year proposal to USAID/Dakar to create an oversight team to improve planning, training, monitoring and evaluation for Upper Senegal River Basin development. Believing that the concept of an oversight or advisory team had merit, but that it had been insufficiently discussed with USAID, OMVS, and member state personnel, USAID/Dakar provided initial funding for Fiscal Year 1986.

4.2 21 MARCH - 6 APRIL 1986

The first visit of an IDA team took place over a 16 day period in March - April 1986. Team members were André Guinard (agronomist and former director of France's Centre National d'Etudes d'Agronomie Tropicale), Papa Nalla Fall (regional economist, faculty member at Centre Africain d'Etudes Supérieures en Gestion and former World Bank officer), Gilbert F. White (geographer and former senior river basin consultant to UNDP), Michael M Horowitz (socio-economist and ecologist, IDA director

and co-director of the IDA team), and Thayer Scudder (river basin specialist, IDA director and co-director of the IDA team).

During the visit, emphasis was placed on discussions in Dakar with officials of the OMVS; Senegal government agencies; research, training, and private voluntary institutions; the Ford Foundation; USAID; and UN agencies. Team members also visited St Louis for discussions with officials in SAED, and Nouakchott for discussions with officials in the Mauritanian Ministry of Agriculture, SONADER, and USAID. In May 1986 a report and proposal on IDA involvement in the Senegal Basin was submitted to the USAID/Dakar (hereafter this report will be referred to as the "first IDA report") which included a number of conclusions and recommendations that are outlined below and supplemented with further discussion based on more recent information.

4.2.1 Conclusions of the First IDA Report

(a) Well aware of obstacles to the speedy utilization of waters stored behind the Diama and Manantali dams for hydropower generation, irrigation, and navigation, officials in the OMVS and in Senegal and Mauritania have begun to consider alternate uses for stored water.

Discussion: This is still the case in Senegal and Mauritania (in Mali, government resources continue to be focused almost entirely on the Niger Basin as opposed to the Senegal

Basin). Indeed, during the July 24, 1986 meeting of Senegal's interministerial council on the post-barrage situation, it was recommended that instructions be given to the relevant ministries to study the optimum duration for a controlled flood in relationship to "recession crops and eco-system rehabilitation."

There is a problem in that these recommendations have been added to previous recommendations dealing with irrigated perimeters and other development options, hence increasing the load upon ministerial capacities. At the same meeting, for example, the inter-ministerial council reaffirmed the government's commitment to implement an investment program for developing 4200 ha of irrigated agriculture per year.

The IDA team agrees with André Guinard's major concerns about government agricultural policy in relationship to irrigation, as outlined in Appendix III of the first IDA report. These concerns can be generalized under two points, which Guinard believes are applicable to both Senegal and Mauritania. The first point is that "irrigation is misunderstood in the SRB." More specifically, rice is grown too often on inappropriate (i.e., too permeable) soils which are utilized primarily because of their proximity to a water source. This results in

> ...an excessive consumption of costly irrigation water lifted with diesel pumps. Another [consequence] is an increase in land development costs since rice irrigation, unlike that for other crops, requires full leveling and bunding to impound a uniform layer of standing water over the whole field (basin irrigation).

Moreover, land leveling that does occur is

> ...inadequate and unnecessarily expensive in village rice irrigation. Uneven leveling results in water waste to flood the higher parts of a basin. Where water is too deep rice might be submerged; where there is not enough water weeds choke rice seedlings, particularly in the SRB where rhizomatous wild rice (Oryza barthii) is a perennial problem. For both reasons rice growth is checked. After a preliminary rough leveling with mechanical equipment, farmers are told to complete the job by hand on dry land. This is contrary to accepted practice in traditional rice growing countries where final leveling is done in mud....

Guinard's second point is that "the main organizational issue in the SRB is a one-sided approach to development with its emphasis on irrigated rice" as opposed to a gradual intensification of local (customary) production systems. This bias must be corrected: "a sensible agricultural policy should aim at full coverage of food requirements, at least, based on integrated rural development of peasant agriculture relying mainly on family resources and minimum financial investment." It follows that this policy should be viewed from the perspective of the farmers rather than from that of the Departments of Irrigation. Rice irrigation per se should not be the objective. The development goal should be to allow farmers---both existing and those to be settled---to improve their whole production system. A major step in the right direction would be to use the controlled Manantali flood to intensify, for local consumption and export, existing systems of flood water irrigation and livestock management within the Senegal Basin (see below for further discussion of this point).

(b) Because alternate uses of waters stored behind the two dams (and especially behind Manantali) have not been seriously considered in the past, there would appear to be an excellent opportunity for AID and other donors to assist in a new assessment.

Discussion: We continue to endorse this conclusion, emphasizing only (as stated in the conclusion that follows) that studies must be linked to implementation of specific projects and/or programs.

(c) Because of the inability of existing planning units effectively to utilize available research, it is not sufficient merely to undertake studies alone, including the enquiries and analyses discussed under the previous conclusion. The new studies that are required should, with donor assistance, be firmly linked to action.

Discussion: This conclusion is reinforced by the decision of government agencies in Senegal and Mauritania to add use of a controlled flood to their existing "overload" of activities. By action we mean the actual implementation of pilot projects, their modification where necessary, and their replication where possible.

(d) Institution-building should focus on increasing the capacity of existing planning units to collect, store, and analyze data; to present options to decision makers based on that analysis; and to monitor and evaluate project/program implementation.

Discussion: We did not mean to imply by this conclusion that institution building should be restricted to existing planning units. If more emphasis is to be placed on the intensification of existing production systems, as we believe it should, this will require a major re-orientation not just of policy but also of research and extension activities. Institution-building in that regard must also be carefully integrated with staff and farmer training.

(e) Within planning and evaluation units there is a need to develop easily utilizable information management systems to expedite the analysis of various data bases, and to enable staff members to present policy options.

Discussion: Because of the importance that IDA accords to the timely implementation of a management information system (MIS), we are making this a high priority activity for FY 87. Professor Michael Burton, in close consultation with the core IDA team, will carry out the following tasks:

-- development of a format for abstracting documents, to make more readily accessible, both to researchers and to host country officials, existing and future information on the SRB;

-- design an audio-visual system to present relevant findings to policy makers in a tight and coherent manner;

-- design a MIS for computerized storage, retrieval, and processing of research findings in all the disciplines involved (including social anthropology, demography, public administration, agronomy, hydrology and hydrogeology, remote sensing), in a form that can be utilized by small computers with off-the-shelf software. IDA is already developing a set of socio-economic and health indicators for monitoring population resettlement at Manantali, and attempts will be made as far as possible to make that system compatible with the SRB MIS to facilitate low cost file sharing and comparative analysis.

(f) There is a major need for more donor continuity in regard to studies, project/program formulation, project/program implementation, and monitoring and evaluation.

Discussion: This conclusion has been reinforced by Scudder's recent participation in a SARSA Cooperative Agreement team evaluating Ghanaian achievements in regard to the development of the lower portion of the Volta River Basin and the Akosombo reservoir basin immediately upriver. Lack of continuity

and coordination of donor activities have imposed a serious constraint on government development efforts in that basin.

4.2.2 Recommendations from the First IDA Report

(a) USAID development assistance for the Senegal River Basin during the next ten to twenty years should focus on habitat restoration and on increasing the income, productivity, and living standards of the existing population of the Basin, with special emphasis on alternate uses for waters stored behind the Manantali Dam during the period of controlled downriver flooding.

Discussion: In this report we have tied this recommendation more closely to the development of pilot projects in the Middle and Upper Basin so that research is more effectively linked to project/program design and implementation.

(b) USAID should assist planning units with major responsibilities for Senegal River Basin development to collect, store, process and analyze data for decision-making, and to monitor and evaluate project and program implementation outcomes. Assistance should include institution building, staff development, and data management.

Discussion: see comments under Conclusions (d) and (e).

(c) Because of the inability of host country institutions to properly utilize their results of sophisticated studies, USAID should assist with the development of an effective information management system that can be used both for analyzing existing and future data, as well as for presenting a range of options to policy makers.

Discussion: see comments under Conclusions (d) and (e).

(d) Unless other donors are sponsoring the necessary research, USAID should fund the necessary studies to assess the uncertainties associated with recession agriculture "après-barrages."

Discussion: Since necessary research, aside from preliminary surveys (such as that by Sir Alexender Gibb and Partners),[4] is not otherwise being supported, we see a definite role here for AID, as elaborated in section 5.1.

(e) USAID assistance should be used to plan, implement, monitor, and evaluate development prototypes for single areas in the Upper Basin, the Middle Basin and perhaps the Lower Basin.

[4]Etude de la gestion des Ouvrages Commun de l'OMVS. Fév. 1986.

While initial emphasis should be placed on how to best utilize the controlled flood downstream for the benefit of environmental rehabilitation and the local population, a longer term goal would be to create a more diversified economy within the Basin.

Discussion: In terms of AID-assisted studies leading to action, we give priority to this recommendation and to the one preceeding it. How to proceed is discussed in more detail under section 5.3.

(f) USAID should amend the scope of work for the Upper Valley Master Plan by putting more emphasis on how to increase the productivity of existing economic activities (especially rainfed agriculture and livestock management) and less emphasis on irrigated perimeters. Such an amendment would significantly reduce person months in the field and detailed mapping requirements, hence cutting costs of the planning exercise by as much as 50 percent.

Discussion: While we still maintain that too much emphasis is being placed on detailed mapping, recent changes in the scope of work now place more emphasis on existing production systems and on marketing networks. If the Bafing River from Bafoulabe to the end of the Manantali Reservoir is included in the scope of work for the Upper Valley Master Plan, as recommended in Section

5.2, the number of person months (and hence the costs of the planning exercise) should remain approximately the same. While in Dakar, we suggested some changes in the type of personnel to be recruited and in time allocation between various activities which need not be repeated here.

4.3 20 JUNE - 9 JULY 1986

A second IDA team visited the Senegal Basin during twenty days in June and July. Team members were Charles W. Howe (natural resource economist and director of the Center for Studies in Environment and Behavior at the University of Colorado), Michael M Horowitz, and Thayer Scudder. During this visit, emphasis was placed on familiarizing team members with the entire basin from the upper end of the future Manantali Reservoir to the Atlantic Ocean.

After an initial day of meetings with USAID and US Embassy personnel in Dakar, Howe and Scudder proceeded to Bamako, Mali where they were met by Dolores Koenig and Curt Grimm of IDA's Manantali Resettlement Project. Prior to visiting Manantali and overflying the Upper Senegal Basin between Bakel and the Guinean border on June 23, the four researchers visited the Selingue Dam and Reservoir on the Sankrani (a tributary of the Niger), concentrating their attention on the artisanal fishery and on one resettlement community.

June 24 - 26 were spent discussing Manantali resettlement with Malian officials in the Projet pour la Reinstallation des Populations de Manantali (PRM) and visiting villages in various stages of resettlement (for a recent update see Dolores Koenig, "The Manantali Resettlement Project: The First Year Move," Binghamton: Institute for Development Anthropology, September 1986). Discussions were also held with Gavan Konare, the OMVS representative at the dam site and with the consulting engineers. On June 27, Howe and Scudder left Koenig and Grimm at Manantali, returning to Bamako by road. Prior to their return to Dakar on the 28th, discussions were held with USAID/Bamako Director E. R. Chiavaroli.

Horowitz joined Howe and Scudder in Dakar, and during the next two days he, Scudder and Colonel Darrell Lowe (Military Attaché at the American Embassy) overflew the Lower and Middle Senegal Basins. On July 1 they met Howe at Kaedi in Mauritania. Howe had driven overland with Jean LeBloas (of USAID/Dakar River Basin Development Office) via Richard Toll and Podor. There they were joined by Joseph Guardiano (Special Projects Officer with USAID/Nouakchott) and Mark Lynham (Chief of the University of Arizona team's Mauritanian Agricultural Research Project, which is based in Kaedi) for visits to the Dirol Plain, Kaedi, and the Gorgol Perimeter. Final days were spent back in Dakar where further discussions were held with Director Sarah Jane Littlefield and USAID staff.

The IDA team is especially grateful to USAID Director Sarah Jane Littlefield and to staff members Jon Anderson, Jim Bonner, Monique Cressot, Jean LeBloas, and Campbell McClusky for facilitating their work during this second visit; to US Embassy Military Attache Colonel Lowe, who piloted Horowitz and Scudder over the Lower and Middle Basin; to Robert Dembele and Yacouba Konate of PRM; to Joseph Guardiano; and to Mark Lynham.

4.4 ACTIVITIES WITHIN THE UNITED STATES AND EUROPE

In addition to proposal and report writing, other activities include personnel identification and recruitment, and networking with other institutions working in the Senegal Basin. Satisfied with outputs to date, USAID/Dakar has asked IDA to submit a five year proposal to start during Fiscal Year 1987. The proposal, as incorporated within the May 1986 report, extends IDA activities to the Middle and Lower Basin. To maintain continuity and to initiate an expanded scope of work (Appendix One), USAID/Dakar added funds to the SARSA Cooperative Agreement which will enable IDA activities to continue into the first half of Fiscal Year 1987. It is hoped that funding for the full 5-year period proposed will be forthcoming.

A core IDA team has been recruited to critique existing master plans and to oversee the IDA effort. This core includes André Guinard, Charles W. Howe, Michael M Horowitz, Thayer Scudder and John Waterbury (Professor of Politics and

International Relations at Princeton University's Woodrow Wilson School and author of Hydropolitics of the Nile). William Phelan, currently in the Senegal Basin as part of the University of Arizona sondeo team, will start work in Binghamton during the latter part of October as full time project research assistant. To facilitate coordination and to provide technical expertise, USAID/Dakar and IDA will work out an arrangement whereby Jon Anderson and Jean LeBloas of the River Basin Development Office will advise the IDA team respectively in forestry and watershed management, and in engineering and irrigation systems.

Under networking, initial contacts have been made with AID/Washington, the University of Arizona, the Land Tenure Center at the University of Wisconsin, ORSTOM, UNDP/New York, and the World Bank.

5 MAJOR RECOMMENDATIONS ARISING FROM SECOND FIELD TRIP

5.1 ADAPTIVE RESEARCH FOR PILOT PROJECT IMPLEMENTATION

The Senegal Valley has been over-surveyed but under-researched. Socio-economic research, which has just begun to move beyond the survey stage, is a case in point. Research needs to be adaptive in at least three senses. First, it must, to a large extent, be empirically based on what is learned in specific areas and on specific topics. Second, it must not occur in a vacuum but rather be tied to specific projects and programs. Third, more continuity in adaptive research is needed whereby monitoring and evaluatory research continue during the implementation stage.

We would like to illustrate this recommendation by specific reference to the types of research needed to efficiently utilize a controlled flood from Manantali dam for floodwater irrigation. At the moment, there is insufficient knowledge to determine the quantity of water which should be released from the dam to flood specific areas of the basin (and especially the Middle and the upper portion of the Lower Basins) for a period of 30 to 45 days. Knowledge of the suitability of soils for controlled flooding in specific areas is similarly insufficient. The determination of soil suitability also needs to incorporate the proximity to villagers who are able and willing to carry out décrue

cultivation after the flood waters recede. Finally, for areas where people are willing to cultivate, more knowledge is needed on the type of cropping systems that are best adapted to controlled flooding, and to the peoples' needs in terms of food security and surplus production for export.

Three types of research are necessary to produce the required knowledge:

(a) Analysis of river flows in relationship to land flooded and land cultivated after the annual flood.

Here research consists of very careful measurements for a minimum of five years on river flows in relationship to land inundated and land recessionally cultivated. Approximately 50 percent of the flow of the Senegal River comes from the Bafing (and hence will be largely controllable at Manantali), with the remainder coming from the Bakoye, the Faléméé and other tributaries. Most of this water is in the Senegal by the time it reaches Bakel, which is a key measurement point in the hydromet system for the Basin. During each year, exact measurements of Senegal River flow must be linked to exact measurements of the arable area inundated by those flows and the arable area actually cultivated. The resulting information will be placed on appropriate maps so that it is possible not only to calculate the total area inundated at different flood levels, but to plot the

distribution of areas flooded and areas cultivated according to location and duration of flooding.

Measurements should start at the earliest possible time so that at least some data have been analyzed before the Manantali Dam is sealed and controlled water releases begin. The minimal measurement period of five years is based on the assumption that the dam will be completed in two years time and the reservoir will fill after a further one or two years, allowing the first controlled flood during 1989 or 1990. If this assumption is accurate, measurements would cover the last flood season prior to inundation, the period of filling and the first few seasons of controlled flooding. Analysis of the accumulated data should provide information sufficient to plan future releases.

While the IDA team does not have the expertise at this time to assess the best techniques for obtaining the essential data, we are convinced of the need to accumulate those data starting at the earliest possible moment. For that reason, we urge that LeBloas' June 1986 terms of reference for Utilisation d'Images Satéllite et de Couvertures Aériennes Vidéo pour l'Evaluation des Superficies Inondés, des Superficies Cultivées en Décrue, et le Suivi de l'Environnement dans la Vallée du Fleuve Sénégal be finalized as soon as possible so that whatever contractor(s) is selected can be operational in time to measure the surfaces affected by the 1987 flood.

In finalizing these TOR we recommend that the contractor(s) also be asked to place, or superimpose, existing data concerning

the structure of the populations of adjacent villages upon the maps, with special emphasis on present village population profiles. We would be pleased to make the appropriate additions to the TOR, and note in this regard that in its work on mapping water points in Central Tunisia, IDA is currently utilizing images generated by Landsat V Thematic Mapper.

(b) Research on local decision making as it relates to décrue cultivation.

Land inundated by annual flooding is not necessarily cultivated by village populations. Sir Alexander Gibb notes a maximum décrue area of about 100,000-120,000 ha, whereas the total area flooded can exceed 400,000 ha.[5] Why do villagers cultivate only a fraction of the available area? At the moment we can only guess at the reasons. Length of time the land is inundated presumably is a major one. Distances from villages may also be involved, although much of the décrue land between villages in the middle valley is controlled by inter-village lineage groups (see here Park, Rogers and Ngaide's June 1986 University of Wisconsin Land Tenure Center Report on Preliminary Land Tenure Study of the Dirol Plain). Labor resources, and production and income generation options competing for those

[5]Etude de la Gestion des Ouvrages Communs de l'OMVS. Rapports Phase I - Volume 1B. Optimisation de la crue artificielle. Sir Alexander Gibb and Partners, Fév. 1986, pp. 3/1, 4/10.

labor resources, presumably are other factors. Yields during the preceding rainy season may also be a factor, along with uncertainties associated with yields from flood recession farming. It is also likely that internal stratification of village populations contributes to insecurity of land tenure and differential access to land, since the most jealously guarded land rights pertain to décrue fields.

Such guesses are insufficient for planning purposes. Policy on controlled flooding must be based not only on knowledge of areas inundated for 30 to 45 days by specific releases but also on reasonable forecasts as to whether or not villagers will cultivate the land flooded. Such forecasts require considerably more knowledge about decision-making at the household, community, and lineage levels regarding (1) the way in which labor resources are allocated between different production and income earning activities (e.g. dieri rainfed agriculture, décrue cultivation, livestock management, fishing, wage labor and other activities), and (2) why allocations are made in the fashions they are (and here topics such as differential access to land and social stratification come into play).

(c) Adaptive research on cropping systems and livestock management

Low yields resulting from lack of control over flood water resources and pests, and from cropping system deficiencies, are a

major factor discouraging flood recession cultivation. The post rainy season sondeo currently being undertaken in Mauritania by the University of Arizona team, coupled with findings from the earlier sondeo, is a first step toward collection of data on the nature of existing production systems, including their strengths and weaknesses---a step which should be repeated as soon as possible on the Senegalese side.

Based on sondeo and other knowledge, an appropriate research program needs to be drawn up and implemented, with implementation areas including the Kaedi area discussed under 5.3. This should not prove difficult since the University of Arizona team is currently based there. The program should focus on both existing production and marketing systems, and on specific crops.

As Guinard writes in Appendix III to the first IDA report, existing production systems

> ...are highly integrated and coherent... A typical SRB family grows rainfed crops in the upper land (dieri) outside the valley, flood recession crops on the valley floor (oualo), and some garden with fruit trees on the river levees. It has livestock grazing dieri in the rainy season and oualo in the dry season. It may also be engaged in some fishing and charcoal making. Family resources are allocated among various activities according to their productivity, and the household pursues an optimization strategy of maximizing output while minimizing risks.

Such systems have their strengths, but they also have their weaknesses, including differential access among households to land, livestock, and other resources. These strengths and weaknesses need to be assessed as they relate to the entire production system and to components of such systems. One such component---flood recession agriculture---has received very

little attention since 1970 and not much more attention prior to that date. According to conventional wisdom (and some research data), yields of sorghum and cow peas can be expected to increase three-fold with better water management and the correct usage of inputs such as urea. Is this in fact the case? Are there other techniques, such as seeding of better varieties and plant protection, which might also significantly raise yields?

Research on must proceed to develop, on the one hand, more appropriate varieties of locally important crops, and, on the other, new crops---such as sesame which plays a very important role in the cropping-livestock management system in Somalia but is not a significant component in Senegal River Basin cropping systems.

Other problems that Guinard suggests might be studied include:

> ...transplanting of flood recession sorghum, a usual practice in other countries, to accommodate shorter flooding and for easier weed control; transplanting of rice to reduce water consumption and to make weed control easier; the labor costs of transplanting (both crops); crop protection against birds and weeds; and crop rotations for optimum use of household resources within local physical constraints (soil suitability, humidity and temperature stress during harmattan).

5.2 INCORPORATION WITHIN THE UPPER VALLEY MASTER PLAN OF THE BAFING FROM BAFOULABE TO THE END OF THE MANANTALI RESERVOIR

In the July 1986 draft of the proposed scope of work for the contractor to be selected to elaborate the Upper Valley

Master Plan, the extent of Upper Valley ends at Bafoulabe. The logic of this is that Bafoulabe is the confluence of the Bakoye and Bafing Rivers forming the Senegal River. There are, however, a number of excellent reasons for USAID to include the Bafing River from Bafoulabe to the end of the Manantali Reservoir within the planning exercise. Four reasons are discussed in the paragraphs that follow.

(a) USAID/Mali is funding ($18 million+) the relocation of approximately 9000 people from the future Manantali Reservoir basin, resettling them both below the dam and around the reservoir perimeter. Since funding covers only the phase of physical resettlement (including village and well construction, and temporary evacuation roads), it makes sense that the Upper Valley Master Plan include a development phase which would present development options (1) for the benefit of the relocatees and of the host villages among which they are being resettled, (2) for the construction township at Manantali, and (3) for the watershed surrounding the reservoir.

(b) According to the OMVS representative at Manantali, aside from onchocerciasis, tsetse, and epidemiological surveys, virtually no research or planning for development purposes has been carried out in the Manantali area. Including that region within the Upper Valley Master Plan would be a

logical extension of the Malian Government's and AID's substantial investment in the phase of physical resettlement.

(c) While the Terms of Reference for the Upper Valley Master Plan include fisheries development within the Manantali reservoir, they neglect other development options for the reservoir basin and for the area between Bafoulabe and the dam site. The best way to correct for this inconsistency is systematically to extend the Upper Valley Master Plan to the end of the reservoir and to treat the Manantali area as a planning region.

(d) Not only were the OMVS Manantali representative and the USAID/Bamako Director supportive of including the Manantali region within the Upper Valley Master Plan, but the suggestion was favorably received by USAID/Dakar and the head office of the OMVS, which in July 1986 was itself about to present such a proposal to the Malian authorities.

5.3 REGIONAL DEVELOPMENT IN KAEDI, MAURITANIA; BAKEL, SENEGAL; AND MANANTALI, MALI AREAS

In our first report we recommended that "USAID assistance should be used to plan, implement, monitor and evaluate development prototypes for a single area in the Upper Basin, the

Middle Basin, and perhaps the Lower Basin." Such prototypes would hopefully produce features which, after the necessary adaptive research in new locations, could be replicated elsewhere in the basin. Careful ordering of priorities and schedules would be essential in order to avoid the managerial and other pitfalls that have befallen other attempts at area development---attempts which have tried to accomplish too much in too short a time.

In refining the above recommendation, nothing further will be written about a Lower Basin prototype until the IDA team has had the opportunity to evaluate existing plans for the Lower Basin during FY 1987. Further upriver, we renew our recommendations that efforts in the Middle and Upper Basins be concentrated on the Kaedi and Bakel areas. In addition we have added the Manantali area as recommended 5.2. In each case, assistance from a number of donors and private voluntary organizations would be needed; hence our recommendation to USAID is that their assistance be incorporated to a greater extent within a regional framework.

5.3.1 Kaedi

Starting with the Dirol Plain, the Kaedi prototype might eventually include Kaedi township and the lower reaches of the Gorgol. In the meantime the AID-assisted development of the Dirol Plain should move forward as quickly as possible, first by building a road along the dike route to Boghe, and second by

completing those feasibility studies necessary for starting intensification of recessional cultivation on the Plain itself. Certainly that is the desire of the Mauritanian government whose initial request for USAID assistance dates back to 1980. Because of less than satisfactory results with large scale perimeters since then, the Mauritanian Department of Agriculture has become increasingly well-disposed toward the type of approach presented in Jean LeBloas' March 1984 Aménagement de la plaine du Dirol, USAID: RBDO.

In the paragraphs that follow the argument is presented for including the Dirol Plain Project in the early "après-barrages" program on the Senegal River. Starting with a summary of the project extracted from LeBloas' report, and supplemented by discussions with LeBloas and others, a brief, qualitative multi-objective evaluation of the project is provided.

The current population of Mauritania is approximately 1.7 million and is projected to nearly 2.3 million in the year 2000.[6] Of the current cereal needs of approximately 240,000 tons per year, irrigated perimeters and décrue agriculture covered only 5 percent in 1983 (the year of the worst river flow on record), 7 percent in 1984, and 24 percent in 1985.

In 1983-1984, only 38 percent of the existing irrigated perimeter hectarage was cultivated, not due to water shortage, but largely due to institutional problems and problems in

[6]The World Fact Book 1986. Washington: US Government Printing Office.

organizing the farmers. Cereal needs by 2000 are estimated to be 450,000 tons per year.

In an average water year, the right bank of the Senegal River has about 48,000 ha under décrue cultivation, producing some 18,000 (metric) tons of sorghum. This production is, however, quite risky because of the great year-to-year variability of the flooding, both from the river and from overland flooding. Inundation must last 30 to 45 days to saturate the soil sufficiently to bring the sorghum crop to harvest. If the extent and duration of flooding could be guaranteed by water controls, the area under décrue cultivation could be substantially increased.

The Dirol Plain lies to the west of Kaedi, containing more than 10,000 ha of arable land. In a year of average flood, only 1500 to 2100 ha are actually cultivated. In 1963, only 200 ha were cultivated. The idea of a Dirol Plain development was included in the master plan for the middle Senegal by GERSAR (June 1980). The concept has been subsequently refined by J. LeBloas. The proposed two phase project (intensification of recessional cultivation followed by irrigation development) would be composed of the following steps:

(a) Detailed hydro-agricultural studies.

(b) Construction of a dike of elevation 13 m and approximately 14 km length to control watershed runoff

and some river flood waters on approximately 6600 ha north of the dike. There exists the possibility of exploiting an additional 2200 ha between the dike and the river (i.e., south of the dike).

(c) A program of research and extension work to improve décrue yields. It is estimated that yields can be improved from the current 400 kg/ha average to 800 kg/ha with wider spacing and varietal selection, and to 1200 kg/ha with the use of fertilizer. This could add as much as 10,500 tons/year of sorghum if the lands south of the dike were exploited.

(d) This dike will provide the base for an all weather road from Kaedi to Boghe, a project already given high priority by USAID/Nouakchott.

(e) In addition to improved décrue production, the project proposal envisions the development of irrigated vegetable and fruit gardens on the high grounds around several major villages. The water could be supplied by pumping from the ponds that are left as water is released from behind the dike. Shallow canals would be dug from the ponds to the garden area to bring the water close to the gardens. Later in the dry season or

in exceptionally dry years, the pump could be used to pump from dug wells.

(f) Groundwater recharge will be increased by holding water on the land for longer periods, enhancing the productivity and reliability of existing village wells and probably making possible the reforestation of the broad tip of the dike itself.

LeBloas' assessment was evaluated during the summer of 1985 by three researchers provided under the Water Management Synthesis II Cooperative Agreement[7]. While the WMSII team suggested various modifications to LeBloas' proposal, including a reduction in dike height which they believed would achieve, during the first, or flood recession enhancement, phase of the project, the same goals at lower cost, in general they supported it against previous criticisms and they strongly endorsed further AID involvement in the development of the Dirol Plain.

Because of the unsatisfactory record of "large-scale centrally managed systems," the WMSII team noted that

> ...the government is more amenable to the development of small-scale irrigation perimeters and the enhancement of recession irrigation. For the immediate future enhanced recession cultivation is an attractive development strategy and is worthy of consideration by USAID to assist the Government of Mauritania to enhance its food security

[7]D. J. Thom, D. C. Slack, and M. B. Lynham, "Pre-feasibility Study of Irrigation Development in Mauritania for the Generation of a Proposal for Agricultural Development of the Dirol Plain, Senegal River Valley, Mauritania."

> situation... The request of the Government of Mauritania to seek USAID assistance to develop the agricultural resources of the Dirol Plain is reasonable and the site has considerable potential for irrigation development. With proper development the Dirol Plain could double the present irrigated hectarage of the whole country, consequently the pre-feasibility team strongly supports AID/Mauritania's involvement in the development of the Dirol Plain.

The importance of this type of recessional cultivation as the source of improved village nutrition and security has been emphasized in the recent comparative African flood plain study Taming the Floods: Environmental Aspects of Floodplain Development in Africa (Sponsored by the Commision of the European Communities, produced by the Center for Environmental Studies, State University of Leiden, December 1985).

LeBloas has estimated that the dike at 13 meters would cost $5.2 million, but these costs could be shared with the cost of providing an improved road from Kaedi to Boghe. Three years of technical assistance and operating costs for 5 years bring the estimated total cost to $5.7 million.

From a national economic point of view, LeBloas estimates an internal rate of return of 18 to 20 percent, an unusually high return. An additional advantage is the simplicity of the structures and the ease of their operation and maintenance.

The likely regional advantages of the Dirol project include self-sufficiency in grain, an exportable surplus in most years, increased nutrition for the local villages, and greatly reduced risk of food supply failure.

It seems quite likely that the combination of increased production in Dirol, and the already high levels of production in

the Gorgol perimeter east of Kaedi and the Gorgol Creek décrue areas would increase local incomes to a level that would generate substantial multiplier effects on secondary activities in the project region.

Socio-economic impacts would include the distribution of the added income among the population and the shifts in land tenure that would follow the Dirol project. Higher income levels, if widely distributed, would stimulate the demand for goods and services, including the provision of government services, making possible a greater variety of services, health care, and education.

Effects on land tenure and social organization are hard to assess. In their recent Land Tenure Center preliminary report on a land tenural survey of the Dirol Plain, Park, Rogers and Ngaide noted potentially explosive land tenure issues. Not only do these involve Toucoulor and Harrateen (most of whose cultivated land is also claimed by Toucoulor), but they also arise within the highly stratified Toucoulor society. Furthermore, both peoples are fearful of national land legislation that could be used, through eminent domain, to reallocate land not just more equitably within the Dirol Plain but also to outsiders. According to the WMSII report, this fear of losing land through redistribution is one reason why local inhabitants are skeptical about the development of irrigation perimeters under SONADER.

Land tenure and social stratification problems are not unique to the Dirol Plain, hence their existence should not be

taken as a reason for not proceeding with development. Indeed, as the WMSII team points out, "Most of the irrigation development projects in Mauritania have been plagued with land tenural disputes resulting in bitterness and disharmony within irrigation perimeters." Finding solutions to such problems, which need to involve interaction between the local inhabitants, their local government, and the national government, deserves as much priority as do technical problems dealing with soil characteristics and physical infrastructure. For this reason we recommend not just that the preliminary land tenural studies initiated by the Land Tenure Center be followed by further surveys, but that the sociocultural survey initiated by AID/Nouakchott during 1986[a] also be continued. In this regard, it is worth mentioning that the WMSII team also emphasized the need for comprehensive socio-economic and land tenure surveys. The results of such studies must then be used in working out mechanisms, which will be supported by the local villagers, for spreading the benefits of development to a broader base.

As for environmental effects, they appear to be positive. One of the most important effects would be raising of the water table which has fallen during the recent low rainfall period. Many trees have died as a result, and raising the water table would save existing trees and facilitate reforestation around the Dirol Basin. Especially important is reforestation along the

[a]Saidou Kane, Enquête Sociologique dans la Plaine du Dirol (Maruitania). Nouakchott: USAID, 1986.

dike itself to act as a windbreak to stabilize blowing soils and sand.

It appears likely that small scale fisheries could be established in the permanent ponds that would be created in the low areas of the basin. Whatever wildlife exists in the area will benefit from these ponds and from increased forage in the drawdown areas that are not planted with crops. Bird life in the area, already surprisingly rich and varied, would be enhanced by the water and added tree cover; the impact of birds on grain harvests in not clearly estaolished in the region.

In sum, the Dirol Plain Project presents an unusual opportunity to enhance agricultural productivity, to revive currently degraded ecosystems, and, it is hoped, to generate significant multiplier effects for the economy along the right bank of the Senegal River.

With appropriate understanding of the social structure of the area, the project should generate significant net benefits for all residents at relatively low cost.

5.3.2 Bakel

Whereas the Dirol Plain would be the focus for initiating a process of region-based development in the Kaedi area, community managed and SAED-Ministry of Rural Development-AID/other donor assisted small scale perimeters (some of which might well be aggregated as units into medium scale perimeters) would appear to

be the logical focus in the Bakel area. For one thing, USAID is already heavily involved in Bakel small-scale perimeter development. For another, in contrast to the situation in Kaedi, land tenural and social organizational features in the Bakel area are more apt to be developmental assets than constraints.

At this point the IDA team has insufficient information to suggest ways in which region-based development might proceed in the Bakel area. It is unclear to us how this area should be defined. Should it be restricted to Senegal---to Bakel and nearby communities along the Senegal River and the lower reaches of the Faléméé? Or should it be broadened to include the Guidimaka area of Mauritania and the Kayes area of Mali? A wider range of feasibility studies is needed to answer such questions, just as a wider range of adaptive research is needed to investigate how an aggregate of small-scale perimeters can be better linked to facilitate nonfarm enterprise and market town development. There is also the question as to whether or not the potential on marigots of gravity fed irrigation based on dikes and regulatory structures should be more seriously assessed.

5.3.3 Manantali

The following options appear attractive for facilitation of region-based development in the Manantali Area:

(a) Rainfed cropping systems, including agroforestry.

(b) Decrue cultivation within the drawdown area of the reservoir which will be extensive in some of the reservoir sub-basins (for example, in the area adjacent to the village of Tondidji).

(c) Gravity-flow irrigation of approximately 3000 ha identified by an Italian-funded reconnaissance of the Bafing river on the left and right banks immediately below Manantali Dam (in which necessary off-take structures will be constructed).

(d) Integration of livestock into the farming system, especially involving animal traction (a significant minority of villagers already make ample use of animal-drawn plows, seeders and cultivators) and development of appropriate grazing zones within the drawdown area of the reservoir (which can be expected to provide valuable pasture throughout the dry season).

(e) Reservoir fisheries (with an estimated potential of approximately 3,000 metric tons per annum).

(f) Conversion of the construction township at Manantali into a development service center for the surrounding population.

(g) Maintaining and possibly upgrading the current all-weather Manantali-Mahina road to the line of rail.

(h) Development of an integrated transport system throughout the reservoir basin which might link resettled and host villages by short feeder roads to the lakeshore (hence not requiring tributary crossings) and from there to the Manantali Dam by lake transport (ferro-concrete or other barges; in-board diesels etc.).

(i) Watershed management and other forms of environmental enhancement including a national park, forest reserves, etc.

6 PROGRAM FOR FY 87

During FY 87, USAID/Dakar would like the IDA team to continue FY 86 activities and to initiate a new set of activities that were outlined in a July 1986 Scope of Work (Appendix I). We are currently recruiting the relevant personnel.

6.1 CONTINUATION OF FY 86 ACTIVITIES

To date, the IDA team has had insufficient contact with West African colleagues. We expect the recruitment of John Waterbury as a member of the IDA core group and as principal adviser to the OMVS and the relevant member country agencies to correct this deficiency. Assisted by Guinard, Horowitz, Howe, Fall and Scudder, Waterbury would work closely with staff in those agencies to help identify policy options, formulate policies for implementation, and identify institution-building and training needs. IDA information management specialists would also work closely with Waterbury.

6.2 PERSONNEL RECRUITED TO UNDERTAKE THE FY 87 SCOPE OF WORK

The following activities have been identified:

(a) Preliminary Critique of Existing Master Plans: This will be the primary responsibility of the core group of five (Guinard, Horowitz, Howe, Scudder and Waterbury), assisted by William Phelan (who---among other tasks--- will abstract important sources according to a format to be designed by the information managment specialists) and members of the larger IDA team.

(b) Approaches to Water Fee Collection among Low Income Producers: This will be the responsibility of Charles W. Howe.

(c) Suggested framework for analysis and monitoring of population and occupational changes in the Senegal Basin: We have yet to select from the three people whom we believe have the necessary qualifications to carry out this assignment.

(d) Analysis of existing hydrological models: This will be

the responsiblity of Hubert Morel-Seytoux, Professor of Hydrology at Colorado State University.

(e) Approaches to flood recession agriculture in the Senegal Basin: This will be the responsibility of Thayer Scudder.

APPENDIX I

"AMEMBASSY DAKAR
SECSTATE WASHDC"

"SUBJECT: PM AND R (625-0929.85): SRB MONITORING -- IDA"

"REF: PIO/T 625-0929.85-3-50073 DATED 18 OCTOBER (sic) 1986"

"SUMMARY: Text of amendment to ref PIO/T follows below. Mission is extending current year services under IDA cooperating agreement consistent with IDA proposal for multi-year monitoring effort and expressions of host government and OMVS interest. Funding this extension is an interim measure pending reobligation actions planned for first quarter FY 87 under which Mission plans fund longer term monitoring effort. END SUMMARY."

"This PIO/T provides NTE additional dols to partially finance a second year of services at the same level of effort under the IDA work program under which it proposes to continue providing background research and advice to OMVS, its member states, USAID, and A.I.D.-financed contractors as outlined in the terms of reference and budget of the original of this PIO/T and as amended by the additional terms attached hereto (Attachments I and II). Pending the availability of funds, additional funding for the second year's effort will be provided."

"Terms of Reference additional to those originally provided:

(1) Continue initial monitoring activities as outlined in the original terms of reference but expanding scope to include the Middle and Lower Basins as well as the Upper Valley;

(2) Identify jointly with USAID/Senegal topics for research/advisory attention under this work program;

(3) Provide experts for work under this program in accordance with individual scopes of work jointly prepared with USAID/Senegal; and

(4) Continue to refine the list of monitoring requirements."

"Scope of work for second monitoring period.

(1) Prepare and submit to USAID/Senegal a written draft of a preliminary critique of the strengths and weaknesses of the existing master plans for the Senegal River Basin (SRB).

(2) Begin a study to identify and recommend possible approaches for applying water use fees to low income agricultural users in the SRB.

(3) Submit a draft demographic model for the SRB that would assist in predicting population growth, migration (in and out), occupational changes, social status changes, needs for services, etc. appropriate for the SRB.

(4) Continue as may be useful the analysis of existing hydrological models for the SRB to make recommendations for strengthening modeling capabilities and for identifying the types of models most appropriate in terms of local institutional capacities.

(5) Submit a preliminary paper on flood recession agriculture in African river basins to identify cost effective possibilities for increasing production and productivity.

(6) Submit activity reports within one month of each field visit. These should include, but not be limited to: entities contacted, areas visited, status of activities, and recommendations for future activities."