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COOPERATIVE AGREEMENT ON SETTLEMENT AND RESOURCE SYSTEMS ANALYSIS

OVERVIEW OF THE AFRICAN EXPERIENCE
WITH RIVER BASIN DEVELOPMENT: ACHIEVEMENTS TO DATE,
THE ROLE OF INSTITUTIONS AND STRATEGIES FOR THE FUTURE

by
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July, 1988



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TABLE OF CONTENTS

CHAPTER 1: INTRODUCTION

A. PURPOSE AND OUTLINE	1
B. JUSTIFICATION	2
C. THE WIDENING GAP BETWEEN RIVER BASIN DEVELOPERS AND CONSERVATIONISTS	3
D. DEFINITIONS	13
1. Institutions	14
2. African River Basin Development	16
E. RESEARCH STRATEGY	20
F. SUMMARY	20

CHAPTER 2: THE RECORD TO DATE WITH AFRICAN RIVER BASIN DEVELOPMENT

A. APPRAISAL AND EVALUATION DIFFICULTIES	23
1. Appraisal Techniques	23
2. Evaluation Techniques	26
B. THE RECORD TO DATE	30
1. Electricity Generation and Transmission	33
2. Irrigation	37
a. Introduction	37
b. The Extent of Irrigation	39
c. Constraints and Difficulties Facing African Irrigation	40
d. The Record to Date	43
(1) Irrigation Impacts on Settler Households	45
(2) Multiplier Effects	46
(3) Local Participation and Small-Scale Irrigation	48
3. Other Effects Including Impacts on Local Production Systems	49
a. Positive Effects	49
(1) Fisheries	49
(2) Livestock	51
(3) Flood Water Agriculture	52
(4) National Parks and Tourism	53
b. Negative Effects of Dam Construction on Riverine Habitats and Local Production Systems	54
(1) Downstream Production Systems	54
(2) Reservoir Basins	58
4. Summary	62

CHAPTER 3: THE IMPORTANCE AND POTENTIAL OF AFRICAN RIVER BASINS FOR LOCAL POPULATIONS

A. INTRODUCTION	67
B. PERCEPTIONS OF OUTSIDERS	68
C. RIVER BASIN SOCIETIES AND PRODUCTION SYSTEMS	69
1. River Basin Societies	69
2. Constraints to Riverine Societies and Production Systems	71
a. Disease	72
b. Irregular Flooding	74
c. Population Increase and Environmental Degradation	75

d.	Drought	75
e.	Summary	76
3.	The Nature of Riverine Production Systems	77
a.	Floodwater Agriculture	78
(1)	Flood Recession and Flood Rise Agriculture	78
(2)	Valley or Swamp Cultivation	83
(3)	Tidal Cultivation	84
b.	Irrigation	86
c.	Fishing	87
d.	Livestock Management	88
4.	The Distribution and Importance of Riverine Production Systems	89
a.	The Lower Pongola Floodplain	89
b.	The Zambezi and Its Tributaries	90
(1)	The Middle Zambezi Valley	90
(2)	The Barotse Plains of the Upper Zambezi	91
(3)	The Kafue Flats	91
c.	The Delta of Kenya's Tana River	94
d.	The Sudd in the Central Sudan	95
e.	West Africa: The Senegal, Lake Chad, and Niger Basin	96
(1)	The Inland Delta	96
(2)	Northeast Nigeria	99
(a)	The Lower Sokoto Basin	99
(b)	The Pre-Kainji Dam Reservoir Basin Area	101
D.	THE DEVELOPMENT POTENTIAL AND ENHANCEMENT OF RIVERINE HABITATS AND PRODUCTION SYSTEMS	102
1.	Introduction	102
2.	Analyses of Potential	103
3.	The Enhancement of Riverine Habitats and Production Systems	106
a.	Introduction	106
b.	Reservoir Basins	107
c.	Riverine Production Systems Below the Dam	109
d.	Constraints to Downstream Enhancement	113
E.	SUMMARY	118
CHAPTER 4: LOCAL ORGANIZATIONS AND RIVER BASIN DEVELOPMENT		
A.	INTRODUCTION	120
B.	ORGANIZATIONS BASED ON LOCAL INITIATIVE	122
1.	Kangocho and Island Farms (Kenya)	123
2.	Lake Victoria Basin Organizations (Kenya)	125
3.	Upper Senegal Valley Organizations (Senegal)	126
C.	LOCAL ORGANIZATIONS FORMED LARGELY THROUGH EXTERNAL INITIATIVE	130
1.	Women's Horticultural Groups	131
2.	The Siatwinda Farmers Executive Committee (Zambia)	132
3.	The Lower Tana Village Irrigation Project (Kenya)	133
4.	Kibirigwe Farmers Cooperative Society (Kenya)	135
5.	Mutuungu Water Users Association (Kenya)	136
6.	Mwea Amalgamated Rice Growers' Cooperative (Kenya)	137

d

D. DISTRICT LEVEL ORGANIZATIONS	141
E. SUMMARY	144

CHAPTER 5: RIVER BASIN AUTHORITIES AND GOVERNMENT

PARASTATALS

A. INTRODUCTION	147
B. THE NEED FOR RIVER BASIN AUTHORITIES	149
C. SUCCESS STORIES	149
1. Introduction	149
2. Case History: The Volta River Authority	151
a. Introduction	151
b. The VRA in Historical Context	152
c. Resettlement and Development	156
d. Research	158
e. Fisheries Development	158
f. Agriculture	159
g. Health	160
h. Lake Transport	161
i. Akosombo Town	162
D. INSTITUTIONAL CONSTRAINTS TO INTEGRATED RIVER BASIN DEVELOPMENT	162
1. Management and Fiscal Constraints	162
2. Politicization	165
3. Policy Biases	166
4. Planning	168
5. Monitoring and Evaluation	169
6. Decentralization, Devolution, and Working with Local Populations	169
7. Coordination Versus Implementation	171
E. SUMMARY	173

CHAPTER 6: BILATERAL AND MULTILATERAL DONOR AGENCIES

A. INTRODUCTION	177
B. UNITED STATES INVOLVEMENT IN RIVER BASIN DEVELOPMENT	177
1. The Post World War II Era	177
2. The 1950s and 1960s	178
3. The 1970s and the 1980s	181
4. Impacts of AID Activities Since 1973	184
5. AID's Inability to Formulate a River Basin Development Strategy	189
6. Summary	196
C. OVERVIEW OF DONOR DEFICIENCIES	197
1. Coordination Deficiencies	199
2. Project Versus Regional Orientation	203
3. Excessive, Inadequate Studies and Unrealistic Planning Expectations	203
a. Ethiopia's Awash River Basin	204
b. Kenya's Bura Scheme (Middle Tana River Basin)	205
4. Delayed Decision Making and Inadequate Supervision	207

E

5.	Inadequate Training and Lack of Continuity of Effort in Regard to Training and Institution Building	208
6.	Insufficient Attention to Local Production Systems	210
7.	Inadvertent Suffocation of Local Initiative and Participation	211
D.	SUMMARY	211
CHAPTER 7: PRIVATE SECTOR AND RESEARCH ORGANIZATIONS		
A.	INTRODUCTION	215
B.	PRIVATE SECTOR FIRMS	217
1.	In Regard to Construction-Related Activities	217
2.	In Regard to Production and Marketing Activities	220
C.	PRIVATE VOLUNTARY ORGANIZATIONS	230
D.	UNIVERSITIES AND RESEARCH INSTITUTIONS	232
E.	SUMMARY	235
CHAPTER 8: CONCLUSIONS		
A.	INTRODUCTION	239
B.	THE RECORD TO DATE	241
C.	THE NATURE AND POTENTIAL OF RIVERINE HABITATS AND PRODUCTION SYSTEMS	245
D.	CONSTRAINTS TO DEVELOPING RIVERINE PRODUCTION SYSTEMS	247
E.	THE ENHANCEMENT OF RIVERINE HABITATS AND PRODUCTION SYSTEMS	248
1.	New Policies and Strategies	248
2.	Improved Water Management	249
3.	Institutional Involvement	252
F.	THE ROLES OF INSTITUTIONS	252
1.	Local Organizations	253
2.	River Basin Organizations	255
3.	Donors	258
4.	The Private Sector	262
	GLOSSARY	267
	BIBLIOGRAPHY	269

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**THE AFRICAN EXPERIENCE WITH RIVER BASIN DEVELOPMENT:
ACHIEVEMENTS TO DATE, THE ROLE OF INSTITUTIONS AND STRATEGIES
FOR THE FUTURE**

Thayer Scudder

CHAPTER 1

INTRODUCTION

A. PURPOSE AND OUTLINE

The purpose of this overview is threefold. The first purpose is to explore the record with river basin development in tropical Africa. The second purpose is to examine the role of institutions in African river basin development. The third purpose is to propose strategies for development for the rest of this century which will benefit larger numbers of people through increased production and income, enterprise development, and employment generation in an environmentally sound fashion. Chapter 1 presents the justification for such a broad approach and defines terms. Chapter 2 examines the record to date with African river basin development. In Chapter 3, the importance and the potential of riverine floodplains and the annual flood of free flowing rivers for millions of African river basin inhabitants are analyzed. Chapters 4, 5, 6, and 7 examine the involvement in river basin development of local

organizations; river basin authorities, and government ministries and parastatals; donor agencies (with special emphasis on USAID and the World Bank); and private sector and research organizations in that order. The final chapter presents conclusions.

B. JUSTIFICATION

The United States Agency for International Development (hereafter referred to as AID) scope of work directed Clark University and the Institute for Development Anthropology (hereafter referred to as SARSA, the acronym for the AID-funded cooperative agreement on settlement and resource systems analysis that is shared by the two institutions) to examine the role of institutions in African river basin development. Granted that more limited assignment, SARSA's broader focus on the record with river basin development, and on strategies for the future, requires justification. Two points of justification are relevant. First is the SARSA conclusion that the experience of institutions with river basin development is best assessed against outcomes -- namely the extent to which the resources of Africa's river basins have actually been developed in recent years and the role that institutions have played in that development. Such an approach is necessary since not infrequently institutional structures are praised and institutional performance is rated as "satisfactory" (as in World Bank project completion reports and evaluations) while economic rates of return and financial performance of projects implemented are rated as "unsatisfactory."

The second point of justification concerns the increasing need for a more balanced assessment of achievements to date, of the potential of river basins for development, and of strategies for realizing that potential in order to bridge the growing gap between pro-big dam and anti-big dam thinking. Involved as development advocates (the developers) is a powerful coalition composed of the leaders of Third World countries, various bilateral and multilateral donors, and firms of consulting and construction engineers. Increasing opposition comes from a coalition of international, national and

local environmental groups, and from private voluntary agencies advocating the rights of tribal peoples and other low income populations with little political clout who all too often have been impoverished by programs of river basin development. These agencies (the conservationists) have become more militant during the 1980s because of the failure of the 1960s' and 1970s' dialogue between developers and conservationists to produce environmentally sustainable river basin development programs that actually benefit the majority of river basin inhabitants.

Both sides have strong but one-sided arguments to support their position. The developers emphasize that the management of Africa's water resources for urban-industrial development and for food self-sufficiency requires the construction of large-scale dams. The conservationists emphasize the very serious negative environmental and socio-economic effects that have accompanied African dam construction to date. Is there a middle position which can broaden benefits to include both rural and urban populations without environmental degradation? Believing that there may be, the SARSA team's analysis has led to a wider range of development options. It is our hope that the conclusions and recommendations will stimulate riparian states, AID, the World Bank, and other donor and lending organizations to widen their perspective as it relates to African river basin development and to approach that development in a more systematic and long-term fashion, with the formulation of policies and strategies preceding rather than following program and project implementation.

C. THE WIDENING GAP BETWEEN RIVER BASIN DEVELOPERS AND CONSERVATIONISTS

Though some developers are concerned conservationists, the relationship between developers and conservationists has increasingly become an adversarial one, with the former pushing for more large scale river basin development projects, while the latter call upon donor agencies "to cut off funds from all large-scale development schemes

that they may plan to finance, or are involved in financing, regardless of how advanced those schemes might be" (Goldsmith and Hildyard, 1984: 345). The rhetoric on both sides is escalating, with river basin authorities and their supporters making unrealistic claims of benefits in their efforts to secure funding, while the critique of conservationists -- important as it has been as a corrective -- places disproportionate emphasis on project costs.

While the construction of big dams has continued to be endorsed by the same coalition of influential actors, if anything donor advocacy (with the major exception of the United States) has increased since the mid-1970s. Within African countries, river basin development projects not only continue to be the largest projects within specific national development plans but also continue to have the direct interest and backing of the head of state whose goals for such projects appear to be more political than economic. In the 1950s, this was the case with the Kariba Dam Project in the Central African Federation, the Kariba site being selected over the Kafue one because it would not only allow the control facilities, initial power station, and transmission lines to be built in white-settler dominated Southern (as opposed to Northern) Rhodesia but also because a dam across the Zambezi at Kariba would provide an actual as well as a symbolic link between those two countries (a link which unraveled with Zambia's independence in 1964).

Though less political significance was given to Nigeria's Kainji Dam and the Ivory Coast's Bandama Dam in the 1960s, both had strong backing from heads of state, with Kainji referred to as "the pillar of Nigeria's economic and social development" (Adeniyi, 1976 as quoted by Adams, 1985a: 177). As for Akosombo in Ghana, Nkrumah's economic plans as well as his vision of a greater Ghana which would play a major role in the Pan-African drama were intricately associated with the Volta Project in spite of the fact that technical details were determined by western contractors and donors.

The technical aspects and political economy of the Aswan High Dam were even more complicated, although Waterbury concludes that "the history of this project is testimony to the primacy of political considerations determining virtually all technical choices with the predicted result that a host of unanticipated technical and ecological crises have emerged that now entail more political decisions" (1979: 6). Soon after the rise to power of the Revolutionary Command Council in 1952, Nasser and his colleagues dropped Hurst's Century Storage Concept for the Nile system in favor of the Aswan High Dam that would give Egypt control within its boundaries over sufficient water for perennial irrigation (*ibid.*, 89). Donor support for the dam played itself out within the context of the Cold War. When the United States and the United Kingdom left the World Bank without its required partners by backing out, in 1956, of their commitment to provide the necessary foreign exchange component for stage one of the project, Nasser saw the United States action in particular as an attack on his regime (*ibid.*, 107). Shortly thereafter he nationalized the Suez Canal, noting in speeches that canal revenues would be used to fund the dam. Following the abortive war over the canal, and with Russian assistance assured for stages one and two, construction commenced in 1960, with the dam becoming an almost unassailable symbol of prosperity, patriotism, and resistance to foreign domination until after Nasser's death in 1970 (*ibid.*, 116-117).

More recent national leaders have continued to place priority on large-scale river basin development projects. In Zambia, President Kaunda pushed hard for dams on the Kafue and for the Kariba North Bank Power Station so as to free the country from dependence on Kariba installations on the Rhodesian side of the reservoir. In Kenya, President Moi is currently pushing for the Turkwell Dam as a means for developing the political economy of the Kalengin-speaking areas. In other cases, heads of states have placed trusted officials in positions of importance with instructions to obtain funding for dams prior to the completion of the necessary feasibility studies, the Balingho Dam

in the Gambia and the Baardheere Dam on the Juba River in Somalia being contemporary examples.

Coalitions between heads of state, donors, consulting agencies and contractors are quickly formed in the large majority of cases. While the resulting joint ventures are prerequisites in Africa for the identification, planning, funding, implementation, and, often, initial management of major projects, since the recession of the mid-1970s it would appear that the involvement of foreign agencies has been increasingly influenced by their own economic self-interests, although that is not to suggest that such interests have been absent in the past or that they do not have their own justification. In the 1950s and 1960s, Anglo-American and Rhodesian Selection Trust (along with the World Bank) provided funding for, and benefited greatly from, Kariba while Kaiser benefited from Volta. On the political front, we have already noted that the West competed with the East for involvement in the Aswan High Dam Project, while the United States Government -- seeking influence within the heart of Francophone Africa when France was asking for high interest rates on loans -- sent Vice President Humphrey to the Ivory Coast to hand-deliver to President Houphet-Boigny financing from the Export-Import Bank for the Kossou Dam on the Bandama River, a project that previously had been rejected on economic grounds by the World Bank.

While political motivations on the part of donors have continued until the present (as with French involvement in the construction of Senegal's Diama Dam), pressure from the international community of donors has stimulated the Arab funding of dams in the Islamic countries of West Africa, and of irrigation in the northern Sudan during the 1970s and 1980s, while more recently the Japanese have become active, especially in regard to irrigation projects. Notwithstanding such a history, the impression since the mid-1970s is that European countries and companies, in particular, have been using grants and other mechanisms as a means to encourage African countries to move ahead with projects of as much, or more, value to the donor (in terms of employment of

consultants and contractors, and sale of equipment) than to the recipient country.

It is this trend, if trend it is, along with the failure of an earlier dialogue between developers and conservationists to produce satisfactory results, that has converted their relationship into an adversarial one. Throughout the tropics the concern of local people, ecologists, environmentalists, journalists, and social scientists about the adverse effects of large scale dams is long-standing. It was institutionalized in 1968 when a conference was convened at Arlie House outside Washington, D.C. by the Conservation Foundation and the Center for Biology of Natural Systems. Its goal was to consider a large number of commissioned papers on the ecological aspects of international development, the proceedings being published in 1972 as a 1000-page monograph on *The Careless Technology: Ecology and International Development*. River basin impacts were sufficiently serious that the editors listed big dams and irrigation first in a ranking of Third World projects that are "being promoted throughout the world with little or no attention to their environmental consequences" (xiii). Kenneth Boulding summed up concerns about dams in particular in six perceptive verses of his *Ballad of Ecological Awareness*:

The cost of building dams is always underestimated-
 There's erosion of the delta that the river has created,
 There's fertile soil below the dam that's likely to be looted,
 And the tangled mat of forest that has got to be uprooted.

There's the breaking up of cultures with old haunts and habits lost,
 There's the education program that just doesn't come across,
 And the wasted fruits of progress that are seldom much enjoyed
 By expelled subsistence farmers who are urban unemployed.

There's disappointing yield of fish, beyond the first explosion;
There's silting up, and drawing down, and watershed erosion.
Above the dam the water's lost by sheer evaporation;
Below, the river scours, and suffers dangerous alteration.

For engineers, however good, are likely to be guilty
Of quietly forgetting that a river can be silty,
While the irrigation people too are frequently forgetting
That water poured upon the land is likely to be wetting.

Then the water in the lake, and what the lake releases,
Is crawling with infected snails and water-borne diseases.
There's a hideous locust breeding ground when water level's low,
and a million ecologic facts we really do not know.

There are benefits, of course, which may be countable, but which
Have a tendency to fall into the pockets of the rich,
While the costs are apt to fall upon the shoulders of the poor.
So cost-benefit analysis is nearly always sure,
To justify the building of a solid concrete fact,
While the Ecologic Truth is left behind in the Abstract. (p. 157)

The 1968 Arlie House conference led to a number of meetings between developers (including participants from AID) and conservationists which produced an agreement on the need for an "Ecological Guidebook for Economic Development." The product of this agreement was a 1974 publication on *Ecological Principles for Economic Development* which was published for the International Union for Conservation of

Nature and Natural Resources (IUCN) and the Conservation Foundation (Dasmann et al., 1974). The last chapter was titled "River Basin Development Projects," the hope of the authors being that their "collective treatment of the various direct and indirect ecological consequences of river basin development will provide the planner with a framework for more adequately assessing the total costs and benefits of a project and for better anticipating the types of information and management needed to minimize adverse environmental impacts and their associated socioeconomic costs."

While a dialogue had been started between developers and conservationists which resulted in the formulation of environmental guidelines by a number of bilateral and multilateral donors (including AID and the World Bank), seldom were these taken seriously by borrower nations. Moreover, they were frequently ignored by project officers of the very development agencies that formulated them. The World Bank is a case in point. Currently the main funder of large-scale river basin development and irrigation projects throughout the tropics, the World Bank did not draw up an Operational Manual Statement on Environmental Issues until 1982. Since that date, the Bank's record in applying its own guidelines has been spotty at best, the most recent examples of inadequate planning and implementation being the Kiambere Dam and Bura Irrigation Project in Kenya's Tana River Basin.

The World Bank is singled out for comment not just because it sets the standard for other donors and is the major funding agency for river basin infrastructure, but also because its activities have caused conservationist agencies to take an increasingly critical stance toward dam construction in general. From emphasizing in the 1960s and 1970s the need to fully assess the full range of costs in benefit-cost analyses, such agencies today are more apt to take an anti-dam stance from the beginning. Influential here has been Goldsmith's and Hildyard's edited two volume work on *The Social and Environmental Effects of Large Dams* (1984 and 1986). Published by the Wadebridge Ecological Centre (which also publishes *The Ecologist* which devoted a double volume

in 1985 to a critique of the World Bank's "global financing of impoverishment and famine"), the volume's editors conclude that there is "clear evidence that building large dams is *not* an appropriate means of feeding the world's hungry, of providing energy, or of reducing flood damage" (1984: 345).

While Goldsmith's and Hildyard's views may seem extreme, they are shared by many other conservationists, including the editors of the *World Rivers Review*, a bimonthly publication initiated in 1986 as the *International Dams Newsletter*, and endorsed by a worldwide network of environmental groups -- including, for illustrative purposes, Sahabat Alam (Malaysia), Environmental Policy Institute and Cultural Survival (both U.S.A.), Environmental Liaison Center (Kenya), and The Energy and Environment Group (India) as well as the Wadebridge Ecological Centre (United Kingdom).

African projects figure prominently in Goldsmith's and Hildyard's volumes and they also receive mention in the *World Rivers Review*. In the former case, eight of 31 chapters in Volume 2 (Case Studies) deal with African projects including the Gambia and Senegal River Schemes, and Mozambique's Cabora Bassa, and Nigeria's Bakolori. While African projects figure less frequently in the *World Rivers Review*, the Senegal River Project, Volta (Akosombo), and Turkwell all receive critical mention.

In exaggerating their statements, both developers and conservationists make misrepresentations which interfere with more dispassionate efforts to assess the advantages and disadvantages of particular programs and projects (and more specifically dams) on a basin-by-basin and case-by-case basis. The Senegal Basin Project is a case in point. In trying to obtain funding, the OMVS pushed to the limit claims for developmental and environmental benefits, with special emphasis on reversing the serious desertification that is occurring throughout the lower and middle basin, and on hydropower, irrigation, and navigation benefits. While the latter combination of development benefits was partly to ensure the cooperation of the three member states

(Mali, for example, wanted navigation to reach its western border), the economics were sufficiently weak that the World Bank refused to participate in the funding of the requisite Diama and Manantali dams.

None of the OMVS member states had the capacity to bring on new pump irrigation projects at the rate claimed, while the costs of dredging and blasting a navigation channel to Kayes in Mali were high. While the hydropower no doubt would eventually find a market, the completion of Mali's Selingue Dam on a tributary of the Niger in the late 1970s has adequately served the Bamako market, while the mining of iron ore and other minerals in eastern Senegal (which would have consumed large quantities of electricity and supported barge traffic on the soon-to-be navigable river) remains a dream for the future. Nonetheless, construction funds were obtained (primarily from Arab donors) for European construction and consulting firms which brought the Diama Dam on line in 1986 while the Manantali Dam began to fill during the summer months of 1987.

Critics noted project flaws from the start. Many, including the author of this report, pointed out in the 1970s that regularization of the annual flood of the Senegal River for purposes of power generation and navigation would eliminate some 100,000 hectares of flood recession agriculture involving up to one half million people. While newly implemented pump irrigation projects were supposed to meet the future needs of flood recession cultivators, it was noted that it would take decades to bring such projects on line. Even if they proved to be economic and even if, in fact, they served the adversely affected people (and both assumptions remain questionable), what would flood recession cultivators do in the meanwhile?

Subsequent critics pointed out that such grandiose Sahelian projects rarely take "into account the interests, let alone the wishes, of the local population" (Mounier, in Goldsmith and Hildyard, 1986: 109), while the *World Rivers Review* headed its article on the OMVS projects as "Dams Threaten a Society" (1986: 1). Such statements contain

much truth, and for that reason alone they have played an important role in alerting concerned planners to the many failings of river basin development projects. On the other hand, too simplistic and too static, they are not helpful in reaching decisions about the future of African river basins. Moreover, they ignore the serious negative effects of the irregular flooding of many naturally flowing African rivers on millions of riparian residents at three to five year intervals, and they ignore the potential benefits that could accrue to such populations from controlled flooding and regularized reservoir drawdown.

River basin development is a complicated and dynamic process that is full of uncertainties and risks. In responding to lessons learned, planners in recent years are becoming more flexible -- at least in some cases. In response to early criticisms, Senegal River basin planners responded to the dilemma of flood recession cultivators by agreeing to a ten-year transition period during which an artificial flood would be released from the Manantali reservoir, the assumption being that enough irrigated perimeters (to be scattered throughout the most affected areas) could be brought on during that time to incorporate farmers formerly dependent on flood recession cultivation. More recently, as the costs for irrigated agriculture have risen to over \$10,000 per hectare, some officials in the OMVS and in the Senegal and Mauritanian governments have begun to wonder whether or not a controlled flood should become a permanent feature of the river's regime even after generators have been installed at Manantali.

In the riverine states the implementation of post dam (*après barrages*) projects is the responsibility not of the OMVS (which is taking on more of a coordinating role) but of the relevant ministries and parastatals. In Senegal, a Cellule Après-Barrages has been established for planning purposes within the Ministry of Plan and a similar cell is being organized in Mauritania (Mali's interests relate more to the Niger than the Senegal). In both cases one option being considered for the future is the intensification

of a more reliable form of flood recession agriculture through the combination of a controlled annual flood (which could greatly reduce current uncertainties associated with flood recession agriculture provided there is sufficient water) and improved agricultural practices.

While the original Aswan Dam (completed in 1902) released downriver the greater proportion of the annual Nile flood, Manantali is the first mainstream dam constructed on one of the major rivers in tropical Africa that has the potential of being operated in such a way as to enhance existing production systems, hence increasing the productivity and living standards of local populations. As with the Itzhezhi dam on the Kafue (a Zambezi tributary in Zambia), release of an controlled annual flood also has the potential for environmental enhancement, while a controlled flood from South Africa's Pongolo Dam has been released since 1982 for the benefit of both the floodplain and the local population.

A "controlled annual flood" option, of course, may well be rejected in the future, or if accepted, the volume and duration of waters released may prove inadequate, especially for habitat restoration. Be as that may, the Senegal case shows that compromises are available which have the potential of meeting multiobjective criteria for benefiting the river basin habitat, including its local population and the encompassing region, as well as the nation as a whole. Looking to the future, much more attention should be paid to the realization of that potential on a basin by basin basis as opposed to further "yes dam-no dam" debates.

D. DEFINITIONS

How SARSA defines such terms as *institutions*, *African river basins*, and *development* reflects the research team's conviction that African river basin development is justifiable only if it can lead to the integrated development of a basin's human, land, and water resources in an environmentally sustainable fashion. The

narrower focus of most studies on river basins as hydrological systems, and on river basin authorities as opposed to a wider range of institutions, has tended to bias the assessment, on the one hand, toward water resource development and, on the other hand, toward national accounting in terms of electricity generation and crop production on large-scale irrigation projects.

1. Institutions

While a wide range of institutions historically have been involved in African river basin development, most analyses deal primarily with river basin development authorities and donor agencies. Title notwithstanding, a case in point is the 1985 HYDROSULT (Montreal) report on an "Evaluation of the Multidonor/Multidisciplinary Approach in International River and Lake Basin Development in Africa." Funded by UNDP to evaluate that agency's "achievements in international river and lake basin development " (Appendix 2: 1), that report dealt mainly with recipient governments, river and lake basin institutions, and collaborating donors in the Senegal, Gambia, Niger, Lake Chad, and Kagera basins. Local organizations, private sector firms, private voluntary/nongovernmental organizations (PVOs/NGOs), research institutions, and universities were ignored -- the focus of the report being on the "concerned" river basin institution, and more specifically on the Organisation pour la mise en valeur du Fleuve Senegal (OMVS), the Organisation pour la mise en valeur du Fleuve Gambia (OMVG), the Niger Basin Authority (NBA), the Lake Chad Basin Commission (LCBC), and the Kagera Basin Organization (KBO). A similar approach was taken by the U.S. Regional Inspector General for Audit (Dakar) in their 1986 "Audit of AID Participation in Sahel River Basin Development." In that case emphasis was placed on the OMVS, the OMVG and the NBA, on the one hand, and on AID country missions, on the other hand.

The SARSA team believes that river basin development is too important and too

complex a process to leave to river basin authorities and national parastatals, and international donors, consultants and contractors alone. Riparian populations as households, communities and larger socio-political units, and as represented by local organizations, must be involved throughout. There is also an important role for private voluntary organizations in enhancing local production systems and facilitating local-level institution building. Indeed, over 30 different kinds of institutions have played an important role in the development of African river basins. SARSA has clustered these according to the task performed, on the one hand, and according to the type of organization, on the other hand. On the basis of task, five clusters are identified dealing with (1) the setting of objectives; (2) planning; (3) plan implementation; (4) management; and (5) monitoring and evaluation. On the basis of organization type, institutions are re-categorized as (1) local; (2) river basin authorities and government ministries and parastatals; (3) donors; (4) private sector organizations including international and national firms, foundations and private voluntary organizations; and (5) research institutions and universities. Boundaries between clusters are permeable and an argument could be made for further subdivision, separating, for example, bilateral and multilateral donors (see Berry and Berry, in the attached annexes, for a suggested analytical framework for the study of this complex of institutions).

Local organizations include such institutions as production and marketing organizations (water user associations, village and project associations, cooperatives, etc.) based on both indigenous and introduced organizational concepts; municipal and district councils and development teams; and social welfare and social service organizations. River basin authorities include both national and international authorities, while parastatals include such project-responsible agencies as the Office du Niger (Mali) and the various Agricultural Production Corporations dealing with such large-scale irrigation projects in the Sudan as Gezira/Managil, New Halfa and Rahad (ministries include, but are not restricted to, those dealing with planning and finance;

water resources, electric power, and public works; agriculture; and mining and natural resources).

Donors are both bilateral and multilateral, while private sector firms include local as well as multinational corporations. Foundations, like the Ford Foundation, continue to be based in donor countries (Germany, Japan, Scandinavia, and the United States, for example) with regional or local offices in recipient countries, while private voluntary organizations include both local and multinational secular and religious institutions. Research institutions and universities are increasingly national institutions within river basin countries although such regional institutions as Environnement et Développement du Tiers-Monde (ENDA) and the United Nations African Institute for Economic Development and Planning (IDEP) -- both based in Dakar, Senegal, have carried out river basin research (see for example, ENDA's recent *Après Barrages* study of the Senegal River Basin) or organized river basin conferences (such as IDEP's 1986 seminar on river and lake basin development in West Africa).

2. African River Basin Development

While this report deals primarily with tropical Africa south of the Sahara, the arbitrariness of definitions dealing with such a complex topic as river basin development is pointed up by the fact that Africa's longest river, the Nile, flows north across the Sahara and through the length of Egypt to the Mediterranean. SARSA has coped with this situation by including the entire Nile basin in its analysis, while restricting analysis of specific institutions to the middle and upper basins.

Most African river basins are potential *heartlands*, the influence of which extend well beyond their physical boundaries as drainage systems. Such an approach is more of an analytical frame of reference than a definition. It has the advantage, however, of avoiding overreliance on too simplistic an approach. Viewed as potential heartlands, river basins include the interrelationships between human resources comprising

sociocultural systems, land resources comprising biological production and earth crustal systems, and water resources comprising hydrological systems (Scope, 1972: 22).

Sociocultural systems, for example, include complex production and marketing components (with the former including not just floodwater agriculture and irrigation but also rainfed agriculture, livestock management, wage labor, commercial activities, and gathering, fishing and hunting), and their interrelationships, on the one hand, with the physical and biotic environment (land and water) and, on the other hand, with wider marketing networks and urban zones.

Whether hydrological, administrative, ethnic, or economic, the boundaries of such a system, and its component subsystems, vary according to the context, hence precluding any simplistic definition. People, for example, frequently move in and out of a basin as labor migrants and permanent migrants, while remittances flow into the basin -- coming from France and elsewhere in Francophone Africa in the case of the Senegal basin. As for hydropower, that is frequently exported to countries and urban/industrial centers lying in adjacent or more distant basins, the Volta, the Nile, and the Tana being cases in point (Volta power from the Akosombo and Kpong dams going to Benin and Togo, Nile power from Uganda's Owen Falls Dam to Kenya, and Tana power from Masinga to Nairobi in the Athi Basin).

As used in this report, the definition of development is influenced by the concept of multiobjective planning and plan implementation which requires that impacts be assessed and compared at national, regional, local, and environmental levels (Howe, 1986). The region here is defined as the river basin as a hydrological unit, while the local level refers to districts and smaller sociopolitical units down to the household level. Such an approach to development obviously influences one's definition of success. While banks may be content with favorable economic rates of return at the national level, the SARSA team rejects such an approach as too narrow.

River basin projects which transfer resources in the form of hydropower to the

national (including across national boundaries to other nations) level at the expense of regional, local, and environmental levels is not considered development, irrespective of short term national accounting as measured by economic rates of return. Stated differently, in regard to such large national projects as mainstream dams, development occurs when production, incomes, and living standards for large numbers of people increase at local, regional, and national levels in a fashion that is environmentally sustainable.

The phrase *large numbers of people* has both economic and social equity implications. Based on an increasing number of microstudies and broader reviews of tropical development (see, for example, Mellor and Lele, 1972; Johnson and Kilby, 1975; Bell, Hazell and Slade, 1980; Scudder, 1985; and Mellor, 1986), it is becoming increasingly clear that the "engine" that initially moves development forward in agrarian nations is the rising disposable income of hundreds of thousands, indeed millions, of small scale *rural* household production units. Not only does most agricultural production come from such households (as opposed to state farms, joint ventures and large and medium scale private sector agro-businesses), but their increasing consumption of local and nationally produced goods and services as they move beyond subsistence can be expected to generate significant amounts of enterprise development and farm and nonfarm employment.

The nature of the increasing demand of lower income populations around the world is remarkably similar as disposable incomes rise. In addition to food, this demand includes improved housing (hence increasing demand for bricks and other permanent building materials -- and for artisans to assemble them); clothing; household furnishings (including furniture and a wide range of appliances); production goods (improved seed, fertilizers, plows, and tractors, for example); and transport (bicycles, animal-drawn carts, two- and four-wheel tractors, and other motor driven vehicles).

The fact that development requires the involvement of large numbers of households

has obvious social equity considerations, since growth and equity become complementary rather than competitive phenomena. As for the distribution of those people, close linkages between agriculture and industry mean that it is not sufficient that beneficiaries be primarily urban since the early stages on the "road to industrialization" require agricultural development (Mellor, 1986). Furthermore, the high cost per household and per hectare that are associated with such river basin development interventions as irrigation projects and rainfed land settlement are hard to justify if increases in production and disposable income do not catalyze a process of integrated development within the river basin. In other words, in addition to national benefits accruing from power generation, river basin development must so stimulate local producers that their increased production and consumption results in major multiplier effects in terms not just of employment generation and enterprise development but also of the emergence of a hierarchy of regional marketing and transshipment centers.

Concern with regional (river basin) development requires analysis of the possible multiplier effects and environmental impacts of different development strategies. Because of aridity complemented by irregular flooding associated with a lack of water control infrastructure, and of disease, African river basins, though potential heartlands, are frequently classified as underdeveloped (even marginal) habitats. Aridity complemented by irregular flooding characterizes long reaches, for example, of the Senegal, Niger, Nile, Juba, Tana, and Zambezi rivers, while the onchocerciasis (river blindness) areas of the Sudano-Sahelian zone have impeded, until recently, the development of the upper portions of the Volta, Bandama and Senegal River basins, and the Middle Niger. Throughout tropical Africa, large portions of river basins frequently lack both primary and secondary cities as well as established communication networks. It therefore cannot be assumed that the multiplier effects of comparable capital infusions will be similar, the implication being that calculation of economic rates of return must be supplemented by social cost-benefit analysis and other techniques for ascertaining not just the multiplier effects of different development

strategies but also multiplier effects that are environmentally sustainable over the longer term.

E. RESEARCH STRATEGY

Drawing on their knowledge of specific river basins and of the literature on African river basin development, SARSA personnel presented a series of *issues papers* at the April 1985 AID Conference on River Basin Development, Irrigation and Land Tenure. Later that year research began on the present study, with comparative fieldwork subsequently carried out in the Senegal, Volta, Nile, Tana, Pangani, and Zambezi Basins. In completing these studies, researchers at Clark University and the Institute for Development Anthropology worked with a number of African and U.S. consultants including the former Chief Executive of the Volta River Authority and the former Chief Planner of the Tana and Athi River Development Authority. SARSA core personnel and consultants also drew on their experience with development in other African river basins including the Gambia, the Bandama (Ivory Coast), the Niger, and the Lake Chad basins in West Africa; the Juba (Somalia) in East Africa; and the Kagera in East Africa. Further literature searches and discussions with experts were also undertaken. In writing this comparative overview, the author of this report has drawn upon all of these materials plus over thirty years of personal experience with river basin development in Africa, Asia, and the Middle East.

F. SUMMARY

The purpose of this overview is threefold. The first purpose is to explore the record with river basin development in tropical Africa. The second purpose is to examine the role of institutions in African river basin development. The third purpose is to propose strategies for development for the rest of this century that will benefit larger numbers of people through increased production, enterprise development, and employment generation in an environmentally sound fashion.

Africa's river basins are important to the continent's future. Most countries have access to only one or two river basins which are either national heartlands or have the potential of becoming heartlands. They are also sites for large dams which tend to be the largest single project in national development plans -- with strong backing from a powerful coalition of national decision makers, donors, and international firms.

Definitions in this report of such terms as "development" and "institutions" reflects the research team's conviction that African river basin development is justifiable only if it can lead to the integrated development of a basin's land, water and human resources in an environmentally sustainable fashion. The narrower focus of most studies on river basins as hydrological systems, and on river basin authorities as opposed to a wider range of institutions, has tended to bias the assessment, on the one hand, toward water resource development and, on the other hand, toward national accounting in terms of electricity generation and crop production on large-scale irrigation projects.

As described on Chapter 2, the record with river basin development in tropical Africa has been unsatisfactory. As used in this report, the definition of development is influenced by the concept of multiobjective planning and plan implementation which requires that impacts be assessed and compared at national, regional, local, and environmental levels. In regard to such large national projects as mainstream dams, development occurs when production, incomes, and living standards for large numbers of people increase at local, regional, and national levels in a fashion that is environmentally sustainable. This characterization of development is based on the increased awareness that the "engine" that initially moves development forward in agrarian nations is not industry but rather the rising disposable income of hundreds of thousands, indeed millions, of small scale rural household production units. Not only does most agricultural production come from such households, but their increasing consumption of local and nationally produced goods and services as they move beyond

subsistence can be expected to generate significant amounts of enterprise development and farm and nonfarm employment. If major dams cannot facilitate development as so defined they should not be built.

In regard to institutional involvement, the research team believes that river basin development is too important and too complex a process to leave to river basin authorities and national parastatals, and international donors, consultants and contractors alone. Riparian populations as represented by local organizations must be involved throughout. There is also an important role for private voluntary organizations to play in enhancing local production systems and facilitating local level institution building. Indeed, over 30 different kinds of institutions have played an important role in the development of African river basins.

Because of the increasing adversary relationship between river basin "developers" and "conservationists," there is a pressing need for a more balanced assessment of achievements to date, of the potential of river basin development, and of strategies for realizing that potential in order to bridge the growing gap between pro-big dam and anti-big dam thinking. Both sides have strong but one-sided arguments to support their position. The developers emphasize that the management of Africa's water resources for urban-industrial development and for food self-sufficiency requires the construction of large-scale dams. The conservationists emphasize the very serious negative environmental and socio-economic effects that have accompanied African dam construction to date. Is there a middle position which can broaden benefits to include both rural and urban populations without environmental degradation? Believing that there may be, the SARSA team's analysis has led to a wider range of development options. It is our hope that the conclusions and recommendations will stimulate riparian states, AID and other donors to widen their perspective as it relates to African river basin development and to approach that development in a more systematic and long-term fashion.

CHAPTER 2

THE RECORD TO DATE WITH AFRICAN RIVER BASIN DEVELOPMENT

A. APPRAISAL AND EVALUATION DIFFICULTIES

1. Appraisal Techniques

The inadequacy of techniques for both the appraisal and evaluation of river basin development projects is a major problem which needs urgent attention. Three approaches are commonly used to justify specific projects, including major dams. These are least cost options for the provision of electricity; simplistic and often erroneous assumptions concerning multipliers; and benefit-cost analysis. Alone the first two are have little utility in terms of multiobjective criteria for river basin development, while benefit-cost analysis, as usually undertaken, is also deficient.

The problem with least cost solutions for electricity generation is that dams are compared with thermal stations and other power sources as if they existed in a vacuum. For example, in advocating dams on Zambia's Kafue River World Bank appraisals ignore serious costs like reduction of the biological productivity of such affected zones as the Kafue Flats -- one of the most productive wetlands in Africa. Part of the problem within the Bank, as with other multilateral donors, is that dam appraisals in Africa and elsewhere in the tropics continue to be primarily the responsibility of regional power divisions, "which seem largely insulated from any innovations that might emerge elsewhere in the Bank" (Stein and Johnson, 1979: 83). Reliance on such techniques should be restricted to such special situations as run-of-the-river installations which do not have a flood regulatory function.

Simplistic and often erroneous assumptions concerning multiplier effects that can be expected to follow the construction of major dams all too frequently are associated with the thinking and statements of heads of state, and their associates. Concerned with both political and economic development, they see large dams as serving their interests in a number of ways. Associated with an easily transferable technology, dams have value as symbols of modernization which brings benefits in the form of cheaper electricity to the urban elite. As a development tool, major dams are seen by heads of state as means for advancing urban-industrial development and food self-sufficiency without their realizing that most dams in tropical Africa have tended to constrain rather than stimulate agricultural development. Furthermore, their role as an industrializing force has been overestimated, as shown by the histories of both the Owen Falls Dam near Jinja in Uganda and the Volta Dam at Akosombo in Ghana.

A number of major problems are associated with benefit-cost analyses as currently carried out. One problem is that too much emphasis is placed on potential benefits associated with the hydropower and irrigation components (benefits which tend to be over-estimated), while too little emphasis is placed on a wide range of other benefits the returns from which are usually underestimated. Within the reservoir basin, these may include cultivation and grazing within the drawdown area, artisanal fisheries and national parks. Still more serious, however, is the tendency to underestimate a wide range of costs associated with resettlement, and elimination or radical alteration of the annual flood which nurtures riverine habitats downstream and is basic to the production systems and life styles of millions of downstream users.

Another major problem with benefit-cost analyses is that they do not deal with the very development outcomes that heads of state wish to realize -- namely multiplier effects. While this is not the place to critique benefit-cost analysis, practitioners adhere to a number of assumptions which are at best only partially applicable to most African river basins. One is the assumption that reliable markets, regional towns, and

communications are available. This is frequently not the case. Though potential heartlands, many African river basins are harsh, disease and pest-ridden habitats which are isolated and underdeveloped. As a result, major multiplier effects cannot be assumed unless the necessary marketing and rural-urban linkages are present. On the other hand, if their development is facilitated, and irregular flooding regularized rather than eliminated, multiplier effects could be significantly greater than heretofore assumed.

Because benefit-cost analyses ignore multiplier effects while heads of state emphasize them, the latter and their ministers are apt to ignore such analyses when they come up with low or negative rates of return. Examples include the Bandama, Diama and Manantali dams in the Ivory Coast, Senegal-Mauritania, and Mali, respectively. In each case, governments sought and obtained international funding for construction after World Bank appraisals came up with unsatisfactory estimated returns. Currently a similar situation involves the OMVG which is seeking funds for the Balingho and Kekreti Dams despite unfavorable studies carried out under the University of Michigan Gambia River Basin Studies program. Aside from studies currently underway in Somalia's Juba River Basin, these are the most detailed studies of river basin development options within tropical Africa.

While the goal of the OMVG is to better the lives of Gambia Basin inhabitants through the construction of up to five dams, the University of Michigan studies concluded that "the specific projects we investigated may not contribute to reaching these objectives as much as originally was envisioned" (1985: xii). The two major projects studied were Balingho and Kekreti which were subjected to benefit-cost analyses both separately and combined, while other analyses dealt with irrigation. Taken together the economic rate of return for the two dams was only 4.8 percent, the negative influence of Balingho reducing the estimated 9.2 percent rate for Kekreti alone. As for irrigation, the rate of return under a cropping intensity of 180 percent

(which is high by African standards) was only 5.9 percent, dropping to 1.1 percent with a cropping intensity of 120 percent (ibid., xxii).

As already mentioned these results have been rejected by the OMVG which is pressing ahead in its search for funds prior to carrying out additional studies recommended by the both the Michigan team and its critics. Such an approach is not in the longer term interests of the OMVG member countries. While the Michigan studies have been criticized on a number of grounds (see, for example, the National Science Foundation, 1985), they are nonetheless the most detailed, in terms of multiobjective criteria, that have been carried out within the basin. To deal with the discontinuities between assessment results and head of state expectations, two approaches are necessary. On the one hand, senior politicians need better information on what can be expected from different approaches to river basin development. In particular, they need be informed about the need for development programs to raise the disposable income of large numbers of river basin residents rather than to impoverish them by transferring basin resources elsewhere. On the other hand, benefit-cost analyses must either address a wider range of benefits (e.g., multiplier effects) and costs associated with those benefits or be complemented by studies which can assess those broader benefits and costs.

2. Evaluation Techniques

To date there have been no macro-economic, let alone broader socio-economic and environmental, assessments of implemented river basin development programs in tropical Africa. For that matter, there have not even been any detailed evaluations of the impacts of specific dam projects as opposed, for example, to such irrigation schemes as Gezira, Mwea-Tebere and Office du Niger. Even the World Bank -- the major donor financing dam construction in Africa -- has yet to fund through its Operations Evaluation Department any Impact Evaluation Reports as opposed to more

limited Project Performance Audit Reports. As their title implies, Impact Evaluation Reports are more comprehensive and deal with development impacts several years after the completion of disbursements; nonetheless both types of reports are project specific rather than dealing with the broader impacts of a project on river basin development. In the case of Bank-financed projects in Africa, they are almost entirely limited to an assessment of the hydroelectric component.

Given the importance of river basin development and the sums of money involved, the lack of evaluations is so surprising as to require some analysis in its own right. A number of factors appear to be involved. The most speculative, one may be a lack of interest in accountability on the part of riverine countries and donors because of the political motivation and mixed agendas behind so many projects. Another factor concerns head of state preferences and the nature of the institutions and the training of senior staff responsible for river basin development, the planning, financing and implementing institutions being primarily interested in big dams for power generation and major irrigation projects. A third factor, though influenced by the second, is more related to the nature of the project cycle as it relates to the construction of physical infrastructure, on the one hand, and rural development, on the other hand. As Guinard sees the situation, "it takes 5 years to build a dam, 25 years to have a real impact on traditional production systems. It is not too difficult to get a five-year project financed. No financial institution would commit itself for 20 to 25 years. . . . Slicing a 25-year operation in 5 pieces based on the standard project procedure is artificial and not satisfactory" (1988 written communication).

Howe believes a fourth factor is "shortness of institutional memory" with donors and planners becoming so wrapped up in the details of particular projects that "the longer term development effort gets lost in changing personnel, changing priorities and the short time horizons of all donor personnel" (1988 written communication). Yet another factor includes a range of methodological problems as to how to analyze what

data are available. As already noted, river basin development is a very complex and dynamic process. On the environmental side, once dams are completed it takes decades for the new reservoir to stabilize itself and generations for scouring of river beds and encroachment of sea water into delta areas (both in response to reduced sediment loads) to occur. Socio-economic and political effects, including the impacts of such scouring and encroachment, work themselves out during equally long time periods and are even more difficult to assess.

At least some economists, engineers, and hydrologists believe that techniques exist to analyze the positive and negative impacts of river basin development, although there are differences of opinion as to what those techniques are. Some would use a systems analysis approach, their analytical tools including interactive modeling (involving computer graphics and display), game theory, and a range of other approaches to decision making and conflict resolution. Howe, on the other hand, would "emphasize the availability of time series analysis, econometric models, ecosystems modeling, hydrologic and water quality models" which are more applicable to riverine habitats and populations. Morel-Seytoux emphasizes a rather similar approach for planning purposes in the Senegal river basin. This he labels "hydro-anthropological" modeling which would, include, on the one hand, stream (riverine)-aquifer models for interpreting ground water data and, on the other hand, anthropological approaches (including decision making models) to the analysis of local production systems (1988 oral communication).

While these various methodologies may be up to the task, the fact remains that no comprehensive analyses of river basin development in Africa have yet been completed. This is a serious deficiency which should be corrected at the earliest possible time through the application of existing methodologies, and the development of new tools, to the analysis of a specific river basin. Granted the stakes involved such a research project justifies strong riparian state and donor support.

Ex post evaluations by recipient nations and donors are primarily concerned with economic rates of return from financial investment in a specific dam or irrigation project. Indirect benefits and costs, including longer term environmental impacts, are ignored as is the distribution of costs and benefits between national, regional, local and environmental accounts. Research efforts deal with restricted topics such as SCOPE's *Manmade Lakes as Modified Ecosystems* (1972), the University of Michigan/ASRT studies of the environmental impacts of the Aswan High Dam (Mancy and Latif, 1983), Waterbury's *Hydropolitics of the Nile* (1979), various studies of legal procedures and arrangements for developing international river basins (Godana, 1985, Okidi, 1986 and 1987a and b, Utton, 1985 and Waterbury, 1987), health impacts of river basin development (Stanley and Alpers, 1975 and PEEM, 1985), comparative analyses of resettlement (Scudder, 1973, and Scudder and Colson, 1982), and studies of underestimated project costs (Goldsmith and Hildyard, 1984 and 1986).

More ambitious attempts to model river basins before and after dam construction usually end up dealing primarily with the physical and biotic environment due to the difficulty of incorporating human activities into mathematical models. This, for example, was the situation with a 1985 proposal for research to be carried out under the auspices of the International Institute for Applied Systems Analysis in Vienna. While those proposing the research noted the increasing international concern over environmental, socioeconomic and political impacts, their proposal still dealt primarily with the physical and biotic environment (IIASA, 1985).

Granted the absence of broader, more quantitative assessments and their rather limited capacity, such qualitative assessments of the record as White (forthcoming) has recently completed for the High Dam at Aswan are especially useful for pointing up the type of issues that need more thorough assessment in relationship to future planning. Such an assessment follows.

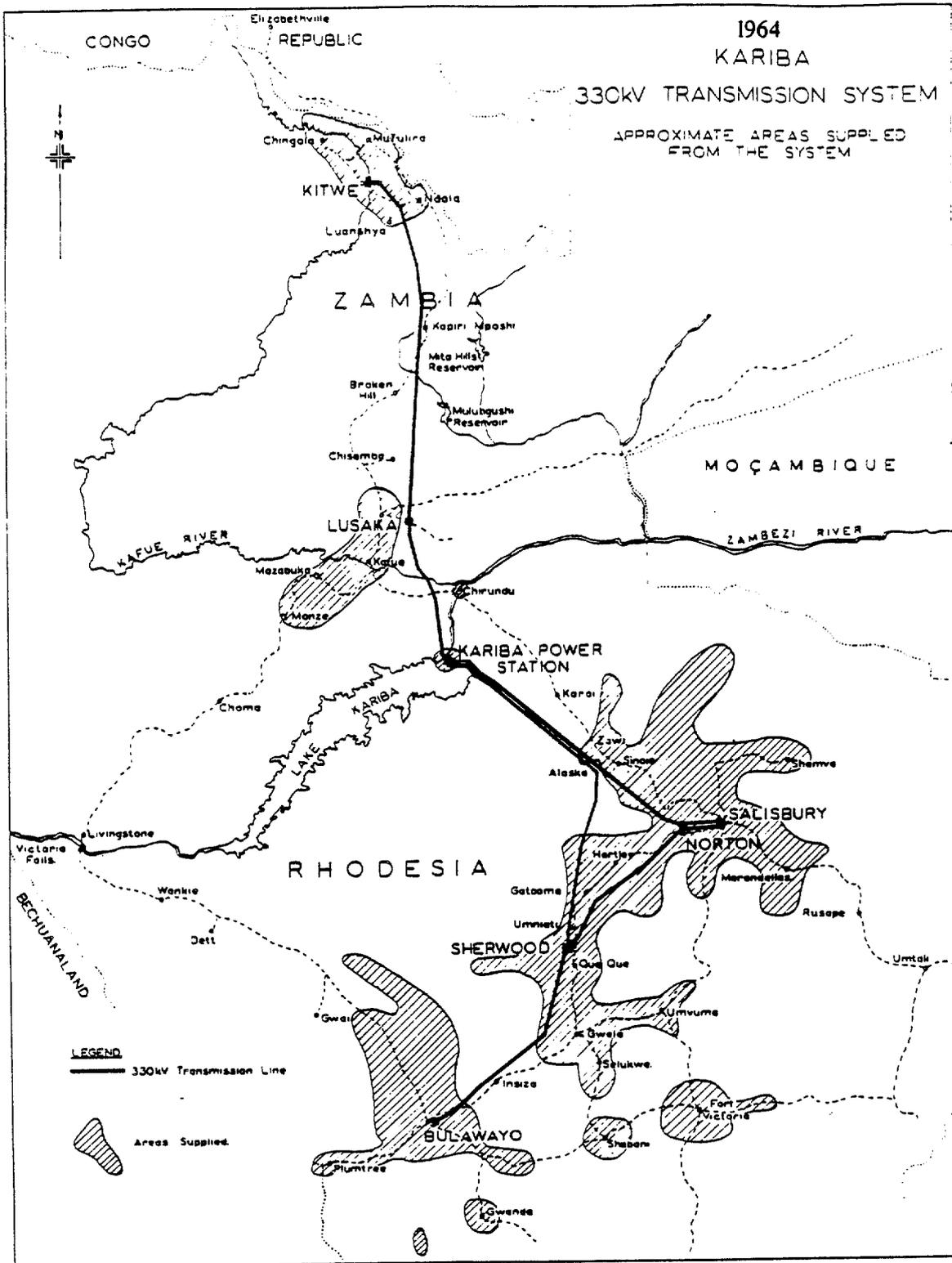
B. THE RECORD TO DATE

Because of relatively limited data the record to date will be dealt with under three general headings: electricity generation and transmission, irrigation, and other effects including impacts on local production systems. In spite of an increasing emphasis on irrigation over the years, the primary effect to date of river basin development in tropical Africa has been to transfer the resources of rural riverine habitats to the urban residential, commercial, and industrial sectors, both within and without the river basin. Though urban areas have benefited, generally speaking their industrial development has been slower than anticipated while their overall development has been at the expense of the rural sector which contains the majority (and in most cases a large majority) of each nation's citizens. In the 1950s Kariba established this pattern which has continued down to the present.

Kariba was planned and implemented by the Federal Power Board of the Central African Federation to generate electricity for the processing of electrolytic copper on the Northern Rhodesian Copperbelt and for electrifying the urban and industrial centers of Southern Rhodesia. Though a brief study by Sir Alexander Gibb and Partners indicated that a medium-scale irrigation project in the Mpendele-Mutulanganga area below the dam was technically feasible, irrigation projects were ignored by Federal planners as well as by donors including the World Bank which partially financed Kariba through the largest loan that the Bank had given up until that time.

Figure 1 shows the transmission lines and areas supplied during the year following the complete filling of the reservoir (1963). Aside from electrification of the townships of Kariba and Siavonga on either side of the dam, and the border post of Chirundu, no electricity was supplied to the Kariba Lake basin and the downstream areas, even for purposes of irrigation. Figure 2 shows the situation in 1981 after completion of the Kariba North Hydroelectric Project added another 600 MW. As before the urban

FIGURE 1



Source: Annual Report and Accounts of the Central African Power Corporation for the year ended 30 June 1964.

industrial sector was the only beneficiary, including the new Zambian township of Maamba serving the adjacent post-independence colliery near the upper end of Lake Kariba. Only thereafter did some Kariba electricity benefits come to the rural sector because of sidelines reaching out from Chirundu and Maamba. In the former case electrification came to the densely populated Lusitu and to the Zambezi Training Farm at the Zambezi-Kafue confluence for small scale irrigation and government facilities. In the latter case it provided electricity for a medium scale irrigation joint venture of 2500 hectares, government services and small businesses.

Throughout this 25-year time period few Kariba benefits, aside from fisheries development and resettlement-related control of tsetse flies, came to riverine inhabitants. Indeed, local resources both above and below the dam deteriorated because resettlement had caused carrying capacities to be exceeded under existing systems of production. As for the fisheries, that was a major resource until productivity dropped off in the mid-1960s. Thereafter the artisanal fishery stagnated while the *Limnothrissa* fishery that started in Rhodesia in the 1970s and in Zambia in the 1980s continued the transfer of resources from the Middle Zambezi to the urban areas since the owners of the costly commercial rigs were primarily outsiders. By 1987, for example, not one rig was owned by local villagers, local elite or by the Gwembe Tonga Rural Council. While villagers benefited from employment on the fishing rigs and in the fish camps, salaries were sufficiently low that few were able to use them for other than subsistence purposes -- contrary to the situation with the artisanal fishery in the 1960s when fishermen invested their profits in marriages, education of children, cattle, plows and small businesses.

The Kariba situation was subsequently repeated at Volta, Kainji and Kossou in the 1960s, and at Selingue in the 1970s. It was also been repeated elsewhere except for increased attention being paid to irrigation. While irrigation was technically feasible in the Kariba, Volta, Kainji and Selingue cases, its potential was de-emphasized. The

same was true in connection with Zambia's Kafue Gorge and Itezihitezhi Dams, since the Zambia Electricity Corporation (ZESCO) resisted requests from the predam Nkambala Sugar Estates (and the more recent Commonwealth Development Corporation funded and managed outgrowers' scheme) for additional irrigation water.

In Ghana, the Volta River Authority (VRA) increasingly is restricting its activities to the generation of electricity for the foreign-owned (VALCO) aluminum smelter at Tema, for Accra and other urban centers in Ghana and for export to neighboring Benin and Togo. Though initially conceived as a multipurpose project, Nigeria's Kainji has had more negative impacts on riverine production systems than any other large-scale dam in tropical Africa, the primary purpose of the dam being to feed electricity into the regional grid for urban industrial development within Nigeria and for export to Niger. This emphasis is symbolized by the 1972 merger of the Niger Dams Authority and the Electricity Corporation of Nigeria into a National Electrical Power Authority. Further upriver in Mali the justification for the Selingue Dam was to provide electricity to Bamako.

The trend toward combining power generation with medium to large scale irrigation projects began in the 1970s and is illustrated by the five dams built on Kenya's Tana River since the 1960s. The first three and the fifth were exclusively for "run of the river" power generation. The fourth, Masinga, provided sufficient storage for irrigating 40,000 hectares, primarily in the Bura Project and the proposed Tana Delta Project. Irrigation is receiving even more emphasis in development plans for the Senegal, Juba and Gambia river basins. In middle and lower portions of the Senegal Basin the plan of the Senegalese and Mauritanian governments is to replace flood recession agriculture gradually with small scale and medium scale irrigation. In Somalia, current plans are to send 70 percent of the capacity of the Baardheere Dam to Mogadishu with the remainder for electrifying the Valley and especially several medium scale irrigation projects. As for the Gambia River Basin, the OMVG

continues to seek funding for Balingho and Kekreti for similar purposes (including irrigation).

1. Electricity Generation and Transmission

Unquestionably dams in Tropical Africa have been a successful means for meeting the increasing demand of African cities and industrial areas for energy, although not necessarily at the most economical cost. In terms of the institutions which planned, implemented and managed hydroprojects and in terms of the urban and industrial development that followed this is a major achievement. On the other hand, using the examples of the dams at Owen Falls and Akosombo, Adams points out that the expected "blossoming" of local industry has tended to not follow the provision of hydroelectric power, while generally speaking demand for power since the mid-1970s has been significantly lower than estimated. Moreover, West Africa's relatively dense rural population "cannot easily be served by grid electricity: it is estimated for example, that no more than 60 percent of Nigeria will be electrified by grid by the year 2000 despite massive investment in generating installations and power lines" (Adams 1985a: 186). Since use of hydroelectric power for rural electrification will be even more difficult and costly in less densely populated areas throughout rural Africa, the supposed advantages of hydroelectric power over other power sources need be continually reassessed, especially if more cost effective new micro-technologies become available.

With the major exception of the Sudan, hydropower generation has been the major function of African dams. It has also been the most successful outcome of dam construction in technical and financial terms. From an engineering point of view, the most carefully appraised projects are those funded by the World Bank. Though further analysis is needed, I assume that the weaknesses of Bank-funded projects are also characteristic of projects, like the Ivory Coast's Kossou, Zambia's Kafue Gorge,

Kenya's Masinga and Mali's Selingue and Manantali, which were funded by other donors. While I have visited those projects, I have not had the opportunity to study their appraisals and evaluations which is another reason for concentrating on Bank-financed projects in this report, and specifically on Kariba North Bank and ItzHITEZHI in Zambia, Kamburu, Gitaru and Kiambere in Kenya, and Second VRA Power and Kpong/Third Power in Ghana.

Without exception all seven projects were appraised, financed, supervised and evaluated strictly as power projects. In each case they were seen as "least cost power expansion programs", although in Zambia and Zimbabwe political considerations led to a different sequencing of projects. River systems were not viewed as potential national or regional heartlands but, like coal, natural gas and geothermal reserves, as a resource for generating power. Indeed, in the Gitaru case, the Bank attempted to ensure through covenants that generating potential would not be jeopardized by using water for irrigation in the Upper Tana Basin until after Masinga was constructed, while in the Volta case the Bank attempted to discourage the VRA's aspirations to be a regional development agency as opposed to an electricity supplier and even pushed, for a number of years, for its merger with the weak Electricity Corporation of Ghana -- an option which could have proved institutionally disastrous for the VRA. Environmental issues were only mentioned in two cases, and in one of those (Gitaru) only to note in passing that another donor had agreed to include Gitaru in its assessment of the ecological effects of Kamburu -- a survey that was completed after Kamburu was built and the Bank's favorable appraisal of Gitaru completed. Resettlement was only mentioned in one case (Kpong), while local production systems and their possible enhancement were ignored throughout.

The titles of the various projects emphasize their hydro-power focus (Table 1). Though power generation was believed to be the only way to repay the costs of dam construction, project outcomes were mixed. While all were seen as least cost options,

348

TABLE 1

Project Name	Date Approved	Loan Closing	Cost (\$millions)	Ex post ERR
ZAMBIA				
Kariba North Bank Hydroelectric Project	1974	1980	130.3	8.9%
Kafue Hydroelectric Project Stage II	1973	1982	148.5	6.6%
KENYA				
Kamburu Hydroelectric Power Project	1971	1976	40.8	21.0%
Gitaru Hydroelectric Project	1975	1980	136.0	12.0%
Kiambere Hydroelectric Project	1984	1988	312.0 est.	
GHANA				
Second VRA Power Project	1969	1973	21.0	20.0%
Kpong Hydroelectric Project	1977	1982	250.6	7.5%

economic rates of return ranged between unsatisfactory and satisfactory. Granted the limited benefits to the rural economy in terms of environmental enhancement, increased production, employment generation and higher living standards, and the high costs and debt repayment responsibilities for some of the poorest countries in the world, one cannot help but question the extent to which they are justified as designed and implemented. Even without attempting to assess opportunity costs and negative impacts, a major conclusion of the World Bank evaluations is that construction of the two most expensive of the six completed projects -- Kafue Stage II and Kpong -- was premature.

Political considerations have played a major role in the sequencing and timing of hydropower projects in Zambia and Zimbabwe ever since the mid-1950s decision of the Central African Federation to build Kariba. At that time Kafue Gorge was the least cost solution; however, the political leadership chose Kariba in order to retain the generating installations within Southern Rhodesia. Sequencing and timing continued thereafter to be influenced by political priorities; first in Zambia and then in Zimbabwe. For example, contrary to World Bank advice in the late 1960s Zambia opted to go ahead with the Kafue Gorge Dam before Kariba North Bank in order to achieve self-sufficiency in case Rhodesia interfered with Zambia's 50% claim on Kariba South Bank power.

In spite of the cheaper cost of Zambian imports, in the 1980s Zimbabwe opted for the same goal of self-sufficiency by initiating the construction of a large coal fired thermal complex at Hwange. As a result once Hwange Stages I and II come on line, imports from Zambia can be expected to decline. Such a decline in exports was not anticipated by the Bank during appraisal. Nor was the commencement of a continuing depression in the mid-1970s which reduced domestic demand. Since this demand can be met by existing production, Kafue Stage II was premature by at least a decade since Zambia was able to meet domestic demand with existing production. Granted the

country's state of near bankruptcy, the opportunity costs for the nearly \$150 million involved are high. Furthermore the Bank's emphasis, as a feasibility justification, on exports of electricity within an interconnected system at the expense of the multipurpose development of the Zambian heartland for both agriculture and industry is questionable on both economic and environmental grounds.

While Kafue Stage II's Financial Performance is labeled "unsatisfactory" by the World Bank, Kpong's is rated "not good." In addition to purchases by VALCO, there too feasibility was justified on the basis of exports and on too high projections of increases in domestic demand. As things transpired domestic demand did not justify Kpong, while supply to VALCO and export to Benin and Togo at existing rates did not warrant construction.

The Second VRA power project and the Kenyan dams, on the other hand, had impressive to satisfactory rates of return. While the Ghanaian project did not involve dam construction (but rather the addition of two more generators to the Akosombo complex), the Kenyan ones did. Not only did they have good economic rates of return but they played a major role in the mid-1980s in avoiding the type of drought-induced power shortages that had adversely affected the Kenyan economy in 1980.

Bank evaluations emphasize certain lessons learned, especially in connection with the Kafue and Kpong cases. Granted the abnormally low reservoir levels behind both Kariba and Volta in the 1980s, hydrological design and operations issues need pay more attention to the great variability in African river regimes, especially in regard to the drought cycle in the arid and semi-arid areas of Africa. Furthermore, as suggested by Canadian commentary on the Kpong report, there is a major need for a standard "Code of Practice" for evaluating hydrological data since all too often consultants and other experts are insufficiently aware of "the very sensitive nature of Africa's hydraulic regimes."

Another lesson warns against overly optimistic appraisals of development benefits,

stressing the need for more reliable forecasting and analysis of demand in the uncertain economies of tropical Africa. As a corrective, more attention should be paid to rehabilitation and better use of existing electricity generation and transmission, and irrigation, facilities including, of course, development of the management capabilities of the institutions responsible for those facilities.

None of the evaluations question, however, the ultimate justifications for the projects involved. Yet if one adds other project costs, the unipurpose focus on electricity generation is not easily justified, especially if one bears in mind such longer term costs as the adverse effects of Kafue Stage I and II on the biological productivity of the Kafue Flats and the foregone opportunities on the Tana and the Volta. There are, moreover, still other less tangible costs. Though some nations under international prodding are trying to correct policies inherited from colonial regimes, throughout tropical Africa rural-urban terms of trade continue to be unfavorable for the village sector. Because it favors the urban residential, commercial and industrial sectors at the expense of the rural sector, river basin development has exacerbated the problem. With a disincentive to produce, rural people figuratively and literally follow the transmission lines to the already overcrowded cities. At least in the Zambian case the Bank's evaluators seem totally unaware of such effects. Hence at the time that a team from the International Labour Organization was documenting a continued decline in rural-urban terms of trade and in living standards in Zambia's rural areas (1981), the 1985 Project Completion Report for Kafue Stage II was referring to the high priority that the Government of Zambia placed on rural development.

2. Irrigation

a. Introduction

As assessed in this report, flood water cultivation and other forms of irrigation have been rather arbitrarily separated. At this point, emphasis is on large, medium and

small government-sponsored irrigation schemes. Flood water cultivation within the context of local production systems is considered in Chapter 3.

Government-sponsored irrigation schemes have been the second major justification for African river basin development, with the emphasis being primarily on medium and large scale projects. In comparison with private sector commercial irrigation (which has had a more successful record to date) or joint ventures (which are comparatively rare), such projects dominate irrigation in tropical Africa in terms of hectares cultivated except in a few countries such as Zimbabwe and Kenya. Aside from government-run sugar estates, these schemes are also largely land settlement projects involving tenant farmers on government-owned holdings ranging in size from approximately 20 hectares to less than one hectare.

Contrary to the scarcity of evaluations dealing with river basin development, and more specifically with hydropower generation, there have been many assessments and evaluations dealing with African irrigation and with specific irrigation projects. Many of these deal with the Sudano-Sahelian zone, irrigation being seen in the 1970s as a solution to the drought problem in the arid and semi-arid lands of Africa. More recent assessments deal with tropical Africa as a whole, two examples being the AID-financed multivolume *African Irrigation Overview* (1987) undertaken by a consortium of U.S. universities through the Water Management Synthesis II (WMSII) Cooperative Agreement, and FAO's *Irrigation in Africa South of the Sahara* (1986).

This analysis draws heavily on the WMSII Overview and especially on Moris' 1987 "Irrigation as a Privileged Solution in African Development". It also draws on African irrigation projects included in the Institute for Development Anthropology's AID-funded global assessment of land settlements in the tropics and subtropics (Scudder, 1981 and 1984), on the World Bank's *The Experience of the World Bank with Government-Sponsored Land Settlement* (1985), on SARSA field studies and reports in connection with this study, and on my own prior experience.

b. The Extent of Irrigation

Though Moris cites the World Resources Institute as depicting Africa as the driest continent, it also has the least amount of irrigation. As shown by Table 2 only four countries in tropical Africa have over 100,000 hectares of irrigation with the Sudan having more than the other countries combined.

Table 2 along with Chapter 3 points up the seldom emphasized fact that use of surface flow water for farming is a common characteristic of indigenous African agriculture. Aside from the Sudan, Madagascar and Zimbabwe, emphasis is on use of flood waters rather than gravity flow and pump irrigation. Though some furrow irrigation has been practiced for centuries in mountain areas, it is uncommon. Individually owned tube wells are also rare, the African equivalent being the use of shadoof and small pumps for lifting water from open wells.

A major reason for this characterization is Africa's relatively low population density on soils with the highest potential for irrigation. Throughout most of Africa the large majority of farmers still practice extensive rain-fed agriculture which provides higher yields per unit of labor as opposed to unit of land than does intensive cultivation, including irrigation. Since labor rather than land is the critical constraint, with weeding being the major bottleneck, the African bias toward extensive cultivation makes sense.

The situation, however, is changing rather rapidly in many river basins due to the combined influence of population increase, rising expectations and environmental degradation. Although the need to develop the potential of indigenous production systems, and especially of flood water cultivation, is stressed throughout this report, this is not because irrigation is unimportant but because flood water cultivation has consistently been neglected by planners. The relationship between the two forms of agriculture, including the need for more irrigation, is well stated by Guinard in the

TABLE 2
EXTENT OF IRRIGATION AND FLOOD WATER CULTIVATION
IN SELECT AFRICAN COUNTRIES

COUNTRY	HECTARAGE ¹	
	Irrigation	Flood Water Cultivation
Sudan	1,700,000..	no data but important
Madagascar	900,000 ²	no data
Zimbabwe	155,000..	no data
Somalia		120,000 ³
Mali	90,000..	110,000+
Nigeria	30,000 ⁴	800,000..
Senegal	50,000..	200,000+
Kenya	33,000..	no data
Zambia	15,000+	no data but important
Sierra Leone	5,000-	..80,000 ⁵
Gambia	2,000..	..33,000 ⁶

1. Figures largely taken from Stern, 1984.
2. Including 750,000 hectares of small holder rice production.
3. Includes both irrigation and flood water cultivation, the latter being most important in regard to area cultivated.
4. Adams in Grove, 1985a: 195.
5. Adams and Carter, 1986.
6. University of Michigan 1985 estimate.

paragraph that follows:

Flood recession agriculture, even-state-of-the art, has a lower potential than irrigated agriculture, at least in the present state of knowledge. Experimental results show that unit yields from recession agriculture can be multiplied by a factor of 2 or 3, i.e. from the present average of 400 to 600 kg per hectare to 1,200 to 1,500 kg of grain per hectare. Irrigation can yield 3,000 to 3,000 kg of grain per hectare and per crop; assuming a cropping intensity of 150%. . . one hectare irrigated would produce 5,000 to 6,000 kg. . . . I am not advocating irrigation as a first phase substitute for the improvement of traditional recession cropping, but as a more or less long term goal where population density, [and] social and economic conditions justify it (1988 written communication).

c. Constraints and Difficulties Facing African Irrigation

To date low population densities and labor constraints have resulted in most government-sponsored irrigation projects in Africa also being land settlement projects, hence compounding planning and implementation difficulties. Unlike the situation in much of Asia where government-sponsored irrigation is a means for intensifying land use in old lands by bringing more reliable water supplies to farmers already practicing irrigation, land settlement requires creating almost from scratch economically and socially viable production systems and communities in problem-prone new lands settled by farmers without irrigation skills and required to live in areas without sufficient communications and rural-urban linkages. To the very real complexity of irrigation is added the complexity of settlement. Difficulties are compounded by variability of soils and adverse rural-urban terms of trade and pricing policies.

A global failing of both rainfed and irrigated land settlement projects is inadequate soil surveys (World Bank, 1985: 36). This problem is compounded in Africa owing to

the distribution of irrigable soils and the variability of what appear to be at first sight relatively homogeneous soils. Accordingly to Rangely, aside from the valley of the Nile in the Sudan and the inland delta of the Niger, "there are no large entities of irrigable land that can be irrigated by gravity flow" (1983: 8). As for soils that appear to have potential, all too frequently more detailed soil surveys (or resulting yields if such surveys are not completed) show that potential to have been overestimated as with Kenya's Bura Irrigated Settlement Project. Though other factors are involved, poor or problem-prone soils are a major reason why land brought into irrigation subsequently goes out of production.

Another problem area concerns land tenure at both the national and the local levels, with AID funding through the University of Wisconsin's Land Tenure Center a major study of the role of land tenure in river basin development. As Bloch has pointed out in the summary volume of that study, "Designers of irrigation projects have been misled by two propositions, which although they are generally valid, are insufficient: first, that in most countries the state is the sole legal owner of land; and second, that in traditional African communal land tenure systems, durable private rights do not exist" (1986: 2). Not only do customary ownership rights pertain to most resources, but they pertain particularly to riverine habitats because of their high value not just to farmers but also to herders, fisherfolk, gatherers, and hunters. Well documented for northern Nigeria (Adams and Grove, 1984), conflicts are inevitable where national agencies ignore these rights, especially in cases where they hand over the land in question to outside interests. Conflicts can also be anticipated where efforts are made to redistribute the land in question among local users without the involvement of those involved. Whether societies are egalitarian or highly stratified, users differ in their access to land resources, some controlling sizeable holdings while others have none. If development agencies wish to ensure local cooperation in the planning and implementation of irrigation projects, they must be especially sensitive to both rights of

tenure and rights of usage.

In good part because of poor government policies and rapid increase in population, production per capita has been declining in Africa. While Lipton (1977) systematically explored the urban bias of development policies throughout the tropics and subtropics, unfavorable agricultural policies and adverse rural-urban terms of trade have been especially characteristic of Africa. Financial resources budgeted for the agricultural sector have been completely inadequate. In their Compact for African Development, the Committee on African Development Strategies noted "African states spend an average of only 5 per cent of their budgets on agriculture, whereas in Southeast Asia, the nations that lead in agriculture spend two to three times as much" (1985: 9). Adverse rural-urban terms of trade have increased the cost of inputs and goods and services commonly consumed by farmers more rapidly than prices for produce, while state control of land and of production and marketing systems have adversely affected farmer initiative. According to the World Bank, "poor agricultural performance has resulted from the combined impact of inadequate incentives -- output prices, input costs and the supply of incentive goods and services (including education and health services) -- and inefficient systems of marketing, transport, extension, and other support services" (1984: 4-5). What is needed as a corrective are "budgetary and pricing policies (including correction for the overvaluation of exchange rates) that will switch the internal terms of trade in Africa toward agriculture" (*ibid.*, 2).

Zambia illustrates what is wrong with rural-urban terms of trade in many African countries. Notwithstanding policy statements to the contrary, since Independence in 1964 "more than 80 percent of productive capital went to the Copperbelt and towns along the railway line" (Simon, 1979: 14). Rural-urban terms of trade have also been deteriorating since Independence (ILO, 1981). Rather than attempting to develop agriculture and industry in tandem, African nations have squeezed agriculture to subsidize the development of urban centers and industry. This is done through

negative pricing policies which are applied to both locally consumed food crops and export crops. Citing a World Bank study of agricultural policies in 13 African countries during 1979-80, Eicher noted that "taking the net tax burden and the effect of overvalued currency into account, producers received less than half of the real value of their export crops" (1982: 160).

Adverse rural-urban terms of trade and agricultural policies hit especially hard at irrigated settlement schemes. While village farmers can use minimal inputs, grow what they want and sell more easily on the open and black markets, government-sponsored settlers are expected to produce government recommended crops and sell through government marketing channels. According to Eicher, "in Mali, the government pricing policy for farmers in a large irrigated production scheme can be labeled as 'extortion.' A meticulous two-year study in 1980-81 has shown that it cost farmers 83 Malian francs to produce a kilo of rice but that the government paid farmers only 60 Malian francs per kilo" (ibid.). Though that may be an extreme case, low producer prices in government-sponsored irrigation projects throughout Africa frequently have been used to subsidize other sectors and/or other irrigation projects. Cotton cultivation in the Sudan is an example where export revenues from the most important source of foreign exchange is used for both purposes, while Kenya's Mwea-Tebere illustrates use of government revenue from rice sales to finance other less profitable irrigation projects.

d. The Record to Date

The combined result of such factors make state-controlled irrigation a relatively unattractive option for African farmers. Hence it should not come as a surprise that the record with such irrigation in Africa is poor. Not only do returns not pay off capital development costs, but frequently they do not even cover recurrent costs. In the four largest projects (Gezira, New Halfa and Rahad in the Sudan and Office du

Niger in Mali) yields are low. For Office du Niger Moris cites Fresson et al. (1985: 204) when he writes that "today 31% of the area developed has been abandoned; many tenants are deeply indebted; and over one-third (36%) were due in 1983 to receive nothing for their season's work after deductions for the Office's services)." For New Halfa he quotes Sørbo (1985: 40) as noting that "production was low; absenteeism was high; there were repeated shortages of water, vehicles and fuel; pests and weed invaded the fields . . . required inputs of seed, fertilizers and pesticides rarely arrived on time; poor storage facilities caused deterioration and losses; and tenant incomes were low and extremely irregular. . . . As in the Gezira Scheme . . . a sense of helplessness pervaded the Scheme and the loss of morale and deteriorating operating conditions were mutually reinforcing."

In seven Sahelian countries which were surveyed under Club du Sahel/CILSS auspices in the late 1970s, "the principal and disturbing discovery was that, between 1975 and 1979, the development of new acreage had barely surpassed the surface area of older projects which had to be abandoned for lack of maintenance or other problems" (de Lattre and Fell, 1984: 59). In a 1981 analysis of ex-post cost-benefit studies of Sahelian irrigation projects, Sparling concluded that the "overall record of irrigation projects in Sahelian West Africa shows a pattern of unprofitability."

Moris explains this unsatisfactory record as being due to policy-makers seeing irrigation as a "privileged solution in African development." The term "privileged solution" he adapts from Hirschmann (1983): "a privileged solution is not thought to require testing and modification. The answer will seem to lie at hand, and what matters is simply to find the resources and will to act. In Africa, irrigation projects . . . seem the obvious solution for modernizing production, minimizing food imports, removing food deficits, and ameliorating the impact of drought" (1987: 99).

With such unsatisfactory rates of return, can anything good be said about government-sponsored irrigated settlement projects and irrigation in general in tropical

Africa and about future prospects? As with river basin development, the answer would appear to be not until major policy changes have been made at the national level and until a wide range of planning and implementation issues (relating, for example, to soil surveys, land tenure, greater diversification of production and integration of livestock, local participation in planning, implementation and management, family income and living standards, a wide range of marketing issues, and management) are more effectively addressed. While success even then may be hard to come by, irrigation in Africa -- like river basin development -- appears to have polarized supporters and critics alike, with the former underestimating problems and the latter underestimating potential. Based on a number of case studies, potential relates to three factors, the first two of which tend to be underestimated. These are irrigation impacts on farm family households; multiplier effects; and an increasing emphasis on local participation and small-scale irrigation.

(1) Irrigation Impacts on Settler Households

Notwithstanding critiques like Barnett's of the Gezira Scheme (1977), there is widespread evidence that the majority of farm families on government-sponsored irrigation schemes are better off than they would have been without the scheme. Carney makes this point for the Gambia's most important irrigation project when she writes, "From the cultivators point of view, the Jahaly Pacharr project is generally considered a success" (forthcoming, 61). Success in this case means only that the scheme provides a more reliable source of food for domestic consumption as well as some cash income; it has nothing to do with success from the donor or Gambian government point of view.

While success from the point of view of the farm family does not mean that all settlers are getting rich or even that they moving beyond subsistence, scheme income has enabled farmers on some irrigation schemes to invest in more lucrative off-farm

enterprises. In stressing the greater profitability of such off-farm enterprises, critics seldom deal with the role of the scheme in providing investment income or other resources (water and feed in the case of livestock, for example). The Gezira scheme is a case in point. Though rightly criticized for exploiting farmers, nonetheless a significant proportion of those farmers have used Gezira income to invest in the education of children, in cattle and other stock, in transport (including trucks moving back and forth between the northern and southern Sudan) and in businesses (including vegetable stalls and other commercial enterprises in Khartoum South and Wad Medani). The same is true of farmers on the New Halfa scheme, and on Kenya's Mwea-Tebere scheme where savings have also been used to purchase land either individually or through land development companies. A word of caution, however, is necessary here. No detailed studies have been undertaken that show the proportion of settler households investing in such off-scheme interests, or that analyze the sources of savings. In some cases it may well be that only a small minority of households are involved and such cases farmers are apt to be elite who received more than one holding or who had access to other sources of capital.

(2) Multiplier Effects

Provided a wide range of issues are properly addressed, there is considerable evidence that settlement projects, and especially irrigated settlement projects, have the potential to catalyze a process of integrated area development (Scudder, 1981 and World Bank, 1985: 17-29). This statement is based on the analysis of a number of older settlement projects, the majority of which are irrigation projects. All tended to share a number of distinctive features relating to favorable (or at least neutral) national development policies; scale (farm families numbering in the thousands rather than the hundreds); and incorporation of a hierarchy of service centers including regional towns. In each case the engine which drove development was the increased consumption by

thousands of settler families of locally produced goods and services as disposable income went up. Demand stimulated enterprise development and both farm and nonfarm employment generation, and regional development followed.

The best examples of irrigation projects catalyzing a process of integrated area development are San Lorenzo (Peru); Minneriya (Sri Lanka); and Metro (Indonesia). Although the best African examples are flawed, nonetheless Abis (Egypt), Gezira, New Halfa and Rahad (Sudan) and Mwea-Tebere (Kenya) have had multiplier effects. A case in point is New Halfa (Salem-Murdock, 1984; Sørbo, 1985). Approximately 100 kilometers long by 30 to 35 kilometers wide, the New Halfa scheme includes nearly 200,000 hectares under irrigation and a population that probably exceeds 300,000 (Eritrean refugees and seasonal workers not included).

Tenancies on the New Halfa scheme number nearly 20,000, of which approximately one-third were allocated to Halfaween Nubians whose homeland was inundated by the Aswan High Dam. It is the initiative of an unknown proportion of these Halfaweens, and especially their success in diversifying their production system and increasing disposable incomes, which has played a role in developing the area. Development here encompasses a dynamic commercial center which El Tayeb (in Scudder, 1981: 182) estimated as having 1408 businesses in 1980 including 335 retailers, 60 wholesalers, 40 restaurant/coffee shop owners, 13 flour mills, and 10 radio repairmen. Nonfarm employment at the time included at least 12,000 permanent jobs and an equal number of temporary jobs, while permanent farmer laborers numbered approximately 50,000 with seasonal laborers exceeding that number.

In summarizing the New Halfa case, Scudder concluded that despite the inefficiency of the management agency (the Agricultural Production Corporation), "a disproportionate emphasis placed on the production of cotton at unfavorable producer prices, and the inability of the APC and the Department of Irrigation to maintain irrigation structures and provide the settlers with a regular supply of water in the right

amounts at the right time, agricultural development at New Halfa is associated with major multiplier effects" (1981: 183). That being the case, imagine what the combined development potential of Gezira/Managil, New Halfa and Rahad might have been for the Butana and associated regional centers (Kassala, New Halfa, Gedaref, Wad Medani and Khartoum) with more favorable national policies and better planning and implementation.

(3) Local Participation and Small-Scale Irrigation

The emphasis here is on what Moris calls demand-driven small-scale irrigation as opposed to government-sponsored small-scale irrigation which is subject to many of the failings associated with larger projects. As described briefly in Chapter 3, small-scale irrigation is more common in tropical Africa than generally realized. While most of this involves the use of individually owned shadoof (as in Northern Nigeria) or small pumps (as near urban areas throughout tropical Africa), there also exist a small number of locally initiated and successfully run small-scale community projects. Some of these involve major government and donor assistance while others (including projects along the Senegal River and in Kenya along the Upper Tana and in the Lake Victoria basin) do not.

The potential of such community run small-scale projects is widely acknowledged. Hence for the Sahel Sparling provides "empirical evidence and theoretical arguments which suggest that irrigation perimeters with farmer control are superior to those with centralized control in standard economic efficiency terms" (1981), while study after study shows how parastatal-assisted but village-run small-scale perimeters along the Senegal out-perform larger scale government-run perimeters. Throughout the continent many of the most successful cases are demand-driven; that is, they were started at the initiative of the farmers rather than that of the government or non governmental organizations. They also tend to be relatively near urban centers. In capitalizing on

such initiative and trying to replicate it, there is a very real danger -- as Okidi (1987) has shown in the Lake Victoria Basin and Adams (1981) for the Senegal River Basin -- of outside agencies and capital unwittingly undermining the very initiative and community action that is a prerequisite for success (on this point see Chapter 4).

3. Other Effects Including Impacts on Local Production Systems

a. Positive Effects

I am aware of no attempt made to quantify other achieved (as opposed to appraised) benefits from African river basin development either at a general level or on a project by project basis. This statement applies, on the one hand, to flood control benefits and, on the other hand, to benefits associated with reservoirs backed up behind the dam. While flood control benefits are clearly associated with the construction of the High Dam at Aswan and with many dams in Asia, on balance flood control in tropical Africa can have an adverse effect because of the dependence of riverine habitats and riverine production systems on annual flooding.

A partial corrective to this deficiency is Elizabeth Colson's and my own research within the Middle Zambezi Valley of Zambia and Zimbabwe which suggests the type of benefits which are associated with reservoir impoundment and which could be significantly increased with better planning. These are fisheries, livestock management, floodwater irrigation, and national parks and tourism (see also Magadza, 1986).

(1) Fisheries

Both artisanal and pelagic fisheries have developed on Lake Kariba. The artisanal fishery developed first, with the local population on the north (Zambian) shore responding rapidly and favorably to a well-planned and implemented program. As a result, over 2,000 fishermen (plus another 1,000 on the south bank) were able to skim

off the high biomass of fish that matured during the very favorable conditions that existed during the initial years of impoundment. As productivity dropped thereafter, the majority of those fishermen reverted back to farming with the major change that the majority now had access to cattle for plowing and other uses -- cattle that had been purchased with fishing profits. Able to cultivate more land per capita, with somewhat higher yields, these farmers were more apt to combine the cultivation of crops for both consumption and sale. Many fishermen also used savings to finance the education of dependents, the majority of those going on to secondary school subsequently investing some of their wages in cattle which they kept with rural relatives. Fishing, along with the brewing of beer, also played an important role in incorporating women into the market economy, with many village women selling produce to fishermen during the early and mid-1960s. Furthermore it provided the most important single source of capital for the large number of village stores, tea shops and beer halls that were built during the decade of development between 1964 and 1973.

The pelagic fishery, based on the build-up in populations of "sardines" (*Limnothrissa* spp.) that were stocked during the 1960s, came into its own in the 1980s, with approximately 20,000 tons of fish landed annually (as opposed to 7,000 tons during the height of the artisanal fishery in the 1960s). While most of the profit went to outsider "businessmen," nonetheless several thousand low income people received employment, approximately half of whom were local villagers on the south bank while a majority were locals on the north bank.

Such landings, and their impact on both the local and national economy, far exceed pre-dam landings or landings which could have been developed in the absence of Kariba's construction. While the sardine fishery could have been developed in more equitable fashion, it has nonetheless provided jobs during very difficult times, and since the development of a contract system in the mid-1980s, some income for

investment in other activities. Fisheries development has also been a major bright spot on reservoirs backed up behind the Volta Dam at Akosombo (with current landings of about 30,000 tons), Kainji, Kossou, Selingue and no doubt elsewhere. Its potential for improving diets and for job creation among low income populations is considerable within all tropical reservoirs, although high sediment loads (as at Masinga) and temperatures (as in Lake Nasser/Nubia) can create special problems.

(2) Livestock

Lake Kariba is characterized by an extensive drawdown area, the extent of which has been significantly increased during the drought years of the 1980s. Though a much smaller area is available on the south bank owing to a rockier and steeper shore line and the presence of national parks, the area available for grazing by domestic stock on the north bank amounts to tens of thousands of hectares. Over the years the drawdown area has been increasingly colonized by the grass *Panicum repens* which has provided a very nutritious source of grazing for cattle and small stock in Zambia and for game (including elephant and buffalo) in Zimbabwe.

Aside from animal trypanosomiasis which continues to be a problem on both sides of the reservoir, the major constraints for livestock management are scarcity of food and water toward the end of the dry season. The Lake Kariba drawdown area eliminates both constraints, the grazing there being some of the finest in Central Africa. Local villagers have responded to this situation by grazing thousands of head of cattle along the edge of the reservoir -- cattle which are both an important form of savings and source of oxen for plowing and haulage.

Like fishing, drawdown grazing is associated with all manmade lakes in the tropics. Though I have seen cattle and other stock grazing drawdown areas elsewhere (including Lake Volta and Lake Masinga), and have been informed of its importance around other reservoirs in Nigeria and the Sudan, drawdown areas continue to be an underutilized

resource for both crop agriculture and livestock management.

(3) Flood Water Agriculture

Most government and nongovernment experiments with reservoir agriculture involve the use of pumps for delivering water to areas above the upper margin of the drawdown areas. Meanwhile, without exception local populations have experimented with recessional cultivation. The largest areas utilized are associated with the largest reservoirs, and in particular with Lake Kariba and Lake Volta. At Kariba, local villagers attempted to transfer their previous system of flood recession agriculture to the reservoir as soon as it formed. Initially drawdown was too irregular (Figure 3), but since the completion of the Kariba North Bank power complex in 1980, drawdown has been regularized, with reservoir levels in years of "normal inflow" beginning to drop in June and continuing to drop without occasional rises until December, hence providing at least five months for drawdown agriculture.

Drawdown agriculture has been especially important during the serious 1981-1984 and 1986/87 droughts. Though I am aware of no estimates of the area cultivated, during late 1986 thousands of hectares of mixed cropping of maize, legumes, cucurbits and other vegetables were involved, with families moving down to the edge of the reservoir to protect their gardens. Drawdown agriculture has great potential at Kariba as well as at other reservoirs. Though no experiments have been carried out, presumably it could be combined with a controlled downriver flood to allow some flood recession cultivation and grazing below dams, hence significantly increasing production and employment. Depending on forecasting capabilities, and the relay of the necessary information to farmers, it might also be possible to grow floating rice in the larger reservoirs like Kariba and Volta where levels increase gradually during and immediately after the rains.

52A

FIGURE 3

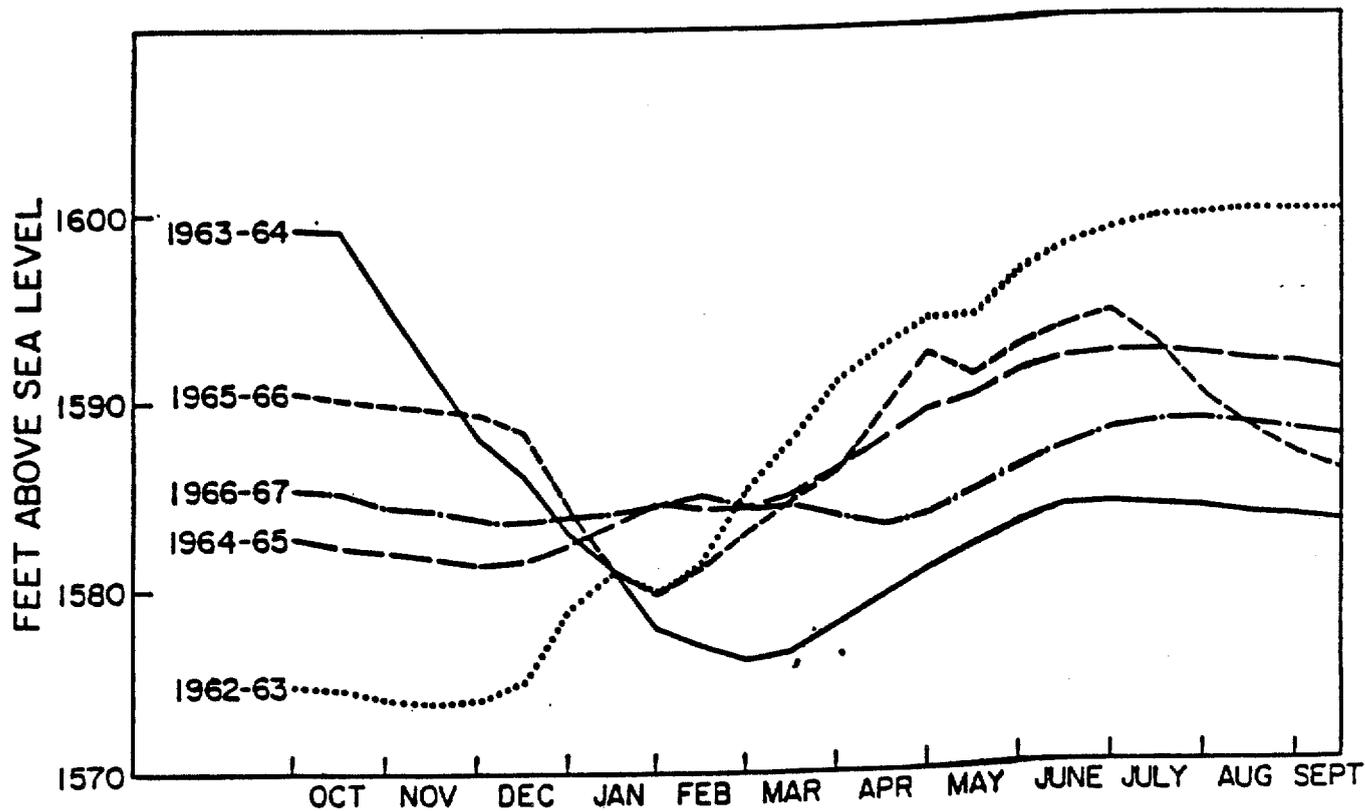


Figure 13-4 Lake Kariba water levels on the 1st and 15th day of each month, October 1962 to September 1967. Data provided by the Central African Power Corporation

Source: Farvar and Milton, 1972: 225.

(4) National Parks and Tourism

Potential here is moderate at best except in very special cases. The Zimbabwean portion of Lake Kariba, for example, is now a major destination for both local and international tourists, and for good cause. Kariba township is the focal point for boating and fishing (including an annual competition for Tiger Fish, *Hydrocynon vittatis*), and for mainland and island safari camp, and national park access. Across the Sanyati Basin from Kariba, Matusadona National Park provides excellent opportunities for bird watching and for viewing elephant, buffalo and antelope grazing the drawdown area. Various safari camps on the water's edge have their own airstrips and welcome international tourists and hunters, while package tours combine Lake Kariba with the Victoria Falls.

This tourism bonanza, however, is partly due to relatively low population densities (in turn associated with relatively small deposits of the locally preferred alluvial soils and the presence of both animal and human trypanosomiasis) and to an iniquitous resettlement policy in the 1950s whereby riverine villages were not allowed to settle around the reservoir margin which was gazetted for National Parks and for other purposes benefiting primarily white Rhodesians. More typical of other reservoir basins is the situation on the Zambian side. Tourism there is much less developed, and what tourism does occur is located near the dam site at Siavonga where new hotel facilities are currently under construction. Underutilized dam site hotel facilities also exist at Akosombo, while a national park has been created at Kainji and another may be developed at Manantali. Such resources, however, are not competitive with other African tourist destinations. Furthermore, they provide little benefit for local populations -- aside from a relatively small number of low wage jobs. Though an administrative subcenter, Siavonga, for example, has little relationship to the surrounding villages, with township planning focused on the lake and the dam rather than the local people.

**b. Negative Effects of Dam Construction on Riverine Habitats
and Local Production Systems**

(1) Downstream Production Systems

Whether built for hydropower generation, irrigation, or both, mainstream dams in Africa regularize river flows, largely eliminating flooding in the process. On balance, impacts on riverine habitats and local production systems are adverse. While post-impoundment ecological research has dealt more with reservoir than with downriver impacts, the latter can be severe, including river bank erosion in the Middle Zambezi Valley below Kariba (Guy, 1981). Over the longer-term reduced flooding is also apt to have a negative effect on floodplain creation, on riverine forests, on alkalinity, and on coastal deltas and beaches. Along the Tana as elsewhere exceptional floods "have a significant effect on the dynamics and form of the floodplain, several large oxbows being created by the 1961 flood. . . . The forest seems to depend on the occasional extreme floods both for the creation of the diversity of conditions which are an important feature of the forest and for the regeneration of individual species of trees" (Adams and Hughes, 1986: 405). By reducing flushing of downstream soils, dam construction can also lead to increased salinity levels (Davies, 1979: 123). Even more disturbing over the longer term is the effect of silt capture within impoundments on the erosion, increased salinity and decreased productivity of delta flood plains and on coastline erosion, a concern which Davies (1979) and Tinley (1971) have raised for the Zambezi and others for the Nile and the Volta.

Elimination of downstream flooding has had a devastating effect on local production systems. On the one hand, riverine habitats for flood water farming and livestock management are drastically reduced. On the other hand, fisheries productivity and hence fish landings for consumption and commercial purposes are adversely affected.

The most detailed analysis of the adverse effects of dam construction on downriver users deals with the Bakolori and Kainji Dams in northeastern Nigeria. Kainji was constructed in the late 1960s mainly for hydropower generation. Regularization of the downriver flood has had adverse effects on people immediately below the dam and hundreds of kilometers downriver. Adeniyi (1973) concentrated on three villages, with a combined population of about 12,000, the furthest of which was over 200 kilometers downriver. Though herders presumably were also adversely affected by the cessation of the annual flood, Adeniyi concentrated on fisherfolk and farmers. In regard to fishing, income from the three villages decreased 47 percent, 60 percent and 73 percent, respectively. That these reductions were related to a drop in fisheries productivity is indicated by catch statistics analyzed by the Kainji Lake Research Institute which showed a decline of over 50 percent. Adverse as the impacts on fisherfolk were, many more people were adversely affected by declines in recessional cultivation. For instance, in Adeniyi's three villages declines of 44 percent, 53 percent and 70 percent were reported in dry season harvests from seasonally inundated areas (*fadamas*).

Far more drastic effects are reported by Awachie (in Welcomme, editor, 1979: 21):

Decrease in fish and crop yields from the *fadamas* (floodplain depression lakes) due to low water level in the river channel and floodplain was noted within one year of dam closure from Jebba to Lokoja. Within the second and third years, the effects of the new rather low level flood regime during the flood season coupled with unsteady flood rises had been felt as far down-river as the apex of the Niger delta. The Niger at Onitsha was scarcely half bankfull. Consequently the rich and extensive Anambra floodplain northeast of Onitsha was grossly desiccated and few floodplain lakes/ponds made seasonal connection with the main river channel.

Fishermen and farmers watched helplessly as their yields fell. By 1970, the Lower Anambra Basin which hitherto had been responsible for 70% of freshwater fish and yam production in Eastern Nigeria, had lost both 60% of its fish output and yam production running into 100 thousand tonnes.

While Awachie notes that a contributing factor to such declines was the 1968-1973 Sahelian drought, his analysis suggests that Kainji was the major factor responsible for drops in fish and crop yields. Though better rainfall in 1975 and 1976 improved the situation for fishermen, still, "they are finding it difficult to locate good fishing grounds and to predict catches from the flood characteristics as before in these downstream stretches -- a situation which may be related to the adverse effects of the dam on species and stock composition and population structure/distribution" (ibid).

While Adeniyi's and Awachie's surveys were largely undertaken at the same time as the 1968-1973 drought (hence making it difficult to factor out dam effects from drought effects), Adams' research along the Sokoto tributary to the Niger was in the late 1970s. Following the completion of the Bakolori Dam he reports that "there was a reduction in downstream agricultural production and fish catches due to the reduced wet-season flooding. Wet-season cultivation of rice declined, and land was turned over from rice to the less productive crops of millet and sorghum. The economically important dry-season vegetable production was reduced, and farmers turned to dry-season labour migration, a traditional response to periods of drought and hardship" (Adams, 1985c: 303). In another publication, he notes that "in the dry season, reduced flooding caused a decline in both the area cropped . . . and a change in the type of crops grown. The drier *fadama* conditions in the dry season became unsuitable for the more water-demanding crops such as peppers and tomatoes, and there was a shift towards tuber crops such as sweet potatoes and cassava, although even these declined in

absolute terms" (1985b: 296-297). The percentage of households doing recessional cultivation in two of Adams' study communities also declined -- from 100 percent to 27 percent in one case and from 93 percent to 59 percent in the other, which is presumably a major reason why labor migration rates increased.

As for rainy season and dry season fishing, "Village surveys suggested a substantial decline in both seasons, except where water bodies were maintained by flow from adjacent upland areas. In a number of villages fishing had virtually ceased, and in others had become confined to the river bed in the wet season" (ibid., 297). Elsewhere in the same article Adams refers to research by Stock (1978) in another Nigerian river basin that describes "the decline in fishing and the crop failure (surpassing that of the 1972-74 drought) in the Hadejia flood-plain following the closure of the Tiga Dam" (ibid., 292).

The construction of both Kariba and Volta also had adverse effects on downstream users, although the number of people impacted upon was fortunately lower. In the Kariba case this was because little floodwater agriculture and fishing occurred in the stretch between the dam and the Zambezi confluence with two major downriver tributaries -- the Kafue and the Luangwa. Nonetheless, in the Lusitu area several thousand people doing recessional cultivation were adversely affected, especially those cultivating floodplains where the Lusitu River joins the Zambezi.

In the Volta case, the downstream population numbered under 100,000 people because the dam was built fairly close to the coast. According to Hilton and Kowu-Tsri, construction of Akosombo "brought severe hardship to the people of a narrow and rather crowded zone below the dam" (1973: 29). As a result of reduced land for flood recession agriculture (which had allowed intensive cropping of annually flooded areas), out-migration increased: "the exodus has affected even the larger villages, whilst some small ones have disappeared entirely" (ibid., 35). Further downstream in the delta, coastal erosion increased after the elimination of the annual flood. According to *New*

Africa 10,000 people were displaced when the town of Keta was destroyed, while another 10,000 were under threat in Aneho (1985: 27). According to Howe (1988 written communication) rising water tables in the vicinity of Keta flooded out lands which formerly had been seasonally cultivated, while valuable lagoon fisheries deteriorated due to increasing salinity.

While it is difficult to assess impacts of dam construction in the Tana river basin because of the lack of pre-dam impact assessments and of post-dam monitoring, and of more academically oriented research, knowledgeable experts informed Little and myself that dam-associated lower flood levels were already having an adverse effect on flood water agriculture. Presumably it was also reducing grazing for livestock as has been the case on the Kafue Flats where the reservoir backed up behind the gorge area has flooded certain eastern grazing areas while flood regularization by the upriver Itezihitezhi Dam has reduced flooding and hence grazing areas at the western end of the Flats.

(2) Reservoir Basins

Throughout the tropics the resettlement of communities from future reservoir basins has been the least satisfactory component associated with dam construction. Tropical Africa has been no exception, since the outcome of a majority of relocation programs there has been unsatisfactory. Possible exceptions to this statement are Kpong in Ghana, Kossou in the Ivory Coast and Kainji in Nigeria; elsewhere resettlement continues to be a major project cost.

Dam relocation by definition is involuntary because the majority of the people do not wish to move. Their opposition to removal is well-founded since without exception the relocation process is stressful, with stress invariably lasting several years after the completion of removal (Scudder and Colson, 1982). Stress is multidimensional. It can be broken down into physiological, psychological and sociocultural components.

Though hard evidence is scarce because of the absence of pre-relocation medical surveys, morbidity and mortality rates appear to increase following removal, the best documentation coming from Egypt in connection with the Aswan High Dam (Fahim, 1983: 59). Generalizing from such cases, the Joint WHO/FAO/UNEP Panel of Experts on Environmental Management for Vector Control (PEEM) noted in a 1985 report that diseases "form a limiting factor in resettlement success."

Psychological stress is associated, on the one hand, with forced departure from a preferred habitat including community, fields and familiar surroundings and, on the other hand, with anxiety about the future. The resulting "psychoses associated with resettlement" are listed by the previously cited Panel of Experts as one of seven health problems confirmed on the basis of "hospital records from resettled areas and on registration of settlers complaints." As for sociocultural stress, that is associated with an undermining of local leadership (including the authority and influence of household heads); the leaving behind of graveyards and shrines; the nonapplicability of much local knowledge to the new habitat; and the almost inevitable conflicts with the host population in the resettlement areas over rights to land, social services, and job and other economic opportunities.

Over the longer term, resettlement is apt to lead to lower living standards and environmental degradation because of the difficulty of planning and implementing viable production systems in new, frequently problem-prone habitats. Throughout Africa government agencies with resettlement responsibilities have tended to underestimate the following crucial factors:

- (1) The number of people requiring removal.
- (2) The financial requirements for resettlement and rehabilitation by a factor of two or more.
- (3) The institutional needs for planning, implementing and monitoring resettlement.

- (4) The complexity of the resettlement process, including the complexity of phasing physical removal with subsequent development, and especially agricultural, activities.
- (5) The time required to complete physical removal with the result that resettlement -- as in the Kariba, Volta, and Aswan High Dam cases -- becomes a crash program to remove the relocatees from the reservoir basin before the dam is sealed.
- (6) The land requirements for relocated rural communities.
- (7) The stress of removal.
- (8) The health impacts of relocation on both people and their livestock.
- (9) Potential conflicts between relocatees and hosts after the completion of removal.

The history of dam relocation in Africa is a history of failure starting with Kariba in the 1950s and continuing down to the present in connection with the World Bank-financed Kiambere Dam in Kenya. In the Kariba case, riot police killed a number of north bank residents when the people resisted government attempts to speed up removal owing to a decision to seal the dam in time to commence impoundment during the 1958-1959 rains. All too frequently the carrying capacity of the land under existing techniques was exceeded at the time of removal with the result that serious environmental degradation has occurred in the Lusitu resettlement area below the dam and in the Siameja and other resettlement areas near the upper end of the reservoir. Indeed, today toward the end of the dry season when the wind blows up the dust, the Lusitu literally looks like part of the Sahel even though average rainfall exceeds 800 mm annually.

In the Kiambere case both the Kenyan government and World Bank appraisal and supervisory missions ignored until 1986 the Bank's own 1980 guidelines as they relate to involuntary relocation in connection with Bank-financed projects. By then it was too

late to implement them since the large majority of relocatees had already left the area without adequate government assistance and compensation to acquire replacement lands. In between these two projects, similar inadequacies characterize project after project. During the 1960s, less than 10 percent of the irrigated land intended for Aswan High Dam relocatees moved to the principal resettlement area in Egypt was ready for cultivation at the time of the people's arrival. In Ghana, insufficient farm land was available for the over 700 village communities that were aggregated into 52 new towns. In both the Egyptian and the Ghanaian cases World Food Program assistance was needed for over five years and today the 52 Ghanaian new towns continue to be nonviable.

In the 1970s, relocation in connection with the Cabora Bassa dam in what is now Mozambique was equally unsatisfactory: "the relocation undertaken by the armed forces appears to have involved a high degree of coercion; moreover, the newlands were often inadequately prepared and the choice of village locations was frequently unsuitable" (Bolton, 1986: 160). As for Nigeria's Bakolori Dam, local opposition "led to repeated blockades of the project in 1979 and 1980 and a violent action by riot police in which many villagers were imprisoned, some injured and some killed" (Adams, 1985d:11). More recently, the impoundment schedule had to be altered at Manantali since relocation had not been completed. The AID-funded relocation program there was inadequate since it dealt only with physical removal as opposed to relocation and development. Even the physical removal component was inadequately implemented, with housing not built according to specifications.

In each of the above cases, resettlement has not only been disadvantageous to the relocatees, but also to the host population and to the governments. In the case of the various governments, adverse impacts will continue since relocation was not designed and implemented in such a way that the development of the relocated population could eventually contribute to the stream of project benefits. For that reason, another

development opportunity has been lost since what evidence is available suggests that relocated populations have considerable potential for development once the stressful period following removal ends -- provided, of course, that the opportunities for development are there.

4. Summary

While the breadth of evaluations is insufficient for formulating conclusions with confidence, nonetheless the record to date with river basin development in Africa suggests that many major dams at best were premature and at worst have jeopardized the integrated development of the river basins in which they are sited. The unsatisfactory record relates both to what has been accomplished and what has not been accomplished. While generation of electricity is the main accomplishment in terms of debt repayment and revenue generation, generally speaking expectations for industrial development have not been met. Even where they have been met, as in the case of Kariba and dams along the Tana river, dam construction has favored the urban residential, commercial and industrial sectors at the expense of the rural majority.

Dam construction has been premature in two senses. On the one hand, decisions by national policy makers have been made to proceed before the necessary studies have been completed. On the other hand, in favoring the urban-industrial sector, the plans that were implemented have frequently ignored the agricultural potential of river basins and made it harder to develop that potential in the future. This potential relates not just to small, medium and large scale irrigation, but also to intensifying local production systems. The nature and potential of these will be examined in detail in the next chapter. Relevant components include not just flood water cultivation, but also rainfed agriculture, livestock management and fisheries. All these components with the exception of fisheries have been ignored. Yet they are the ones that support the largest number of people in tropical Africa. Given the fact that the rising disposable income

of millions of scale-scale rural producers is the engine which initially drives development forward in agrarian nations, it is a tragedy that Africa's largest development projects have not only failed to benefit large numbers of rural households but also have made millions of river basin residents worse off and have adversely affected riverine habitats.

Most irrigation projects are hardly an exception to this negative conclusion since it is hard to justify the results on either economic or financial grounds. Capital development costs have been escalating with some exceeding \$20,000 and even \$30,000 per hectare. Even with double cropping of high value crops it is not possible to pay off such costs; indeed, frequently projects do not even cover recurrent costs. While families on irrigated settlement schemes may be better off than they were before the project, still many do not move beyond subsistence. And in comparison to households dependent on rainfed and flood water agriculture, irrigation, except in the Sudan, benefits a relatively small minority.

Bearing in mind that most African nations have access to only one or two major rivers, and that these rivers are national heartlands or have the potential of becoming heartlands, African nations cannot afford to ignore broader development strategies that increase productivity, living standards and employment for larger numbers of people. And with development capital getting scarcer, they cannot afford to use available monies for projects of dubious benefit.

The trouble is that broader strategies which seek to develop local production systems in an environmentally sustainable fashion have yet to be justified in economic and sociopolitical terms. Even if justification is forthcoming, it remains to be seen if governments are willing to make the necessary policy changes and changes in development priorities. Following a detailed assessment of investments in large scale infrastructure for Sahelian development for AID in the late 1970s, Stryker et al. (1978) concluded that the optimum strategy for the 1980s was to concentrate on rainfed

agriculture in areas of higher rainfall. River basin development then could follow in the 1990s. Such informed recommendations have been ignored, with the thrust for dam construction and irrigation at the expense of riverine production systems and environmental management continuing unabated during the 1980s.

Dam construction and irrigation are supported by a much stronger coalition than supports other river basin development alternatives, a coalition that includes senior politicians (up to the presidential level), national and international river basin development authorities, ministries of power and irrigation (or their equivalent), the World Bank and UNDP, a number of major bilateral donors and western firms of consulting and construction engineers.

Under the circumstances, the temptation is to conclude with Goldsmith and Hildyard that dam construction is "bad". The problem with that approach, however, is the likelihood that African nations cannot afford *not* to develop their river basins, although such development need not necessarily involve major dams. Not only are populations increasing more rapidly than in other continents, but the large majority of Africa's citizens "want development." Because of the extreme irregularity of African river regimes, which undercuts the productivity of local systems of flood water cultivation, and externally assisted systems involving partial water control, every three to five years, dam construction remains an option for improving water control through storage and released flooding. In climates where rainfall is restricted to one or two short seasons, where rates of evapotranspiration are high, and where water is in scarce supply much of the year, there seems to be no alternative to careful river basin planning -- as emphasized by both Farinan (1972) and Siann (1981: 219) in the Nigerian case. Planning, however, must be multiobjective, with environmental, local and regional needs balanced against national and urban-industrial needs.

It is one thing to talk about multiobjective planning. It is a very different thing to carry it out and then to build the results into policies and plans which are then

implemented. Current planning approaches are deficient. Unless they can be improved and taken seriously by policy makers, further dam construction should be avoided. As Gilbert F. White has recently argued for the lower Nile in relationship to the High Dam at Aswan, avoidance of unexpected costs and improved planning requires improved monitoring (White, forthcoming). It also requires a better understanding of results of previous experiences with river basin development in tropical Africa -- hence the need for basin-wide impact evaluations.

The lack of adequate assessments not only leads to adverse impacts on local habitats and local producers, but can also result in the design and construction of non viable projects. Adams considers Nigeria's Bakolori Dam to be such a project. He points out that while the relationship in downstream areas between flooding and flood plain agriculture had been understood since the 1920s, "the Bakolori Project was constructed without consideration of its impact on downstream farmers" (1985:10). The extent to which the area designated for the associated irrigation project was already under local cultivation was seriously underestimated. Issues associated with project-related land expropriation and compensation were poorly handled. In sum, had the effects of the project on downstream users "been properly assessed, and included in the economic appraisal, they should have been enough to prevent development of the project" (1985b: 300).

Improvement of planning also requires broadening benefit-cost analyses, or supplementing them to the extent necessary, to deal with both direct and indirect benefits and costs in regard to local, regional, national and environmental accounting. Such broadening need not necessarily lengthen the appraisal period, since rapid survey techniques have been developed which are suitable for both ex ante and ex post assessments. On the other hand, as stressed by both Bloch (1985: 22) and Stagliano (1988 written communication), broader feasibility assessments for both dams and irrigation projects should include from the start social science analysis of local

communities. Such analysis need pay particular attention to land tenure, local production systems, marketing networks and rural-urban linkages within the encompassing region. In regard to irrigation, they also need to pay far more attention to local participation in the planning, implementation and management of community-based irrigation which need not necessarily be small-scale since locally managed sections can be aggregated or federated into larger schemes while separate community schemes within the same area can be linked within a regional context.

Both AID and the World Bank have been placing more emphasis on social science and environmental analysis in relation to river basin development projects, with the Bank taking a much harder look, for example, at the relocation component of dam projects (Cernea, 1988). While improved planning is emerging as a result (as in Somalia's Juba Valley), a major problem concerns the implementation of those plans. Here is where there is a need for education of senior policy-makers, and especially heads of state, as to what can be reasonably expected from different approaches to river basin development. As the lead donor and the major actor involved in river basin development throughout the tropics and subtropics, the World Bank is the logical organization to take the lead here, the stakes being too high for heads of state to continue making the kind of ill-informed decisions that they have made in the past, and that continue to be a major risk in regard to such contemporary cases as the Gambia and Juba River Basins. To date, however, the World Bank has been part of the problem. It remains to be seen whether the new thinking within certain Bank offices, and the pressures from without, can enable the Bank to broaden its perspective and use its influence to the extent necessary.

CHAPTER 3

THE IMPORTANCE AND POTENTIAL OF AFRICAN RIVER BASINS FOR LOCAL POPULATIONS

A. INTRODUCTION

The purpose of this section is first, to demonstrate the extent to which millions of people were, and still are, dependent on the annual flooding of the large majority of Africa's rivers and second, to discuss the developmental potential of riverine production systems. It is against this background that the argument is advanced that future river basin development projects must address themselves to a much greater extent to enhancing, rather than destroying, local production systems if they are to spread benefits more widely to resident low income populations and so encourage regional development.

Most of Africa (and even a greater proportion of tropical Africa) is drained by less than ten major river systems, the basins of which are largely characterized by seasonal rainfall, and hence by unimodal or bimodal rainy seasons followed by dry seasons (of 2.5 to 10 months) during which lack of moisture precludes rainfed agriculture. As a result of these rainfall patterns, a common feature of a large majority of the continent's rivers is seasonality of runoff with meanmaximum discharge frequently ten times that of mean minimal discharge. Examples include the Orange, Zambezi, Tana, Juba, Nile,

Gambia and Senegal Rivers as well as tributaries of the Niger. Adams refers to FAO data that show that 70 percent of the run-off from the Niger's Sokoto-Rima system occurred over two months (1985a: 192) while 80 percent of the flow of the Gambia River at Goulombou occurs over a three month period. With the exception of the Orange (much of which flows through the white farmlands of South Africa and then through sparsely populated desert country in Southwest Africa), local economies are dependent, to a considerable extent, on these flood regimes.

The major exceptions to extreme seasonality of run-off are the Niger, the White Nile and the Congo. In the case of the Niger, though downstream flows are regulated to an extent by the inland delta in Mali, annual flooding is still essential to millions living close to the river banks in Niger and Northern and Central Nigeria. Annual fluctuations are also important to the economies of over a million people, as well as to millions of domestic stock, living along the White Nile in the vicinity of the Sudd (which, like the inland delta of the Niger, regulates the flow of the White Nile to an extent) in the Central Sudan and below the Sudd in the Northern Sudan. Only for the Congo, the lower and middle portions of which flow through humid rain forests, are annual fluctuations of relatively little importance to riverine inhabitants.

B. PERCEPTIONS OF OUTSIDERS

A striking feature of large-scale post-World War II river basin development projects is the extent to which the importance of annual flooding for local farmers, transhumant pastoralists and fisherfolk is ignored by both researchers and developers alike (the World Bank, for example, continues to ignore downriver impacts of Bank-funded dams in Kenya in spite of its own environmental guidelines). Other than lack of concern for the future of those people, three factors appear responsible for this major oversight. The first is the tendency to follow geographers and botanists in regionalizing Africa on the basis of climatic zones and their associated vegetation zones

rather than of river basins which tend to traverse several such zones. A second factor relates to the geology of Africa. Composed largely of plateaus of ancient crystalline rock, Africa is estimated to contain at least 30 percent of the world's hydro-electric potential. The rivers carry relatively low silt loads (some major exceptions being rivers that drain the Ethiopian highlands and the Tana River). These facts have tended to draw the attention of developers and politicians alike to the energy potential as opposed to the agricultural potential of Africa's river basins.

The third factor is the popular perception of Africa's river basins as marginal habitats for people owing to the prevalence of disease, pests and irregular flooding, the assumption following that relatively few people will be affected by river basin development. While there is no question about many African river basins (and especially their middle and lower reaches) being harsh environments, nonetheless many have been densely populated for centuries, with some associated with state formation. Over a million people inhabit the Senegal River Basin and tens of millions the Niger Basin. The fertile alluvial soils, fishery resources, and grazing lands of the Upper Zambezi in Barotseland, and the alluvia of the Middle Zambezi in the Gwembe Valley, supported two of the densest rural populations in Central Africa. In the latter example, 55,000 people had to be relocated in connection with the construction of the Kariba Dam, practically all of whom lived close to the Zambezi or its major tributaries. The next two major dams built in tropical Africa, Volta and Kainji, caused the relocation of over 80,000 and 40,000 people, respectively.

C. RIVER BASIN SOCIETIES AND PRODUCTION SYSTEMS

1. River Basin Societies

In passing it is important to emphasize the important role that riverine and lacustrine habitats have played in the African origins of sedentary communities, crop agriculture, states and civilizations. Crop agriculture came relatively late to Africa,

appearing in the Nile Valley some 6000 years ago and in West Africa 3000 years ago. Along the Nile, however, gathering of wild grasses with associated grinding artifacts and sedentarization may date back nearly 15,000 years (Wendorf and Schild, 1976: 286), with the richness of the habitat perhaps delaying the domestication of cereals which subsequently were introduced from southwestern Asia.

At Dhar Tichitt in south central Mauritania, pottery (which is an important indicator of sedentarization) appears in the archaeological record at least 1000 years before its known occurrence in the Nile Valley. Dhar Tichitt communities are associated with now dried up lakes where people fished, gathered wild grasses and other produce and hunted over seven thousand years ago. Munson believes that they commenced incipient cultivation about three thousand years ago when they began to cultivate a species of millet (*Pennisetum* sp.), and perhaps also *Brachiaria* in the drawdown areas of gradually desiccating lakes (1976: 188).

Based on the Dhar Tichitt and other data, Harlan suggests that "the original *décrué* [flood recession] techniques were learned along the margins of the Sahara or in what is now the Sahara itself" (1976: 16). In those locations he believes that the existence of shallow lakes provided exceptionally favorable conditions for experimenting with herding, fishing, gathering, hunting and crop agriculture, with the latter shifted to higher risk (due to irregular flooding) riverine habitats when the lakes dried up. Portères (1962) sees the middle Niger, including the inland delta, as the area of origin of African floating rice (*Oryza glaberrima*), five species of sorghum, one of *Pennisetum*, and perhaps fonio (*Digitaria exilis*).

In more recent times African rivers were well traveled by fishermen and traders. In the Sudan the Kingdom of Meroe (where the first use of iron in Africa has been recorded) was situated on the Nile, while a number of African kingdoms are associated with the Lake Chad Basin, the Middle Niger and the Senegal -- kingdoms which Bass (1986) graphically describes as being nurtured by the associated wetlands. The inland

delta was especially important to a number of early cities (like Djenne) and kingdoms. Currently the International Union for the Conservation of Nature (IUCN) is preparing a masterplan for the inland delta at the request of the Malian government. According to Bass this will include novel proposals for reintegrating indigenous 19th century management districts "each of which was controlled by village elders known as Masters of the Land (*duguti*) and Masters of the Water (*djitigi*) . . . into the management of the delta" (ibid, 24).

2. Constraints to Riverine Societies and Production Systems

Before describing the nature and potential of riverine production systems it is important to emphasize the constraints imposed by riverine habitats on local producers and societies. Such constraints as disease, pests and irregular flooding are ongoing and longstanding. Others like drought are recurrent, while still others like population increase and environmental degradation are relatively recent. Together they illustrate the precarious situation in which many riverine populations increasingly find themselves. Conservationists who are critical of river basin development policies and projects tend to ignore these "natural constraints" and the burden they place on riverine communities. What is at fault is not necessarily river basin development as such (including mainstream dams) but rather the type of river basin development that has been undertaken to date.

As previously mentioned, the middle and lower reaches in particular are harsh habitats due to disease, pests and irregular flooding. These are all constraints over which riverine communities have little control. Their mitigation (in the case of disease and pests) and their more productive use (in the case of flood regimes) require major state assistance often backed by international research, technical assistance and finance. Conservationists tend to ignore this point, just as they tend to ignore the fact that the large majority of riverine inhabitants want development, although defined on their own

terms. The ongoing program for controlling river blindness (onchocerciasis) is a major international effort involving a number of West African nations, WHO, the World Bank and various bilateral donors. Control of locusts and grasshoppers also requires international assistance, while improved extension services are needed for promoting such more desirable measures as integrated pest control. Control of irregular flooding (both too much and too little water) may require major infrastructure including mainstream dams. In the paragraphs that follow, the adverse effects of disease, irregular flooding, population increase and environmental degradation, and drought on riverine communities are briefly discussed.

a. Disease

Many serious tropical diseases are especially prevalent in river basins. While malaria and schistosomiasis are endemic, two other diseases have periodically caused the depopulation of portions of certain basins. These diseases are onchocerciasis (river blindness) and trypanosomiasis (human sleeping sickness). Though also occurring in East Africa, the depopulating effect of river blindness is largely restricted to portions of certain rivers in West Africa, especially the Volta, Bandama, Middle Niger and Upper Senegal. So serious has been the impact of onchocerciasis that a massive internationally orchestrated control program has been underway since the late 1970s. While the risk of reinfestation from untreated areas remains a major problem, this can be greatly reduced by current intentions to extend the program to the westernmost areas of infestation (and in particular to eastern Senegal). As for treatment, a major breakthrough is the recent manufacture of the ivermectin-derived drug Mectizan since an annual dose of several pills is apparently sufficient to kill the parasites. Distribution of this drug will presumably increase the ongoing movement of spontaneous settlers into previously depopulated areas. While such movement illustrates the success of the control program in reclaiming large areas for human settlement, a major weakness

throughout the program's history has been the relative inattention paid to development strategies for the reclaimed areas, including strategies for enhancing the productivity and sustainability of the type of local production systems described in the sections that follow.

The overall impact of human sleeping sickness on river basin depopulation has been even more serious since the tsetse carriers of this disease (and of trypanosomiasis in domestic animals) are found in riverine and lacustrine forests, thickets and cultivated orchards throughout much of tropical Africa. Although on a relatively small scale, periodically portions of the Middle Zambezi have been depopulated. Much more serious were epidemics during the first half of the twentieth century in the Lake Victoria basin, in tributary valleys draining the Nile-Congo divide and in West Africa. Even though human sleeping sickness was probably endemic to West Africa with Lake Chad and Niger-Benue foci, the origin of the West African epidemics appear to have been in the Congo basin. Molyneux associates their spread with colonial expansion and control which stimulated return migration of people to river valleys from upland refuge areas and increased trade and movement within those river valleys. Epidemic outbreaks of human sleeping sickness followed, the impacts of which Molyneux equates with the impacts of slaving during the previous century. Riverine communities were driven back to upland areas where excessive populations, in relationship to the carrying capacity of the land under existing techniques, led to soil degradation and erosion (1985: 253-267).

Throughout tropical Africa human sleeping sickness remains a major threat to life, with Molyneux suggesting a recent resurgence of the disease in West and Central Africa. Again international intervention is needed if tsetse flies are to be controlled in the interests of local riverine communities. Currently, for example, the European Economic Community is funding what may become a four country program to control tsetse in the Middle and Lower Zambezi Valleys. While such programs have great

potential to benefit local populations, realization of that potential requires appropriate development policies and plans, and the implementation of those plans.

b. Irregular Flooding

While the annual flood sustains both the riverine habitat and riverine production systems, periodically too much flooding as well as too little flooding drastically reduces crop yields. According to Simmons (1986), irregular flooding along the Niger has an adverse effect on yields every third year on the average. In the Oueme Delta of Benin, Guinard notes the "non-negligible odds" facing farmers due to a range of constraints including "flood vagaries in timing, level and duration" (1988 communication to the author). While irregular flooding in the Middle Zambezi is less a constraint than irregular rainfall (the situation being the same in the Oueme), on occasion it is a major problem. In one neighborhood, early and extreme flooding reduced crops sown on riverine alluvia by as much as 80 percent during the 1956-57 rainy season (Scudder, 1962: 226).

A major way in which local farmers have attempted to cope with the uncertainty involved has been to develop cereal varieties which differ in their tolerance of drought and flooding. Throughout tropical Africa riverine populations have developed early maturing (90 day) varieties which trade off higher yields for drought resistance and early availability. In West Africa, Adams (drawing on Gallais and Sidikou, 1978) notes how villages in the inland delta have selected rice varieties in relationship to soil conditions, with several varieties planted together as a further risk-aversion technique: "parallel with this adaptation to unpredictable flooding is a collective rotation of fields in response to perceived cyclical changes in flooding, frequently involving shifts over a wide area" (1985a: 188).

Though production systems in the Sokoto-Rima Valley of Nigeria are less complicated, Adams sees the area as another locale for the diversification of floating

rice. Including Asian rice, some 20 varieties were recorded from his study area in the upper Sokoto valley, and while the depth and predictability of flooding there was less than in the lower Rima valley, "farmers selected rice varieties to plant in different fields according to their flood-tolerance in the same way" (1986: 34).

Correctly designed and operated, major physical infrastructure could not only reduce the uncertainty associated with unpredictable flooding but it also could enhance productivity through controlled downriver flooding and reservoir drawdown.

c. Population Increase and Environmental Degradation

Population increase in the Middle Zambezi Valley began to put increasing pressure on older alluvial soils between the first and second world wars. By the mid-1950s sizeable areas had been taken over by deep-rooted grasses, with local villagers clearing gardens for the first time on inherently less fertile Karroo sediments back in the bush. By then game populations were also being depleted, while labor migration rates among male tax payers exceeded 40 percent, with the highest rates in those areas where land holdings per capita were smallest (Scudder, 1962).

Heeg and Breen also refer to a relationship between population increase and environmental degradation on the Pongolo floodplains, "as evidenced by degradation of the vegetation." Labor migration rates have also increased, going from 18-19 percent of "the male population" (hence presumably nearly 40 percent of the adult male population) in 1960 to 28 percent in 1970 (1982: 61-62).

d. Drought

Throughout the arid and semi-arid lands of Africa, population increase and drought have brought farmers and herders into increasing conflict over scarce resources. Historically this conflict has been building up over the years due to the development of irrigation projects that have encroached upon, or cut off access to, dry

season grazing lands without incorporating livestock within their production system.

Rainy season ranch lands were also being encroached upon by expanding populations of farmers during the years of favorable rainfall that preceded the 1968 Sahelian drought.

Currently farmers increasingly are putting under cultivation swamplands and floodplains hence eliminating another crucial source of dry season grazing.

Especially in the Sudano-Sahelian zones, droughts since 1968 have put increased pressure on riverine habitats and riverine production systems. In a 1986 research proposal, Turner summarizes recent source material on the inland delta of the Niger when he refers to "increasing environmental degradation and conflict over land resources. . . . Significant levels of devegetation and soil erosion as well as reduced productivity of the range have been observed on the non-flooded borders of the Delta floodplain." Conflict increases because the drought has brought other pastoralists and their stock into the area at the same time as expansion of crop lands by farmers has reduced the area available for cultivation. In the Senegal River Basin drought has brought commercial fishing to a virtual halt and has motivated formerly transhumant herders to request land for irrigated farming (Bloch, 1986: 13-14).

e. Summary

While riverine habitats are highly productive, they are not human paradises. If their potential is to be realized, they must be carefully managed. While the logical starting point is the production systems of riverine residents, currently the natural resource base is under considerable pressure from these systems, while conflict is increasing among different categories of users. Future development strategies must deal constructively with the dynamics of the current situation if the resource base, productivity and living standards are to be improved.

3. The Nature of Riverine Production Systems

Riverine production systems in tropical Africa are multi-faceted. Listed according to their diminishing dependence on an annual (or biannual) flood, the more important components are flood water agriculture, irrigation, fishing, livestock management, gathering and hunting, rainfed agriculture, and wage labor -- the latter becoming increasingly important as a result of the incorporation of local economies into a wider political economy, and of population increase and environmental degradation. While some of these components have no direct relationship to flooding, their relative importance through time is responsive to changing circumstances, including changes in rainfall and river flows.

Where rainfall is good (both in quantity and distribution) riverine farmers are apt to emphasize extensive rainfed agriculture on alluvial and other soils because of its greater returns per unit of labor. Where rainfall is poor more emphasis is placed on flood recession cultivation during the following dry season, and where both rainfall and flooding is restricted, wage labor, and especially labor migration to external locations, becomes more important. Labor migration in turn may have a constraining effect on local agriculture by reducing labor availability and land cultivated -- hence the anomaly of uncultivated land in food deficit areas in years of adequate flooding and rainfall. Transhumant pastoralists may respond to periods of drought or political instability through temporary or even permanent sedentarization along rivers, as is currently occurring along the Middle and Lower Tana River in Kenya where some herders are taking increasingly to farming while others hire themselves out to herd the stock of farmers, wealthy pastoralists and cooperative ranches.

The various components of such systems may be incorporated by one or more ethnic groups within a single diversified production system (as along the Middle Zambezi), or they may be associated with different ethnic communities through occupational specialization (as in the inland delta of the Niger), in which case the

various groups are intricately related through a complex of economic, social, and political ties. In the paragraphs that follow the most flood dependent components are isolated for purposes of analysis. It must be kept in mind, however, that they are part of complex and dynamic systems, composed of one or more ethnic groups, within which the relative importance of the different components responds to changing circumstances.

a. Flood Water Agriculture

There are four types of flood water agriculture in Africa, all of which probably date back several thousand years in their areas of origin. A form of natural irrigation, they utilize rainfall, sheet flow, river flood regimes, and tidal action either singly or in various combinations. Associated with riverine and lacustrine habitats, the first two are fresh water flood recession and fresh water flood rise cultivation. The third and fourth are valley and tidal cultivation. None have received from developers the attention they deserve although researchers have begun to pay them increasing attention (see, for example, Scudder 1980, Linares 1981, Adams 1986, and Adams and Carter 1986).

Major attempts in Egypt were made to control floods for agricultural purposes. In tropical Africa, however, such efforts were largely restricted to small canals to direct flood waters, and to levees to control it and to control tidal intrusions into paddy fields along the coast, especially in West Africa from Guinea to Senegal and the Gambia.

(1) Flood Recession and Flood Rise Agriculture

Over the centuries, the most common type of flood water agriculture is flood recession cultivation (*décrue* in francophone Africa) in which farmers sow the banks of rivers, streams and lakes as the flood waters recede during the dry season. The other is flood rise agriculture which is much more localized, occurring primarily in West Africa. Most well-known is the seeding of floating rice (*Oryza glaberrima*) just prior to the

commencement of the annual flood (*crue*) in the inland delta of the Niger. Flood rise rice is also planted along the lower Gambia and Casamance rivers although there Asian rice has apparently replaced floating rice and transplanting is delayed until after the rains or the annual flood has flushed out salts that accumulated as a result of salt tongue intrusion from the Atlantic during the dry season. In East Africa Asian rice (*O. sativa*) is also cultivated in the lower Tana delta in Kenya, and the lower Rufiji basin in Tanzania. In both deltas farmers take advantage of high tides which spread the river's floodwaters through small canals into cultivated areas (including small polders on the north shore of the lower Tana).

Flood recession agriculture is found throughout Africa, the classic, and quite probably historically antecedent, system dating back over five thousands years in Egypt where farmers not only planted behind the receding flood but also cut major canals and built large dikes to channel water between the Nile and adjacent basins. Perhaps 5,000 years ago more ambitious water management works were undertaken to prepare the cultivation of larger basins with basin irrigation continuing into the present century. Waterbury summarizes this system well:

Under the basin irrigation system humankind and the Nile river established a remarkable ecological balance at moderate levels of population density. The system's dynamics were simple. As the Nile's waters began to rise in flood in the late summer, teams of villagers would prepare off-take canals to channel the flood waters into large basins. These varied in size from perhaps 2,000 feddans (one feddan = 1.038 acres) where the alluvial plain was narrow to 20,000 feddans in the broad deltaic zones. Basins of 40,000 and even 80,000 feddans were not unknown, but the average, at least in recent times, has been about 7,000 feddans. Each main off-take canal would feed about eight basins, and as these had a natural downstream slope, they had to be subdivided by transverse barrages to

hold the water evenly over the entire surface. The slope of the canals would be less than that of the river in order to slow the flow of the flood waters.

Each basin would be allowed to fill to a level dependent on the volume of the flood. . . . The water would then be allowed to stand for 40-60 days on what were to become cultivated fields, deeply penetrating and saturating soils that had dried and cracked during the dry months. Then any excess water would be released to flow back into the Nile, now at a much lower stage because of the passing of the flood (1979: 27-28).

Though the colonial powers in tropical Africa tried similarly to manage floodwaters, especially along the Niger in Mali, but also in Nigeria and Senegal, local populations at most dug canals to channel water into adjacent basins. Very different crops were also grown in tropical Africa than in Egypt: "since the flood came to Egypt in late summer, only cool-season crops were suitable. Egypt grew such crops as barley, emmer, flax, chickpeas, and lentils, all imported from the Near East. The great African domesticates such as sorghum, pearl millet and Old World cotton were not grown in Egypt until late in historical times. The Nile did not flood at a suitable time for such warm-season crops" (Harlan and Pasquereau, 1969: 74).

In tropical Africa, while the basic pattern is the same throughout, a wide range of variation occurs in response to different conditions between river basins and within river basins. Everywhere crops are planted in succession during the dry season as the annual flood recedes, with successive harvests often continuing after the arrival of the rains, and even after the initial rise in water levels in the case of flood-tolerant species of sorghum in West Africa. The hoe is the major tool, although animal traction may also be used. Between river basins, there are major differences in preferred crops, while within a particular basin systems of recessionary cultivation vary in response to the steepness of the river bank, the prevalence of annually flooded overflow basins, and

the extent of tidal intrusion. In Somalia flood recession agriculture on the Juba south of Luuq is restricted to banks and adjacent flood plains of the river, while further downstream in the river's meander zone, most flood recession cultivation occurs in depressions (*deshek*) that are connected during the flood to the main river.

The main crops are cereals, maize in southern Africa, and rice and sorghum elsewhere, with some millet grown in West Africa. Except for cotton and tobacco, other crops are usually interplanted, including legumes, cucurbits and other vegetables. Crops are planted in succession as the water level falls during the dry season. The most drought-resistant crops, like millet in West Africa, are planted first. The lowest planting is timed to allow harvesting to just precede or coincide with the initial rise in water levels that follows the arrival of the next rainy season.

Total hectares sown differ from river basin to river basin, and from year to year within the same basin, varying in relationship to such factors as flood plain morphology, flood and soil conditions, and the nature of the preceding rainfed harvest. Larger areas are available for cultivation when flood waters penetrate inland basins as in the Lower Nile, the inland delta of the Niger and the Middle Senegal basin. In the Middle Senegal, for example, over 100,000 hectares may be sown following a "good" flood, whereas flood recession areas along the Middle Zambezi are largely confined to the primary channel of the river and to the deltas of tributaries. In both cases, as elsewhere, most people appear to cultivate less than a quarter of a hectare per active adult as opposed to over double that amount in regard to rainfed agriculture. Cultivation is relatively labor intensive due to the need to break up the surface to reduce water loss through capillary movement and to protect seeds and plants from pests. Weeding, on the other hand, tends to be less a constraint than with rainfed cultivation, especially where duration of inundation is a month or more.

Opinions on yields vary, no doubt because of the differential impact of flooding and pests in different areas and from one year to the next within the same area. In

Guinard's experience yields tend to be the same as in rainfed upland areas with the important exception of being less erratic (1988 written communication). The author's experience in the Middle Zambezi Valley parallels Guinard's. While Adams notes income figures from Lake Volta drawdown cultivation that are 1.4 times those from upland areas, the differential may be due more to the value of the crops grown (especially in regard to green maize and other vegetables) than the quantity, the same being the case with higher incomes derived from flood recession cultivation along the Niger and the Sokoto-Rima system in Nigeria where onions are an important cash crop. To sum up, yields of cereals tend to vary between 400 kg and 800 kg per hectare.

While areas cultivated per household usually are relatively small (in comparison to rainfed fields), land suitable for flood recession cultivation is the most highly valued by riverine populations, being subject to elaborate rights of usage and tenure. This value reflects several considerations. One is the orientation of the cultivators toward the river and toward flood recession gardens which become green at the very time that surrounding areas begin to wilt under the increasing heat of the dry season. In the Middle Zambezi, for example, riverine Tonga are apt to leave their villages during the hottest time of the year to set up housekeeping along the upper margin of their flood recession gardens, this being one reason why "outsiders" label them "people of the Zambezi." Another consideration is the fact that green vegetables (including fresh maize) become available during the driest and hottest part of the year. A third reason is the role of such gardens in bringing to an end, or at least interrupting, periods of hunger that follow the failure of rainfed agriculture. While this last reason has become increasingly important in the Sudano-Sahelian zones and the lower rainfall areas of central and southern Africa where increased frequency of drought over the past twenty years has adversely affected rainfed harvests, those same droughts have also reduced flooding and hence the extent of land available for recession cultivation.

(2) Valley or Swamp Cultivation

Valley or swamp cultivation deals primarily with swampy areas which may or may not be associated with external drainage. Moisture is provided by a combination of sources including seepage, rainfall, sheetflow and stream flow. On the plateaus of central and southern Africa, sites for valley cultivation are referred to as *dambos* and *vleis* respectively, whereas in Francophone West Africa they are referred to as *bas fonds*. In Nigeria a more generic term is used. This is *fadama* which includes any seasonally flooded (including river banks) or permanently flooded area. While a narrower definition is used here, classification becomes difficult where depressions and swampy areas may or may not be seasonally connected to riverine floodplains depending on the extent of local rains, sheet flow, and riverine flooding (see Adams and Carter, 1986, for further discussion).

Depending on flood conditions and the cropping system one to three crops per annum can be grown. During the rains rice is the preferred crop, although it may be replaced during periods of drought by other cereals. Following the rains a variety of cereals and vegetables are grown. While a major constraint is weeding due to competition from perennial grasses and other wild growth, yields and cash returns can be relatively high even though those reporting them consider them to be low in comparison to agricultural research stations. In Sierra Leone, for example, Rydzewski reports yields ranging from 450 to 1350 kg/ha (1984: 138). As for income, in the vicinity of Zaria, Nigeria, Norman notes villages where valley fields that were one tenth of the cultivated area provided close to one fourth of net farm income (as cited by Grove, 1985: 172).

Though not a new cropping system, the extent of valley cultivation in recent years has been on the rise, in part because of population increase (with people now farming swampy areas that formerly were used for grazing, fishing and gathering), and in part because of proximity to urban centers with an increasing demand for fresh vegetables.

Scope for further expansion is considerable. In the Gambia, 1980 estimates of "swamps" (which include both tidal and freshwater areas) exceed 100,000 hectares of which only one-third are cultivated (Carney, 1985: 18a). In Sierra Leone land available for valley cultivation is estimated at 300,000 hectares of which some 80,000 hectares are cultivated (Adams and Carter, 1986: 11). Although Adams and Carter estimate that *fadama* cultivation (here including floodplains) has more than quadrupled between the 1950s and the 1970s, with 800,000 hectares estimated to be under cultivation by 1981, the potential is estimated at two million hectares (*ibid.*, 2).

(3) Tidal Cultivation

Though tidal cultivation can be considered a variant of swamp cultivation, it has several distinguishing features which warrant separate consideration. These include coping with, and benefiting from, tidal intrusions and the predominance of Asian rice in the cropping system. Two variants of tidal cultivation have been reported in the literature: the relatively small scale East African version where tidal bores or flows are used to channel non saline floodwaters into rice fields and the larger scale West African version that has been best described from the Casamance region of Senegal (Linares, 1981) and the Gambia river (Carney, 1985).

Virtually nothing has been published on the East African version. In West Africa, a more accurate designation would be cultivation of tidal zones, the emphasis being on the reclamation of appropriate areas of mangrove swamp along the coast from Sierra Leone to Gambia and the lower reaches of the Casamance, the Gambia and other smaller rivers and tributaries (*marigots*). In the Casamance case mangrove swamps extend 150 kilometers inland, their upriver margin being determined by the extent of salt tongue (tidal) intrusion during the dryseason. Along the Gambia they extend 215 kilometers inland.

The antiquity of the cultivation of tidal zones is unclear. While floating rice has

probably been cultivated in fresh water sites for over a millennium, the Casamance being a secondary center of domestication for *Oryza glaberrima* according to Portères, it has either been replaced by Asian rice in tidal zones in recent centuries or was never cultivated there. Be as that may, by the time of arrival of the first Europeans "the Diola and their relatives in what is now Guinea-Bissau had already converted much of the mangrove swamp fringing the tidal estuaries of important rivers into a network of paddy fields" (Linares, 1981: 559). Since 1968, recurring droughts have adversely affected yields due to increasing salinity, which in some areas along the Gambia has even led to die off of mangrove swamps while elsewhere it has been a major factor, along with increasing labor migration rates, in the cessation of tidal cultivation.

Tidal cultivation of Asian rice is associated with the rainy season, the latter part of which corresponds to the annual flood, providing a six to seven month cultivation season in nondrought years. It reaches its highest development in the higher rainfall areas where Linares (ibid.) refers to impressive dikes and sluices with irrigated fields internally ridged (as along the southern portion of the Casamance delta where rainfall of 1200-1500 mm is recorded). Rainfall is needed to flush out the salts that accumulated during the dry season either through capillary action or tidal intrusion. With the arrival of the rains, seed beds are prepared in fresh water depressions, with the seedlings transplanted in the tidal fields after salinity levels have dropped. Close to the ocean dikes are built to preclude tidal intrusion, with two-way sluices regulating waterflows. Primarily dependent on rainfall, the first crop of rice may be followed by a second crop (either ratooned or newly planted) in years of adequate flooding.

In comparison to other types of floodwater cultivation yields are surprisingly high. The better watered portions of the Casamance delta, for example, "permit a labour-intensive wet rice monoculture, supporting up to 65 persons per km², to be practiced on the heavy clayey soils of the floodplain and tidal swamps" (ibid., 561), while a similar production system among the Balanta of Guinea-Bissau support "rural

populations at densities of 50 to 75 persons per km²" (ibid., 579). In both cases yields range between 2,500 and 3,500 kg per hectare. While sources do not discuss the reasons behind such high yields, they may well be related to the high productivity associated with the mangrove ecotome.

b. Irrigation

Both customary systems of riverine (as opposed to mountain) irrigation and more recent smallholder (as opposed to village association) pump irrigation have received scant attention from researchers, the most detailed analysis being Roder's 1973 study of the Gungawa in northwest Nigeria. Although irrigation is practiced by only a fraction of those who do some form of floodwater cultivation, the shadoof (a manually operated device with a weight at one end and a receptacle for raising water at the other) is especially common in Northern Nigeria and along the Nile both north and south of the Sahara in the Sudan.

Since the end of the second World War an increasing number of small-scale entrepreneurs have purchased small pumps for irrigating small riverine plots where they grow fresh vegetables and fruit for nearby urban markets, and onions, green beans, green fruit (mangoes, for example) and cut flowers for more distant markets (including contract farming for international ones). I have visited such small-scale entrepreneurs along the Zambezi, Tana, Juba, Nile, Logone-Chari, Niger, Volta, and Senegal Rivers. Along the Senegal returning migrants from France and elsewhere in West Africa have purchased larger pumps which may be used by village irrigation associations with and without government and donor assistance (Chapter 4). While irrigation farmers are less vulnerable to regularization of river flows in connection with dam construction than flood water cultivators, lower water levels increase the labor and the fuel costs for shadoof and pump operators, respectively, by increasing the height that water must be lifted, and by extending the period during which irrigation is needed in the case of

those who use shadoofs and pumps as a supplement to flood recession agriculture.

c. Fishing

Annual flooding significantly increases the productivity of riverine fisheries by providing a rich source of food and protection for spawning fish and their fry. In Welcomme's words, "the increase in the area of water during the floods releases nutrients from the terrestrial into the aquatic components of the system. This results in a surge of production centred primarily on the growth of higher plants, which in turn support both epiphytic organisms and dense colonies of creatures in their root masses" (1979: 81). These in turn provide food and protection to fish. "Good floods inundate larger areas, making available greater quantities of food, and improving conditions for reproduction and shelter. Recruitment, growth and survival are as a consequence better in years when discharges are high, subject to their timeliness, and the population is correspondingly greater" (*ibid.*, 177).

Not only are floodplains more prolific, but they are also easier for local populations to fish than the main channel. As a result a wide range of techniques, including night fishing with torches and spears, fish traps, fixed valved and valveless fish baskets, fish drives, seine, gill and cast nets, and poisons, have been developed to fish flood plains, with the fishing season starting when the floods encroach and continuing until the flood waters dry up or recede back into the primary channel. In some areas, the Nile Sudd, for example, and Zaire's Ubangi River, riverine communities increase the area of the floodplains by excavating canals to connect low lying basins to the main channel. Along the lower reaches of the Oueme in Benin, narrow trenches that may exceed a kilometer in length are dug perpendicular to the main channel, with entering fish caught when flood water subsequently recedes.

Throughout tropical Africa fish are an important source of animal protein, with observers from as far apart as South Africa (Heeg and Breen, 1982: 72), the Sudan and

West Africa noting "how riverine fisheries make available an important source of high quality protein in areas that otherwise would suffer from serious nutritional deficiencies" (Scudder and Conelly, 1985: 12). According to Henderson (1984 written communication), along the Nile and its tributaries in the Southern Sudan surveys suggest that some 40,000 tons of fish per year are consumed locally. Nile floodplains also support a major commercial fisheries. Although no figures are available on annual yields along the Nile, landings exceeding 100,000 tons per annum are reported from the inland delta of the Niger, and in the Lake Chad basin where fluctuations in water levels cause landings to vary between 30,000 tons per annum and 220,000 tons (Lowe-McConnell, 1985).

d. Livestock Management

Riverine habitats are important to the livestock of mixed farmers and transhumant pastoralists alike. Rainfed croplands provide post-harvest stover for livestock during the early part of the dry season. In the Middle Zambezi, the livestock are those of the farmers. In the Middle Niger, they tend to be those of transhumant pastoralists whose herds are welcomed by farmers because of the manure that they drop during their sojourn -- hence illustrating the type of complex interrelationships that link farmers and herdsmen of different ethnic groups (they are also linked by such other relationships as herding arrangements and exchange of cereals for animal products).

Of still greater importance for livestock, however, are floodplains after the recession of the annual flood. These provide a critically important source of pasture during the latter part of the dry season when vegetation elsewhere for grazers and browsers alike is scarce. At that time livestock converge upon wetlands from much more extensive upland range lands. Without access to such dry season pastures herd size could not be maintained. Examples include the livestock of the Tembe-Thonga along the lower reaches of the Pongolo in South Africa, of the Ila of the Zambian Kafue Flats, of the

Orma and Somali in the Tana delta of Kenya, of the Nilotic people who graze several million stock on the seasonally flooded wetlands that comprise the Sudd, and of the Peul and other West African peoples who are dependent on the floodplain pastures of the Lake Chad Basin, the Middle and Lower Niger and the Senegal along with other West African rivers and their tributaries.

These flood-dependent pastures support a variety of highly nutritious grasses which provide grazing at a critical point in the annual cycle. Some, like *Vossia*, emerge while flood waters are still standing with hungry cattle wading up to their necks to consume them. Others, like species of *Echinochloa*, thrive at the edge of the receding water while species of *Panicum* thrive after the flood waters have receded. So attractive are these "meadowlands" that it is not easy to get cattle to leave them when the arrival of the rains rejuvenates inland pastures.

4. The Distribution and Importance of Riverine Production Systems

The production systems described below are selected to show the importance of annual flooding for millions of people in widely separated regions of tropical Africa. Where riverine habitats have been altered by dam construction, irrigation systems and other river basin development activities, the descriptions apply to the pre-development situation.

a. The Lower Pongolo Floodplain

The Pongolo River rises in the highlands of South Africa and flows approximately 550 kilometers to enter the Indian Ocean in Mozambique where the river is called the Maputo. Though no doubt flood recession agriculture also occurs downriver, the best documentation is on the Lower Pongolo floodplain and the adjacent Makatini Flats. The local population consists of approximately 40,000 Bantu-speaking Tembe-Thonga who can grow two crops annually during years of normal flood, one being a rainfed crop

and the other a flood recession crop. Very valuable grazing for stock is provided during the dry season when flood waters recede. "(D)ependent upon periodic flooding for their maintenance," *Cynodon dactylon* grasslands are "extremely important" (Heeg and Breen, 1982: 65). Important also for people, especially during hunger years, are water lily tubers (*Nymphaea* spp.) and water chestnuts (*Trapa* spp.).

Heeg and Breen report information that the local people have the highest nutritional status of any "rural black population in Natal" (p. 72). This they associate with what appears to be an adequate intake of animal protein, of which 400 tons of fish per annum from the floodplain is the most important source. Because of population increase, however, all available floodplain land is under utilization, while marginal upland sandy soils are increasingly being placed under cultivation. Labor migration rates among men have been rising having gone from somewhat less than 20 percent in 1960 to approximately "28 percent by 1970" (p. 62).

b. The Zambezi and Its Tributaries

(1) The Middle Zambezi Valley

Prior to the construction of the Kariba Dam in the late 1950s, the Gwembe portion of the Middle Zambezi Valley supported over 60 people per square kilometer in the vicinity of the Zambezi River and the deltas of its major tributaries. As with the riverine populations of the Luapula River in northern Zambia, this was one of the highest rural population densities in Central Africa, and was due to the utilization of the fertile alluvial soils of the Zambezi for growing two crops annually.

The diversified production system of approximately 85,000 Tonga-speakers had the same components as that of the Tembe-Thonga, although their relative importance varied. Because of tsetse infestation, cattle and other livestock were of less importance in parts of the Valley, although recession cultivation and fishing played a similar role in the lives of the people. While labor migration had also become increasingly

important, with 42 percent of taxable men absent in 1956 (Colson, 1960: 32), the dynamics involved are complicated -- both in regard to the reasons for increasing labor migration and its impacts on riverine production systems. In the early part of the twentieth century labor migration was primarily a response to colonial policies which, on the one hand, required cash payment of taxes and, on the other hand, did not encourage commercial agriculture in the African reserves. Subsequently it became more a means to accumulate savings to purchase consumer goods, finance marriages, and acquire a greater degree of independence from senior kin. Still more recently wage labor has also become a major source of support for those with restricted access to land because of population increase, scarcity of alluvial lands and degradation of older alluvial soils which are not annually inundated.

(2) The Barotse Plains of the Upper Zambezi

Floodplains were even more important for the people who inhabited the Barotse Plains on the Upper Zambezi above Victoria Falls. The dominant Lozi who ruled a kingdom comprising, at its height, some 25 ethnic groups, focused on a floodplain 120 miles long and up to 25 miles wide. According to Gluckman, "the flood dominates Lozi life. It covers and uncovers gardens, fertilizing and watering them; it fixes the pasturing of the cattle; it conditions the methods of fishing. All life in the Plain moves with the flood. . . . The Lozi calendar is largely defined by the state of the flood. The two great national events of the year are the moves of the king between his Plain and his margin capitals" (1951: 11).

(3) The Kafue Flats

Major tributaries of the Zambezi, including the Kafue, Luangwa and Shire, also played a critical role for other Zambian peoples. The best described example is the Kafue Flats, the material in this section drawn from reports of the University of

Zambia's Kafue Basin Research Committee (Williams and Howard, 1977 and Howard and Williams, 1982); Fielder, 1973, LaMunier, 1969 and a series of unpublished papers by Hayward (1981-83). The area of wetlands is approximately 7000 square miles in the middle of Zambia (Figure 4). Through the Flats, which extend some 250 kilometers with a maximum width of over 50 kilometers, "the Kafue takes a meandering and indeterminate course . . . , the main stream splitting and joining in places. Many blind-ended 'lagoons' are linked to the river, and these and other water or swamp-filled depressions ('ox-bow lakes') are indicative of former river courses" (Williams and Howard, 1977: 13).

Prior to the development of the Kafue Flats fishery, which attracted people from within and without Zambia, the only permanent residents within the Flats were the Twa who were acknowledged by the surrounding villagers to have customary fishing rights. These surrounding villagers belonged to several ethnic groups, including the cattle-rich Ila. All farmed the uplands surrounding the flats during the rainy season, and then planted flood recession gardens which were harvested "at the end of the dry season, thus alleviating the possibility of famine during the main growing season" (Rennie, 1982: 38).

The surrounding villagers were also mixed farmers, combining agriculture with animal husbandry. Cattle were especially important. In the mid-1970s Bingham estimated that approximately 250,000 cattle (or between 10 to 20 percent of the national herd) were dependent on grazing the flats during the dry season, and especially during the critical three to four months preceding the commencement of the rains (1982: pp 95 and 98). Though all the surrounding people plow with oxen, the Ila were more herders than farmers. With approximately 13 head of cattle per adult male, in the early 1970s Fielder (1973) considered them to be the wealthiest pastoralists in Central Africa. During the dry season the welfare of their stock was dependent on the Flats and especially on *Echinochloa stagnina* and *Vossia* spp. which dominated the wetland grasses

and had a carrying capacity estimated at approximately two hectares per cattle unit. In the Ila heartland around Namwala, annually cattle were driven across the river after the flood to graze the northern wetlands, with the services of Twa ritual leaders sought for protection during the crossing, while the knowledge of other Twa was used to find strayed cattle (Lehmann in Williams and Howard, 1977: 44).

According to Rennie, in the flooded areas there was an "ecological cycle which connects cattle and fish. When the floods subside, lush grass appears. Unless this is grazed by the cattle, during the next flood the decomposing vegetation reduces the oxygen level in the water and thus the fish population. In addition cattle manure provides nutrient for the fish. Ila therefore recognize the connection between good dry-season grazing, and a good fish catch during the subsequent floods" (ibid., 38). While a similar association also existed between the large herds of lechwe antelope which utilized the Flats (and were periodically thinned by large communal hunts), fishery productivity was especially influenced by the extent of flooding, with good yields following good floods.

The Kafue fishery is one of the most productive in Zambia. During the 1968-1977 period, for example, landings from the commercial fishery varied from a low of 3400 tons in 1974 to a high of 9829 tons in 1977. The history of this commercial fishery illustrates the dynamics that so often are associated with local production systems. Though fishing in the 19th century was primarily consumption oriented, even before the British consolidated their power in the area, local villagers were fighting a losing battle against in-migrating Lozi fishermen from the upper Zambezi. In 1882, for example, the Lozi Paramount levied an annual tribute against local Tonga and Ila. According to LaMuniere "the Paramount claimed the right to hunt, fish, to own land and to keep representatives in Ila and Tonga land" (1969: 41). By at least 1917 incoming parties of Lozi fishermen had begun to commercialize a fishery which they continued to dominate until the 1950s.

By the end of the 1950s the expanding Kafue fishery had attracted a multiethnic population from Zambia, Malawi and Tanzania. The majority in LaMunier's 1961 sample had arrived during the past ten years, many having lost their previous source of employment during the recession on the Copperbelt that began in the late 1950s (Hayward reports a similar influx of the unemployed and the underemployed following the commencement of the current depression in the mid 1970s). However, Lamunier explains the rapid commercialization of the fishery during the 1950s primarily in terms of three other factors. One was the introduction of nylon gill nets in the mid-1950s with estimated production increasing from 1700 tons in 1954 to a high point of over 11,000 tons in 1958. The other two factors were the increasing demand for fish in nearby urban centers and on the copperbelt, and the rapid development of the fish trade, with hundreds of relatively small-scale traders responding to the opportunity provided by increased catches and increased demand.

c. The Delta of Kenya's Tana River

The Tana Delta is utilized by a number of ethnic groups of which historically the most important were the agricultural Pokomo and the transhumant pastoral Orma. In more recent times land pressure to the south has resulted in some colonization of the delta by Girriama, while drought and political instability to the north have stimulated some Somali sedentarization within the Valley. Also in more recent times, the wealthier Pokomo have begun to acquire cattle (often cared for by Orma herdsman), while cattle-poor Orma, as well as some Orma elite, have taken up agriculture. Both Orma and Pokomo have also organized cooperative ranches.

Notwithstanding the above dynamics, the Pokomo remain primarily agriculturalists and the Orma primarily pastoralists. The former practice recessional cultivation when the annual flooding caused by the "long" rains recedes, the primary crop being rice. They also practice some flood rise agriculture by channeling the rising waters into

carefully leveled paddy fields, with such tree crops as bananas, mangoes and papaya grown on the surrounding bunds. Little and Scudder were also informed during fieldwork that incoming tidal movements are used to divert river flows of fresh water into paddy fields during the flood season. Marsland (1937: 58) reports similar use of tides for flood rice cultivation in the Rufiji Valley of Tanzania.

Coinciding largely with the southern half of the delta the Tana River District contains one of the largest cattle concentrations in Kenya. Dependent on grazing that is renewed by annual flooding, these cattle are not only a major source of meat for the Nairobi market, but they are also "a major source of immature cattle for ranches in Taita and other coastal districts" (Little, 1987: 79).

d. The Sudd in the Central Sudan

One of the largest wetlands in the World, the Sudd is an essential resource for over one million Nilotic people and several million livestock. When rising flood waters top the natural levels of the Nile and join rainfed sheet flow to inundate a flood plain of thousands of square kilometers, east of the Sudd Nilotes and their stock shift to the adjacent uplands where they cultivate rainfed crops. As the flood waters recede, stock are driven across the intermediate pastures to graze the seasonally inundated areas (*toich*) throughout the dry season. Among the Nuer, whole villages move down to the cattle camps where fishing is also undertaken. Among the Dinka, the elders and children stay in the villages where ratooning may provide a second crop of sorghum, while the young men and women move to the cattle and fish camps.

To the southwest, reduced wetland areas and the presence of tsetse flies in adjacent uplands are associated with lower densities of both people and livestock. To the northwest, "population densities are much higher, presumably because there are large areas of tsetse-free uplands coupled with extensive *toich*. . . . Exploiting the exceptionally productive ecotome between land and water, the Dinka . . . have attained

high population densities. Where migration has been difficult, a major Dinka response has been a degree of agricultural intensification. . . . During the dry season cattle graze on *toich* and other pastures during the day. At night they are staked out, approximately a meter apart, on garden land, being rotated to another parcel or garden after approximately a week" (Scudder, 1980: 387-388). The whole system is mutually reinforcing. Seasonally inundated pastures provide dry season grazing for sufficient cattle to deliver three to five tons of manure per hectare to garden land, the fertilization of which is therefore indirectly tied to the annual flood of the Nile.

e. West Africa: The Senegal, Lake Chad and Niger Basins

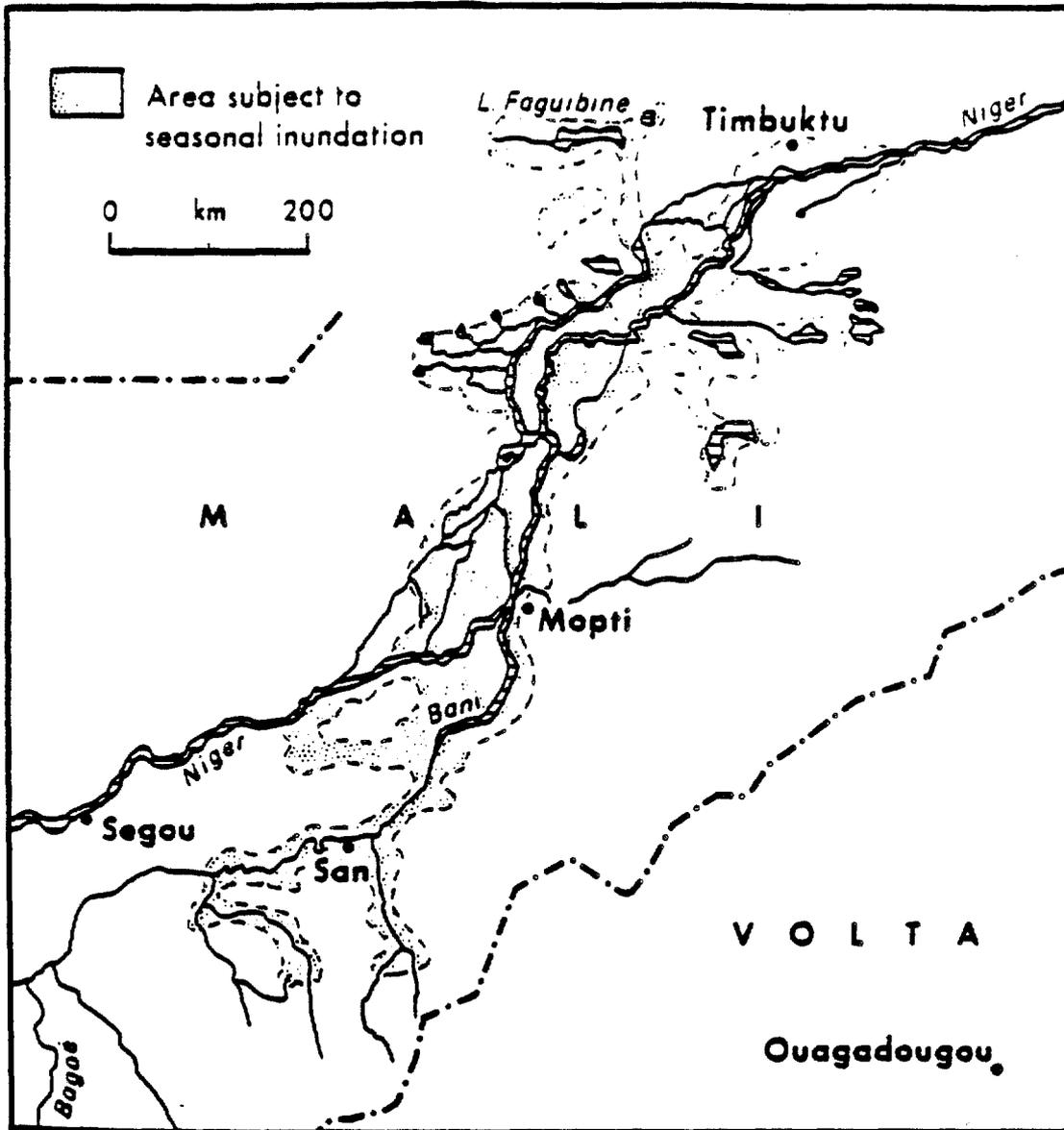
The most intricate systems of production are associated with the Senegal, Lake Chad, and Niger Basins where they involve more complex relationships among ethnic groups than occur in East, Central and Southern Africa. In each case floodwater cultivators, herders, and fisherfolk are involved. Larger numbers of people and larger amounts of land than in other parts of Africa are also involved. In good years, well over 300,000, and perhaps more than 500,000, hectares are utilized for flood recession agriculture (over 100,000 hectares in the Senegal Basin, an estimated 165,000 hectares along the Niger in Guinea, Mali and Niger, of which up to 110,000 hectares are within the inland delta, and extensive but unknown area in the Nigerian portion of the Niger basin and in the Lake Chad-Logone-Chari basins).

(1) The Inland Delta

Some of the most detailed descriptions of riverine production systems relate to the Niger basin -- both to the inland delta in Mali and to the Niger and its tributaries in Northern Nigeria. During the mid-1950s nearly half a million people utilized the inland delta (Figure 5), including 70,000 farmers, 80,000 fishermen and over 300,000 pastoralists (Gallais, 1967). Periodically they were incorporated within a single political

96A

FIGURE 5



The Inland Delta of the Niger

Source: Harris, 1980: 389

framework, with the various ethnic and occupational groups linked together in a set of dynamic and complex relationships which "have maintained environmental quality . . . , with each population of producers using a repertoire of diverse techniques that is modified from time to time according to labour resources, management needs, and local environmental and sociopolitical conditions" (Scudder, 1980: 388).

Numerically and politically the pastoral FulBe have been the dominant force in and around the inland delta for centuries. As with other African wetlands, the inland delta draws cattle and small stock from surrounding areas during the post-flood season, with customary users alternating between rainy season pastures as far afield as Mauritania and dry season pastures in the inland delta. During 1977 Breman and his colleagues studied the annual cycle of transhumance of one herd: "during the 9 months (November till July) of the dry season the herd feeds on perennial grasses of the flood plain of the Niger. First they feed on their own pasture reserves belonging to the village, and then later on they move to the common pastures in the middle of the Central Delta. During the rainy season, when the Delta is flooded, the herd moves on to the newly established pastures of annual grasses and herbs in the South-east of Mauritania" (1978: 3). According to their estimates about two million cattle were dependent on the inland delta at that time.

While the importance of the inland delta has been enhanced by recent drought, the expansion of agriculture and stock ownership among farmers coupled with the inflow of more stock and herders has led to increasing conflict between pastoralists, farmers and fisherfolk (Cissé, 1985) as well as to reports of degradation of the surrounding nonflooded plains. As in the Sudan, Kenya, Zambia and elsewhere, internationally funded government projects have exacerbated the problem. Referring to Operation Riz-Mopti (ORM) in the mid-1980s Simmons notes that "the takeover of traditional riverine pastures (*bourgou*) for rice cultivation has already been an issue and the integration of livestock and rice is a constant problem for farmers and ORM. The annual passage of

the major herds from the wet season pastures in the north to the dry season pastures in the south requires political intervention at their highest levels: timing is critical to minimize crop damage while maximizing herds' use of the Delta pasture and water supplies as they move south" (1986: 9). To resolve such problems Bass notes that the masterplan being prepared for the inland delta by the International Union for the Conservation of Nature will include "novel proposals" (1986: 24) for utilizing indigenous conflict resolution techniques from the nineteenth century for management purposes (at that time the delta was divided by the Macina state into 37 districts under the control of village elders coordinating the use of land and water resources).

Inland delta farmers cultivate cereal crops on both the rising (*crue*) and falling (*décrue*) flood. According to Portères (1962), the inland delta was a center for the domestication of floating rice thousands of years ago. Today it continues to be the main center for flood rise agriculture, with floating varieties of rice planted just before the river begins to rise. Like the floating rice of southeast Asia, these varieties are able to rapidly lengthen their stems as water levels rise, with farmers harvesting the crop from dugout canoes. Yields tend to range between 500 to 800 kg per hectare. Nonfloating varieties of rice are planted later in higher areas which are only flooded to a shallow depth, the crop being harvested after the floods recede.

As for flood recession agriculture, that is a more sophisticated version of the systems already described. Depending on slope, type of connection to the river and the extent of the annual flood, the amount of land cultivated from year to year may vary by a factor of two or three. Two cereal crops are sown, with the more drought-resistant millet planted on the higher slopes, while sorghum is planted lower down. Sorghum is the dominant crop with yields estimated at about 800 kg per hectare. Two varieties of sorghum are utilized, a more drought-resistant durra type and a more flood-resistant guinea corn. The latter is planted on the lowest slopes both because it is less drought-resistant and because it is able to tolerate a degree of inundation if the next

flood commences before the crop is harvested. To further reduce risks by shortening the cultivation season, farmers may transplant seedbed grown guinea corn to their lower gardens as soon as flood waters recede. In addition to selecting crops because of their response to different flood and soil conditions, farmers also take under consideration previous experience with pests in selecting varieties and planting dates (Harlan and Pasquereau, 1969).

Throughout the upper and middle reaches of the Niger, commercial fishing is undertaken by specialist populations who have mastered the use of floating nets on the main channel. In the inland delta, Lowe-McConnell (1985) estimates number of fishermen at 50,000 (with another 1,300 in Niger, 4,600 in Nigeria up to the delta, 5,000 on the Benue and an unknown number in the delta itself). Two ethnic groups -- the Bozo and the Somono -- provide most of the fishermen in the inland delta: "they form a well-structured social group with uncanny knowledge of their physical environment and a large range of traditional means to control their fish production. They have a large variety of gear, from seines to catch nets, dragged mesh nets to barrages" (CILSS, 1975: 3). Under favorable conditions annual yields of 100,000 tons are not exceptional for the inland delta. Elsewhere in the Niger system, the next most productive fisheries is the delta where Lowe-McConnell reports landings of 60,000 tons per annum (ibid).

(2) Northeast Nigeria

(a) The Lower Sokoto Basin

Adams has described in detail the riverine production system of some 50,000 people living along the Sokoto River between the Bakolori Reservoir and Sokoto (1986) and the adverse impacts of the Bakolori Dam on that production system (1985b and c). The riverine strip is about 120 kilometers long, while the total area cultivated during the rains and the dry season is approximately 170 square kilometers. During the rains

farmers interplant upland gardens with cereals, legumes and cucurbits as elsewhere. They also utilize at least 20 varieties of rice. Rice (both Asian rice and West African floating rice) is sown in areas (*fadamas*) which are seasonally inundated by rainfed sheet flow and by flood waters. What Adams refers to as relay cropping also utilizes *fadama* areas for recessional agriculture during the dry season as water levels drop.

In Adams' words,

there are a great number of local varieties of rice and sorghum in the flood-plain adapted to particular conditions of flooding, soil waterlogging and desiccation through the growing season. In general the flood plain is about 90 percent cultivated, although some areas are less intensively worked. The most important aspect of the flood-plain in agricultural terms is its capacity to support cultivation using residual soil moisture into the dry season and after the end of the rains. In the drier parts of the flood-plain, the wet season crops are followed by a series of relay crops such as cotton, groundnuts and cowpeas, similar to those grown on surrounding upland rainfed land. In the damper areas, rice or sorghum are, however, followed by a number of different vegetable crops (onions, peppers of various sorts, potatoes or cassava, for example) grown in small gardens. These cover a far smaller area of the flood-plain, but the quality of husbandry is high, and the crops valuable. Shallow wells are often dug, either in the plot itself or in the bed of a dried-up channel, and water applied to the plot, sometimes by shadoof (1985b: 295).

More recently, Adams notes that "The key factor in floodplain cultivation is the extent and duration of *fadama* surface-flooding in the wet season. Although local runoff and even rain alone can cause limited flooding in the *fadama*, extensive inundation depends on overbank discharge in the main river" (1986: 33).

(b) The Pre-Kainji Dam Reservoir Basin Area

Before the construction of the Kainji Dam, several detailed studies of local riverine production systems were carried out in the future reservoir basin under the auspices of the UNDP-FAO-Nigerian Kainji Lake Research Program. The area is occupied by at least 10 ethnic groups whose villages may be interspersed and who are characterized by varying dependence on the Niger and its floodplains. At least half of these groups combine flood recession agriculture with manual lift (*shadoof*) irrigation. The most sophisticated farmers in the 1960s were the Gungawa who had shifted almost entirely from flood recession agriculture to small-scale, single household irrigation (Roder, 1970). The river bank was terraced and divided into small plots. Though other vegetables were grown, the main crop was onions. Seedlings were transplanted from seedbeds as the water level dropped, with the harvest sold to centers as far away as Ibadan.

As elsewhere rainfed agriculture was more widely distributed over upland areas where sorghum and millet, legumes and cucurbits were interplanted. Rice was also planted in seasonally flooded areas (*fadamas*). After the rainfed harvest, the herds of pastoralists were encouraged to graze the stubble during the dry season, manuring the fields in the process. As in the inland delta, the FulBe were the main herders, with farmers increasingly hiring them to take care of their own stock. Later in the dry season, cattle were driven into wetlands or across the river to Foge Island to graze the grasslands nurtured by the annual flood.

Fishing was carried out on a subsistence basis by many people and on a professional basis by the Sarkawa and the Kyedyawa, with commercial landings of dried fish trucked out of the regional center of Yelwa. According to Jenness (1973: 49), three distinct types of fishing were common. These were "(1) a low grade, primarily upland creek pattern; (2) a more advanced and intense Niger River marginal

swamp pattern; and (3) a professional, river and swamp, pattern. Each of these has changed noticeably in the last twenty years with the advent of cheap and easily available nylon gillnets and machine made hooks."

D. THE DEVELOPMENT POTENTIAL AND ENHANCEMENT OF RIVERINE HABITATS AND PRODUCTION SYSTEMS

1. Introduction

No systematic attempts have been made by African governments (including universities and research centers), former colonial powers, donors or international researchers to assess systematically the development potential of riverine floodplains or production systems in tropical Africa. In their 1982 report on the Pongolo Floodplain, for example, Heeg and Breen wrote that, "the asset value of the floodplain has not yet been considered in any of the development plans, largely because none of the planners have ever visited it" (p. 92). Similar statements could be made for other riverine habitats throughout Africa. In the Kainji case, for example, "no attempt was made to evaluate the impact of the dam in downstream areas," while "little effort has been made to monitor . . . the downstream effects of the dam" (Welcomme, editor, 1979: 21). The situation is identical in regard to dam construction in Kenya's Tana River Basin. Here the lack of attention to downriver impacts is even less justified; first because five dams are involved, and second because the construction on the fifth, Kiambere, proceeded after environmental guidelines for World Bank-financed projects had been formulated and approved.

The best assessments of the development potential of riverine habitats and production systems are the research papers and seminars sponsored by the University of Zambia's Kafue Basin Research Committee, on the one hand, and the AID-financed environmental and socioeconomic assessments of the Senegal, Gambia and Juba River Basins, on the other hand. Though more detailed than various UNDP-funded river

basin surveys, these studies are nonetheless incomplete, in large part because they were in response to government intentions to build dams to serve other goals. For that reason, the various studies were more concerned with mitigation of adverse effects on riverine ecology and local populations of dams designed primarily for hydropower generation and large-scale irrigation rather than for the enhancement of local production systems.

While the absence of careful assessments of the development potential of riverine production systems is unfortunate, enough is known to suggest that the potential is considerable.

2. Analyses of Potential

The most detailed assessment of potential applies to Zambia's Kafue Flats, and specifically to a series of studies carried out under the auspices of the Kafue Basin Research Committee. The University of Zambia's Kafue Basin Research Project was approved by the University senate in 1967 after President Kaunda had announced the previous year that Zambia would go ahead with the Kafue Scheme. Though an earlier UNDP-funded and FAO-executed "multipurpose" survey of the basin had noted various mitigating measures to "protect" the Kafue Flats, Kafue was essentially a unipurpose scheme to generate electricity for ensuring Zambian self-sufficiency in the event that the Rhodesian government diverted supplies generated at Kariba.

The Kafue Scheme was completed in two major stages. Stage one involved the construction of the Kafue Gorge Dam and power station immediately downstream from the eastern end of the Kafue Flats. Work began in 1967 and was completed in 1972. Stage two involved increasing the generating capacity at the gorge dam and building the Itezhitezhi Dam upriver from the Flats to regulate the flow of the Kafue. Construction began in 1972 and was completed in 1978.

The University's Kafue studies began in 1968. Their purpose, reinforced by a

request in the mid-1970s from Zambia's National Council for Scientific Research for further information on the implications of Kafue Basin development, was to carry out a balanced program of interdisciplinary research which "could contribute to the planned development of the Kafue Basin" (Williams and Howard, 1977: 5). While useful research has been completed, this goal has not been realized simply because generation of hydroelectric power has dominated the thinking of both the implementing agency (the Zambia Electricity Supply Corporation or ZESCO) and the main funding agency (the World Bank) with the result that insufficient water is available for other purposes including irrigation and habitat management.

The Kafue Flats case is instructive not just because of the importance of the Flats to the Twa and the surrounding populations and their livestock but also because of its importance to Zambia. While most African societies were sufficiently satisfying to their members that the colonial authorities initially had to use taxation as a mechanism to induce active males to join the colonial labor force, rates of labor migration have remained relatively low among the Ila as well as among other agro-pastoralists using major African wetlands. While the situation is less clear among agriculturalists, in part because of population increase and riverine degradation, in Kenya Little and I were informed that the agricultural Pokomo in the northern portion of the Tana Delta had relatively low labor migration rates by Kenyan standards and that they had not needed food relief following recent droughts.

In the Ila case, Rennie asks, "Was there any internal dynamic which might have impelled people in this area, or sections of them, to respond positively to the economic change brought by colonial rule? My conclusion is that there was virtually nothing which the colonial economy could offer which would have resulted in a large-scale response." He then goes on to write, "There can be no doubt that the more perceptive of the population are aware that their present relative prosperity, all too rare in a Zambian rural area, is due to their refusal to be incorporated within the colonial

economy on the terms of the colonialists. By refusing to be drawn wholesale into the labour migration network, by refusing to sell cattle at the rates required by the colonial government, by retaining many of the traditional cultural values and functions of cattle, they have to a certain extent protected their economic position" (in Howard and Williams, 1977: 39 and 41).

Areas like the Kafue Flats historically have also served as magnets for outsiders during "bad times." Such is the case today, for example, in regard to the inland delta of the Niger, the Lake Chad basin, and the Tana River delta. In the Kafue case, Zambia's economic downturn since the mid-1970s has "seriously reduced employment opportunities, with many unemployed and underemployed men turning to fishing and the fish trade" associated with the Kafue Flats (Scudder and Conelly, 1985: 31). According to Hayward, continuation of the downturn has also drawn upper income civil servants and other urban residents into the fishery as absentee owners for fishing boats and gear who recruit their labor force from what has become a rural proletariat: "economic pressure within the society as a whole is thus increasingly pushing the higher economic strata into informal activities and reproducing overall socio-economic stratification in the informal sector as well." Little (1985) has documented a similar phenomenon in regard to cattle ownership in Kenya's Baringo Lake Basin, while the two of us observed a like situation in the Lower Tana Basin.

Africa's major wetlands, such as the Kafue Flats, the inland delta of the Niger, the Lake Chad Basin, the aggregate of riverine habitats within Nigeria, and the Sudd, have more than local or even regional importance. They are major national resources. In the Kafue case, Bingham writes in the same publication as Rennie that the Lower Kafue Basin, which is dominated by the Flats, "is the single most valuable agricultural entity in Zambia, and probably in Central Africa" (p. 102). No doubt Howard and Williams had this in mind when they concluded in the preface to their first volume on the Flats that the Kafue Basin Research Committee "believes that development plans

should recognize that biological and agricultural necessities may ultimately overwhelm other factors: in particular that the biological productivity of an area such as the Kafue Flats may in the long run prove to be vastly more important to mankind than its short term value as a modified water storage for the generation of electric power."

In the case of Nigerian riverine habitats, Adams notes that, "the productivity and extent of floodplain land cultivated using traditional techniques . . . can be contrasted with the poor performance, small area and high cost of formal irrigation schemes. . . . About one million ha are cultivated under some kind of traditional irrigation or flood-adapted cropping in Nigeria, compared with only 30,000 ha developed for formal irrigation" (1986: 30).

When viewed from such an agricultural and biological perspective, a very strong argument exists for using river basin development to increase rather than decrease the productivity of riverine production systems, especially granted the increasing awareness that the industrial development of Africa's predominantly agrarian states requires that development to go on hand in hand with agricultural development (Mellor, 1986).

3. The Enhancement of Riverine Habitats and Production Systems

a. Introduction

Riverine production systems are clearly important for millions of people and their livestock. Requiring little capital, until recent years they were environmentally sound and relatively productive, with yields of fish apt to range between 20 and 30 kg per hectare (and over 50 kg per hectare in exceptionally favorable locales), with the better floodwater pastures able to support one livestock unit for every two hectares, and with cereal yields ranging between 400 and 800 kg per hectare. Provided appropriate policies are implemented, the issue addressed in this section is the extent to which such yields can either be increased or spread over a wider area. While there is quite a bit of information on possibilities for extending the area under utilization, there is little

research on intensification -- this being a gap that needs correction at the earliest possible movement. What information is available from research in the 1970s along the Senegal River suggests that sorghum yields, for example, can be increased two to three fold through use of some fertilizer (urea, for example) and improved water management.

The key to the enhancement of riverine and lacustrine habitats and production systems is improved water management. Ironically, since dam construction to date has been a degrading factor, that management may well require the construction of more tributary and mainstream dams, although of course their design and operation would have to allow a regularized drawdown of the reservoir and a controlled downriver flood of sufficient duration.

b. Reservoir Basins

Because of the priority given to hydropower generation and downriver irrigation, the development potential of manmade lakes in the tropics in general and in Africa specifically has been underestimated, except for fisheries and except by local populations. Though fisheries productivity downriver is decreased by dam construction since inevitably there is some reduction in flooding and nutrient levels, this drop in productivity, in some cases, can be more than offset by the development of a reservoir fishery as in the case of Lakes Kariba, Volta, and Nasser/Nubia (behind the High Dam at Aswan).

At Kariba the development of an artisanal fishery was carefully planned and implemented in the late 1950s and early 1960s. Landings rose to approximately 7000 tons in 1963, before dropping to less than 2000 tons when the initial bloom of productivity that follows impoundment ceased. Income from fish sales during those good years enabled many northbank residents to purchase cattle and plows hence speeding the transition from hoe cultivation to the use of the plow, and the

development of the cash cropping of cotton. Fishing profits were also a major source of funds for financing education of children and other dependents during the years immediately before and after Zambia's independence, and they were the largest single source of capital for opening small businesses within the Zambian portion of the Kariba Lake Basin. Encouraging the sale of village produce and of locally brewed beer, the artisanal fishery also played the major role in drawing village women into a market economy. More recently the stocking of Kariba in the late 1960s with the Lake Tanganyika sardine (*Limnothrissa* spp.) has led to a large scale open water commercial fishery landing up to 8000 tons of sardines per year in Zambian waters and over 10,000 tons in Zimbabwean waters. The development of the Volta reservoir fishery has been on a still larger scale. During the period of high productivity following impoundment landings reached 60,000 tons. Though they subsequently dropped to approximately 30,000 tons, thousands of fishermen and their families continue to be supported by the fishery.

In contrast to fisheries, little attention has been paid to enhancing the potential of reservoir basins for livestock development. Once reservoirs stabilize, their upper margins and drawdown areas tend to be colonized by highly nutritious grasses which can support moderate densities of livestock and wildlife. At Kariba, the grazing along the foreshore now rivals that of the Kafue flats, with extensive pastures of *Panicum repens* supporting tens of thousands of cattle during the long dry season on the Zambian side, and big game (including elephants and buffalo) and other wildlife on the Zimbabwean side. West African reservoirs presumably have similar potential; indeed the drawdown area of the Manantali reservoir can be expected to become a major source of grazing for pasture-starved stock once the reservoir fills. Lake Kainji presumably already provides an important source of grazing, while the northern margins of Lake Volta could serve as a fattening ground for Sahelian stock before they are sent by the newly developed lake transport system to markets in the south.

Local populations around the edge of Lakes Kariba, Volta, Aswan and Kainji, and no doubt other reservoirs, have also begun to practice recessional cultivation within the drawdown area. At Kariba, for example, recessional cultivation over the more extensive Zambian drawdown areas provided the major source of locally produced maize during the 1981-1984 drought. Notwithstanding, the potential of the drawdown area has been largely ignored by planners and ministries of rural development, the principal exceptions being soil and crop surveys and pilot projects with small pumps carried out on Lake Volta during the 1970s and the 1980s by various organizations (including the Volta River Authority, FAO, local research institutes and private voluntary organizations), research under the Kainji Lake Research Institute, and private voluntary organization, Ministry of Agriculture and Water Resources, and FAO research on the Zambian shores of Lake Kariba. While such research points up the underutilized potential of the drawdown area (a potential which the conservationists tend to ignore in their critique of dam construction), its realization requires guaranteeing to farmers a number of water free days during which they can grow recessional crops and an extension system which informs farmers when they can expect reservoir levels to begin to fall and when they can expect them to rise. Though no studies on such synchronization have been carried out, it should be possible to combine a regularized drawdown with a controlled flood below the dam, hence increasing the agricultural benefits, and income and employment generation benefits, to an extent which could very well offset losses in power generation and electricity derived revenue.

c. Riverine Production Systems below the Dam

While riverine production systems are dependent on annual flooding, the very irregularity of that flooding in much of Africa is a major constraint to their development. If the flood is too early it can sweep away rainy season crops planted on alluvial soils before they are harvested. If it is too high it can destroy crops on

perimeter soils which are not normally flooded and leave essential pasture lands inundated and hence unavailable throughout the dry season. And if the flood is below normal, the area that can be put under recessional cultivation and the area that can be grazed throughout the dry season is greatly reduced.

The adverse effects of irregular flooding are documented in case after case. In the inland delta of the Niger irregular flooding adversely affects crops one year out of three. In the Sudd higher water levels since the 1960s have eliminated important seasonal grazing grounds around Fangat. Along the Middle Zambezi, the record flood of 1957 came a month early, sweeping away most of the crops planted on floodplain soils. The rapid retreat of those same flood waters caused recessional crops planted on the higher slopes to dry up subsequently, while an earlier than usual rise in water level due to the early commencement of the following rainy season flooded out recessional crops on the lower slopes before they could be harvested.

Although the ancient Egyptians were apparently able to manage the annual flood of the Nile in such a way as to support a dense population in an environmentally sustainable fashion without the construction of major dams, the few efforts along similar lines by colonial governments in tropical Africa have had mixed results at best. Though it may be related to the more favorable topography of the lower Nile (and especially the Fayum and the delta), the reason for this situation is unclear. Be as that may, the record to date suggests that the necessary water control might best be provided through dam construction combined with a controlled downriver flood.

Most examples of partial water control come from the Niger basin, involving both British and French efforts. Adams discusses various attempts between 1917 and 1925 to divert and retain waters in basins adjacent to the Sokoto-Rima system through the construction of canals, dikes and small dams. The local population, however, were unable to maintain these works with the result that many were seriously eroded or washed away by subsequent floods. Even when they withstood flooding, a major

problem was the speed with which flood waters rose in the basins and the variable depth of water from one year to another. Too rapid a rise of flood waters snuffed out newly planted rice, while too slow a withdrawal interfered with recessional cultivation, grazing and certain types of fishing -- clap net use, for example. During other years, inadequate flooding failed to fill the basins (1985d: 12-20).

In summarizing the unsuccessful British experience in the Sokoto-Rima system, Adams suggests that the outcome could have been different if construction had been preceded by adequate hydrological and technical surveys, if construction had been more professional, and if the whole effort had not been so dependent on a single administrator. Perhaps so; however, the French and, since independence, the Malian experience in the Middle Niger basin with partial water control of a more sophisticated nature is, at best, only a partial success. The two largest Malian ventures are the Opération Riz-Mopti (ORM) and the Opération Riz-Ségou, both of which lie in the inland delta and both of which try to reduce the risks associated with customary flood rise and flood recession cultivation.

In a January 1986 AID document, Simmons provides a recent assessment of both attempts at partial control:

The production of rice in the 30,000 hectares flooded seasonally by the Niger River in the region of Mopti has a longstanding tradition. People planted scattered plots of rice throughout the area, depending on their assessment of likely rainfall and flooding conditions. Production was lost, Viguié estimated in 1937, in one year out of three due to too much or too little water.

In an effort to improve these odds, the first dikes for achieving some control over the water level had been constructed under Ministry of Agriculture auspices in the 1940s. But it was only with the constitution of the ORM in the early 1970's, the construction of improved water control structures with World

Bank funding, and the introduction of floating rice varieties from Asia, that the potential of semi-controlled rice production began to be seriously evaluated as a major public investment. In the early years of ORM, the picture looked very bright. Yields were more than double those achieved with local rice varieties (*Oryza glaberrima*) and the economics of the semi-controlled flooded production system looked good. . . .

By the early 1980's, however, the promise of the early years had tarnished considerably as yields declined steadily and the flood proved to be less reliable than it had been in the 1975-78 period. Between 1982 and 1984, farmers in the ORM harvested nothing. Disappointment with low yields turned into disaster as farmers went into debt to plant and realized nothing from their efforts. (p. 8)

In an effort to improve the situation, further multilateral and bilateral funding was provided to add more canals along with a pilot project within ORM to experiment with pump irrigation of perimeters double cropped in cereals and vegetables. Opération Riz-Ségou has evolved in a rather similar fashion since the 1940s, and with similar problems of uncertain water delivery; ". . . farmers still lost 80 percent of their crop one year out of three in the 1970's . . . and production has not reached the anticipated 2-plus tons per hectare" (ibid., 11).

Whether or not this more capital intensive approach proves economic remains to be seen. Simmons is skeptical, noting -- because of uncertainty over water and commitments to other components of their diversified production system -- the reluctance of farmers to invest in the type of inputs (such as fertilizer and improved seed) that extension agents are pushing to obtain the higher yields needed to cover recurrent expenditures. The various managerial and other problems involved, including competition between farmers and herders, are similar to irrigation projects with full water control and the record with them throughout tropical Africa, with only a few

exceptions (such as Kenya's Mwea-Tebere project) has been poor in terms of yields and income generation.

d. Constraints to Downstream Enhancement

Theoretically full water control for flood water cultivation would be best achieved by dams designed to allow a controlled downriver flood. In practice there are several constraints, the importance of which will vary from basin to basin. Before dams are advocated for controlled downriver flooding, they need to be carefully assessed. The first constraint relates more to enhancement of the environment. Granted the complexity of floodplain ecology, can a manmade flood provide a reliable alternative to natural flooding? The second constraint is more technical and relates more to enhancement of production. It concerns knowledge of how much water must be released to inundate preselected areas, when that water should be released, what is the optimal period of inundation, and whether or not hydrological modeling is sufficiently accurate to determine the timing of whatever releases are necessary. Such knowledge is not yet available. In the Manantali case, for example, it has yet to be determined whether flood waters should remain on the land for as little as 15 days or as long as 45 to increase crop yields. As for the enhancement of fisheries, in the Pongolo case, "an artificially released flood in September, 1984 was unfortunately too early for the flood-dependent spawners to breed; it is hoped that floods in 1985 will be better timed" (Institute of Natural Resources, 1985: 20).

Even if knowledge about how a controlled flood can be most productively used is forthcoming, and even if the operational skills exists for managing such a flood, a third constraint concerns whether or not the required amounts of water can be stored, especially if it is learned that prolonged flooding (e.g., 30 days or more) is required for production purposes and habitat rehabilitation. The recent drought cycle in West Africa, for example, has adversely affected reservoir levels behind the Volta and

Kossou Dams. At Volta electricity generation has been insufficient to meet demand, with no electricity delivered to VALCO during 1985. The problem of water availability brings up a fourth constraint which is economic. To date, the generation of electricity has been the main source of funds for loan repayment. Since the direct and indirect economic benefits of a controlled downriver flood have never been carefully calculated and compared to other development options, it remains to be seen if trade offs between flooding and electricity generation are sufficient to justify reducing power output in order to release a flood.

In the two best described cases of experimentation with a controlled flood it is questionable if the four constraints outlined in the preceding paragraphs can be overcome simply because the dams involved were designed and implemented with other purposes in mind. The two cases are the Pongolapoort Dam in South Africa and the Itezhitezhi Dam in Zambia. In each case, because of conflicting demands for water, a controlled flood will not have the same profile or the same duration as a natural flood. Waters will rise more rapidly and cover the land for a shorter time period.

The Pongolapoort Dam was constructed in the late 1960s, with impoundment in 1970. Built to provide irrigation for some 40,000 hectares, as elsewhere in Africa at the time no attention was paid during feasibility studies to the value of the downriver flood plain for the local people or as a natural resource. The situation changed in the late 1970s, however, following a workshop on "Man and the Pongolo Floodplan." By 1982, those operating the dam "had embarked on a policy of controlled flooding on the advice of a panel of local scientists and officials" (1985 communication from P. de Lalouviere of the University of Natal). This is possible because construction of the irrigation system has been delayed. Should it eventually come into existence, it is questionable if water would be sufficient to continue controlled flooding.

While Pongolapoort was designed and implemented for irrigation purposes, the two Kafue dams were primarily built to provide hydropower. Though the storage capacity

behind the Itezhitezhi Dam was increased to allow controlled flooding of the Kafue Flats over a four week period during years of low rainfall (Balasubrahmanyam and Abou-Zeid in Howard and Williams, 1982: 33), under natural conditions flooding might go on for as long as six months. For that reason the Kafue Basin researchers question whether such an abbreviated flood can maintain the biological productivity of the Flats. Furthermore, ZESCO experts already are suggesting that the Kafue be channelized. Channelization would increase power generation by regularizing a larger flow to the Kafue Gorge dam but only at the expense of reduced Kafue Flats flooding and productivity.

Though yet to be considered a primary function of river basin development, enhancement of existing production system has been receiving more attention in more recent feasibility and other studies. Examples are the AID-funded Senegal and Gambia River Basin environmental and socioeconomic studies, AID and GTZ (Federal Republic of Germany) funded studies of Somalia's Juba Valley, and the UNDP-funded socioeconomic studies of habitat and production systems along the proposed route of the Jonglei Canal immediately east of the Sudd in the central Sudan.

In both the Senegal and Juba cases such studies have definitely had a cautionary impact. The AID-funded study of the Senegal confirmed that "normal" annual flooding allowed the recessional cultivation of approximately 100,000 hectares, most of which was in the Middle Valley and most of which would no longer be cultivatable once the river flow was regularized following the construction of the Manantali Dam. As a result the riparian states through the OMVS agreed to allow a controlled downriver flood for at least ten years or until replacement irrigation for those involved came on line.

Currently, because of the high cost per hectare of irrigation and disappointing yields, studies are underway in both Mauritania and Senegal to assess the pros and cons of continuing a controlled flood indefinitely. However, a continuation of the Sahelian

drought combined with current plans to install the first turbine may preclude the possibility of releasing a sufficiently large and prolonged flood to recharge aquifers for habitat enhancement and possibly tube well irrigation and to intensify recessional cultivation.

In the Juba case, AID has funded Associates in Rural Development to carry out detailed ecological and socioeconomic studies the results of which are to be incorporated within a masterplan under preparation through the combined efforts of the German firm, Agrar-und Hydrotechnik (AHT), and the Ministry of Juba Valley Development. With GTZ funding, AHT has also completed a study of recessional agriculture below the proposed Baardheere Dam. In years of "normal" flood approximately 12,000 hectares are cultivated, while wetlands in the Middle Juba Valley and between the Lower Juba and the Lower Shebelli provide crucial though unstudied pasturage for cattle and other stock. Though it remains to be seen what policies are formulated for operating the dam once constructed, one scenario being planned -- complete with economic rates of return -- is intensification of flood recessional agriculture through controlled flooding, followed by gradual conversion to irrigation. In order words, enhancement of recessional cultivation, as in the Manantali case, is only seen as a stage in transition to irrigation. Indeed, the political decision to build Baardheere to supply hydropower and water for large-scale irrigation was taken before the completion of feasibility studies and a master plan. Achievement of those goals will require regularizing the flow of the Juba within its primary channel and hence elimination of annual flooding.

As in the Somali case, a political decision to proceed with the Kekreti and Balingho Dams was made by the Gambia River Basin Authority (OMVG) prior to the completion of feasibility studies. Again irrigation and hydropower generation figure prominently although Balingho like the Diama Dam on the Senegal is conceived mainly as a salt intrusion dam. The major difference, however, is that the AID-funded studies give

Balingho a negative rate of return while Kekreti appears to be a borderline case. One reason for the high costs associated with Balingho is that the impoundment would flood out some 15,000 hectares of swamp rice (University of Michigan, 1985: xvii).

Notwithstanding this fact, along with other costs associated with Balingho, the OMVG continues to seek funding for both dams.

Though construction has stopped due to the resumption of civil war between the North and the South, the major purpose of the Jonglei Canal is to provide additional water for irrigation to the northern portion of the Sudan and to Egypt. In this case, however, the political need to provide some benefits to the South has favored, under the Jonglei Commission, a program for enhancing local production systems which was carefully researched primarily by Sudanese scholars with the help of international consultants and UNDP funding. As a result Stage I of the Jonglei Project was designed to provide small-scale irrigation and improved grazing and water supplies for the various Nilotic peoples who lived along the canal route. Also under the Jonglei Commission a fishery development program was funded by the UN Capital Development Fund for the same people.

It is not coincidental that development goals in the above cases were as much influenced by political as by economic considerations. With the partial exception of Jonglei, in each case the enhancement of local production systems was largely ignored during the decision making process. As a result, as elsewhere in tropical Africa, it is likely that river basin development as planned will continue to destroy local production systems and to degrade riverine habitats. Reversal of that situation will require not only broader feasibility studies guided by multiobjective planning criteria which include enhancing the development potential of local production systems, but also a greater awareness on the part of national leaders of the longer term costs of the current approach. One result of such studies, granted the complexity of the issues involved and the lack of current knowledge, may be to reject certain dams, which might otherwise

be built, as environmentally, economically, and socially unsound.

E. SUMMARY

Riverine production systems are found throughout Africa, their origins in the Nile valley and the inland delta of the Niger going back thousands of years. Over the millennia, riverine communities have evolved their own cultigens including floating rice, flood tolerant varieties of sorghum, and various other early maturing crop varieties. Such production systems support, economically and nutritionally, moderate population densities and overall many millions of people and livestock. Although they are under increasing pressure today because of population increase, drought and river basin development, such systems have proved to be environmentally sound over the centuries. This is especially the case of those components -- flood water farming, fishing, and grazing of annually inundated wetlands -- which are dependent on the annual flood. While upland fields and pastures are under increasingly pressure from increased populations of people and stock, there is no evidence that the fertility of flood water gardens has been adversely affected, nor is there evidence of overfishing of the riverine fisheries as a whole (aside from particular species) except for the Senegal River. There drought has been the major culprit, with annual flooding insufficient not only to sustain the previous fishery but also to keep the river flowing in its middle reaches throughout the year, with the result that reduced fish populations are restricted to pools where they are easily caught.

As the Senegal case shows, the annual flood is crucial to the maintenance of fishery productivity. It is also crucial for transhumant pastoralists whose stock are dependent on riverine and floodplain grasses during the latter part of the dry season. As for flood water farmers, their use of the floodplains is so enduring that they have evolved cereal varieties which are specially adapted to both floodplain and drought conditions. Though gardens cultivated during the dry season are relatively small, increasingly they

are being used to grow commercial crops, in particular vegetables, which have high value because they are harvested at a time when fresh produce is otherwise in short supply.

For reasons outlined in Chapter 2, the impact of river basin development on riverine habitats and riverine production systems and communities has been largely negative. To correct this serious deficiency river basin planners need compare the enhancement of local production systems both upstream (and especially in the reservoir basin) and downstream from dams with other development options. More specifically, the net economic benefits of a system comprising hydrodams plus enhanced traditional production systems and riverine habitats through regularized reservoir drawdown and downstream flooding should be compared as a matter of course with the net economic benefits of hydrodams plus irrigation through the virtual elimination of annual flooding.

To facilitate such comparisons more funds should be allocated both to improving understanding of the nature of riverine habitats and production systems, and to seeing how they respond to regularized reservoir drawdown and controlled downriver flooding. Experiments about to commence in the Senegal Basin below Manantali have pan-African importance; indeed their importance extends beyond Africa. Because generators have yet to be installed at Manantali, research teams, with the support of the OMVS and the three governments, have the opportunity to study such topics as aquifer recharge and response of local populations to controlled flooding over a several year period. Only through such experiments can the potential of riverine habitats and production systems be sufficiently assessed to enable planners intelligently to determine their future rather than to continue, through ignorance, to contribute to their deterioration.

CHAPTER 4

LOCAL ORGANIZATIONS AND RIVER BASIN DEVELOPMENT

A. INTRODUCTION

The next four chapters deal with the record of various types of organization with African river basin development. Granted the frequency with which inadequate management is mentioned as a major constraint in Africa (see especially World Bank, 1984a, volumes 1 and 2), the topic of institutional capabilities is a very important one. In the chapters that follow, however, a special effort has been made to examine relatively successful organizations in order to emphasize not only that such organizations exist but also that they have played, and can play, an important role in river basin development. Because of the importance of local participation, local organizations are considered first. Though most need some external assistance from time to time, the timing and extent of that assistance need be more carefully assessed so that, unwittingly, it does not undermine the initiative and enterprise that outside agencies are trying to encourage.

For the record with river basin development to become more satisfactory, hydropower generation need be combined with new strategies which benefit riverine production systems. Examined in Chapter 3, these systems have supported millions of people over the centuries without environmental degradation. If such systems are to be enhanced in the future and if new systems for local populations are to be developed, a major question warranting analysis is whether or not local populations have the organizational capacity to operate, maintain and manage them. In this section, the

record of local organizations in African river basin development is assessed.

The conventional definition of "local" tends to be restricted to organizations larger in scale than household residential units and extended family kin groupings and smaller in scale than the district and subdistrict (Uphoff, 1987: 11). This restricts them primarily to groupings larger than household and family that exist within a cluster of communities or a project. While such a definition ensures that the main participants are local people as opposed to government officials and other "outsiders," SARSA has used a broader definition that incorporates such larger units as irrigated settlement schemes that include parts of several districts (Rahad, in the Sudan for example), districts (and especially district development committees and local authorities), and subdistricts.

There is not much of a literature on the role of local organizations in African river basin development. Uphoff (1987), for example, includes no African examples in his section on irrigation water management. Though local organizations are involved in undertaking a wider range of functions, their best known river basin development role is in the form of irrigation associations, and especially water user associations, and here the African case material is sparse. This does not mean, however, that examples do not exist. While none of the classic examples of indigenous organizations such as the Indonesian subak and the Philippine zanjeras are African, local associations of producers nonetheless built, operated and maintained from one generation to the next small-scale irrigation projects in various parts of Africa, including the mountain habitats and rift valleys of Eastern Africa. The examples discussed in this section, however, are restricted to those actually surveyed by SARSA personnel in river basins in Kenya, Senegal, Tanzania and Zambia.

The effectiveness of local organizations in enhancing riverine production has been mixed at best. The biggest problem has been a lack of continuity as shown by the inability of members to work together over extended time periods. This problem has

been especially serious in regard to operating, maintaining and managing recently introduced small-scale irrigation projects, with water user and other types of producer organizations all too often collapsing after a few years. To better understand the record three types of organizations are analyzed.

The first two types are project oriented while the third type -- as represented by district development committees and councils -- is based on administrative units. The first type involves local organizations which arose as a result of local initiative. Some operate, for the most part, independent of external assistance. Others have subsequently received significant government, private voluntary organization (PVO) and/or donor assistance. The origin of the second type of organization is due primarily to "outside" initiative. Emphasis has been on organizations to run small-scale irrigation projects and on committees and unions in centralized government-sponsored irrigated settlement schemes. Also initiated by outsiders, the third type of organization includes district development committees and county councils which have been supported in recent years through post-independence decentralization programs.

B. ORGANIZATIONS BASED ON LOCAL INITIATIVE

The two categories examined in the field were organizations operating with minimal external assistance and organizations that had accepted significant assistance. While both were problem-prone, external assistance posed the greatest threat because, on the one hand, it tended to undermine local initiative and, on the other hand, to create jealousies and factions. A number of such organizations were analyzed in Kenya's Tana River and Lake Victoria Basins and along the south bank of the Senegal River. None were found in the Middle Zambezi Basin.

1. Kangocho and Island Farms (Kenya)

Because of problems associated with local organizations initiated from without, in Kenya the SARSA team made a special effort to search out organizations which had been created by their members. In the Upper Tana Basin, two locally operated and maintained small-scale irrigation projects were visited. These were Kangocho and Island Farms.

In the Kangocho case, local villagers grouped to rehabilitate and expand a furrow which had been operated (and probably built) by a European during the 1940s for irrigating vegetables which were processed at a nearby factory in Karatina for British military personnel. During the emergency period prior to Kenyan Independence the European stopped operations. While local villagers continued to draw water from the furrow for drinking and other domestic purposes, irrigation stopped until a small groups of farmers began to irrigate small vegetable plots in 1968. Over the years this group has expanded until is numbered approximately 100 farmers in 1986.

As is often the case one individual played a dominant role in starting what is now called the Kangocho Water Furrow Self Help Group. Leadership is provided by a three member Kangocho Water furrow committee, with the group initiator as chairman. In the late 1960s and early 1970s the group expanded the system by digging additional side furrows off the main intake canal. Five such furrows were operational in 1986, with the entire membership of the group working together to carry out periodic maintenance activities. No water distributional problems were mentioned. Members are all villagers. A building fund is kept for construction purposes and a periodic tax levied on members.

Kangocho land use is intensive. In walking through the project, I was reminded of intensive household production systems in densely populated hill zones in South Asia. Though some farmers have separate, small coffee plots, most rely primarily on their furrow irrigated plot on which they have their living quarters and outbuildings,

livestock (especially a few stall-fed grade cattle), and vegetable and tree (coffee, bananas and papaya in particular) crop gardens. Gardens are manured, with some farmers purchasing manure while others use their own. Some labor is hired. While plots were relatively small (the two we visited were said to be about an acre), income is sufficient to meet basic needs including educational fees for children. Those to whom we talked insisted that they did not receive special visits from agricultural extension or other government personnel. Rather government assistance had been limited to construction by the Irrigation and Drainage Branch (IDB) of the Ministry of Agriculture of an improved (and much needed) intake structure from a fast flowing stream on the slopes of Mount Kenya.

Though located at a higher elevation, Island Farms is also on the slopes of Mount Kenya. It differs in several other respects, however. First, farmers are government recruited settlers a minority of whom were allocated 55 acre plots on a former European holding, while the others received 7-10 acre plots. Second, only part of each holding is irrigated. Third, due to an insufficiency of water (Island Farms is located on the dryer southwestern slopes of Mt. Kenya) and higher elevation, emphasis is on dairying rather than crop agriculture. The first settlers came in the early 1960s. A dairy cooperative with approximately 250 members was formed in 1963. Because of a need for water, in 1965 the members worked together to extend to their land a furrow that the European settler had commenced. Subsequently, a separate water users association was started. While membership overlapped significantly, 7-8 person management committees had different personnel. Over the years a second and third furrow were added, and at the time of our interview members were working on a fourth furrow. As at Kangocho, the water users association was able to handle water distribution without conflict even during the 1984 drought. At that time, a decision was made to reduce the size of furrow offtake pipes to individual holdings from two inches to three-quarters of an inch. At the same time a rotational system was worked

out between top and bottom enders which we were told worked equitably, with 20 farmers receiving water at a time.

Though Island Farms holdings are much larger than Kangocho ones, with rainfed agriculture combined with irrigation, some intensification has occurred with farmers manuring their fields from their herds of dairy cattle and growing rainfed Pennisetum for fodder. Labor is hired by practically all the farmers for both their dairy operations and their irrigated vegetable holdings of carrots, cabbage and other cold-tolerant crops. Even less government assistance has been received than in the Kangocho case. Again we were told that agricultural extension officers did not visit, although artificial insemination services were provided by the veterinary department.

As children of the original settlers married, over the years membership has increased in both the water user association and the dairy cooperative. For the future, insufficient water is seen as the main constraint. After the 1984 drought, the membership, with no outside assistance, started excavation of a fourth furrow on which work continued for two years. Unfortunately, it was improperly surveyed so that much additional work, including resurvey, must be undertaken before land can be irrigated and stock watered from this fourth furrow.

2. Lake Victoria Basin Organizations (Kenya)

In his 1987 SARSA report on "Irrigation Activities and Institutions in Kenya's Lake Victoria Basin," Okidi describes several self-help organizations, of which one success and one failure are described below. The successful organization was started by a former municipal employee who had been impressed by a PVO demonstration project. Rejecting their avant garde technology (windmills and solar pumps), he organized a group of farmers to replicate the demonstration project's land preparation and canal excavation techniques on customary holdings on the shore of Lake Victoria. A local management committee was formed, with leadership provided by the scheme instigator

and a retired clerk. Irrigation is by bucket from canals extending inland from the lake. Crops are relatively high value vegetables which are sold locally, while advice is provided by an agricultural instructor from a nearby training center.

The origin of the unsuccessful case was in the mid-1970s. Also involving bucket irrigation from canals from Lake Victoria and local sale of vegetables, this self-help project involved about 50 farmers cultivating holdings averaging 0.2 hectares in size. Impressed by the farmers' initiative, a Peace Corp volunteer began providing assistance. He also convinced the government Provincial Irrigation Unit (PIU) to provide assistance for redesigning the project as a small-scale pump irrigation scheme. The farmers provided the labor and the PIU provided a diesel pump. Pumping began in 1979. Later that year, however, two political factions developed in regard to candidates supported during the 1979 general elections. Although another pump was provided so that each faction had their own, there was insufficient cooperation to operate and maintain the scheme so that it had completely collapsed by early 1987. While politics polarized the farmers in this case, experience elsewhere would suggest that factionalism was increased by the rapid transition of a relatively simple project to one involving two diesel pumps. In this case the Peace Corp Volunteer and the PIU may well have provided too much assistance, too quickly -- assistance for which there apparently had been neither a strong need nor a strong demand.

3. Upper Senegal Valley Organizations (Senegal)

While little has been written on the Kenyan cases, there is an extensive literature on local irrigation associations along the Senegal River which are considered by many to be among the most successful examples of locally run irrigation projects in tropical Africa. Found in Mali, Mauritania and Senegal, these associations are not only multiethnic in some cases but in others have been federated into unions. In the Lower Basin they are apt to be associations of "young men;" in the Middle and Upper Basin of

villagers. As in Kenya, they are not longstanding indigenous organizations but rather have been formed to plan, implement and manage small-scale pump irrigation projects. Initiators or leaders are frequently returned labor migrants from France or elsewhere in West Africa, while remittances from other labor migrants help cover start-up and recurrent costs.

Much of the recent literature has been cited in Miller's 1984 *Peasant Autonomy and Irrigation: Innovation in the Senegal River Basin*. The best documented cases are from the Upper Valley and specifically the Bakel area. There two types of locally initiated organizations exist. As throughout the Basin, in both types irrigation schemes are small (usually under 100 hectares), with household plots often less than one quarter of an hectare. For that reason they cannot support the household which incorporates irrigation within a more diversified production system which continues to include rainfed and flood recession agriculture, livestock management and wage labor. Cropping emphasis is on food security from the cultivation of rice and other cereals, although women's groups cultivate vegetables for sale as well as for local consumption.

The first type of organization operates and maintains a small-scale irrigation project with minimum external assistance. An example is the Balou association, the members of which applied for and received a status which enabled them to take out bank loans directly from the Senegalese National Development Bank (B.N.D.S.). As of this date they are successfully operating their irrigation scheme totally independent of "the Senegalese government parastatal (SAED) responsible for irrigation development in the Basin" (Miller, 1984: 90). Moreover, Balou is "everything that small-scale schemes are supposed to be. The village scheme has dynamic, competent leadership, high levels of productivity, and has maintained its small-scale participatory management style for what has grown into a 108 hectare irrigation scheme" (p. 121).

The second type receives assistance from SAED and is also apt to receive help from private voluntary organizations and donors. Here the best known example is the

Soninke Federation of Bakel which both Adams (who has served as secretary to the Federation) and Miller have analyzed. The initial village association of 80 members started up in the mid-1970s, before SAED had begun to operate in the Bakel Zone. Shortly thereafter neighboring villages formed their own associations and commenced construction on their own irrigation projects. In 1976, ten of the 14 villages in the zone formed the Federation.

The instigator was a former labor migrant who returned from France in 1973 with a small pump. He also arranged for technical assistance and funding, with government approval, from the French development agency Centre International de Developpement Rurale (CIDR), and OXFAM and -- later on -- War on Want. Subsequently, with neither the full awareness nor the approval of the Federation leadership and members, the expatriate adviser brought in SAED as a condition he said, for receiving AID assistance (Adams, 1981: 336). While the resulting assistance allowed expansion, it also resulted in a loss of local autonomy since SAED recruited the previously independent French technical assistants, took on overall control of the project, and required the Federation to enter into a contractual agreement. These events were at the instigation of both SAED and the various donors. While donor insistence for SAED control has not been carefully analyzed, at least three factors appear to be involved -- all of which undermine devolution of management and local participation. One is the desire of donors for fiscal accountability, which is related to their belief that it is easier to account for funds through a parastatal with an auditing section than through peasant associations. Another, emphasized by Miller, is the humanitarian but impractical desire of donors to increase social equity within the village schemes by reducing elite control -- impractical not just because leadership continues to remain in elite hands but also because local control is replaced by more bureaucratic government control. A third factor is the ambivalence of government toward strong local organizations.

Certainly increased control by SAED was not agreed upon by the Federation whose

leaders were very well aware of the nature of SAED and the problems that plagued SAED's operations in the Lower and Middle Basin. According to Geller et al (1980: 144), "S.A.E.D. was authoritarian, highly centralized, and primarily concerned with imposing its own master plan on the rural populations. It seized land, displaced populations, and relied heavily upon capital-intensive machinery to achieve its objectives. It had little interest in promoting a dialogue between itself and the rural populations. As a result, S.A.E.D. was not very popular in the Fleuve despite strong backing it received from the central government and foreign aid donors." Once in control, SAED attempted to make local associations dependent on it for credit as well as for a whole range of inputs. While the provision of these was apt to be untimely, producers were still required to reimburse their expenses with the result that indebtedness, and dependence on SAED, increased.

SAED's official involvement started a lengthy period of confrontation that continues to the present, and which has had a destabilizing impact on the Federation. Miller's dissertation (1984: iii) emphasizes the resulting tension between "local autonomy and state intervention" while Adams contrasts the centralized SAED approach with the participatory peasant approach. Increased resources also appear to have generated friction between and within the various associations which have undermined their solidarity and effectiveness, a problem which Okidi also describes for Kenya. Meanwhile the Federation continues to try and reassert its autonomy. One approach has been to be officially recognized as an organization that can, among other things, borrow from sources other than SAED. While SARSA researchers were told that recognition appeared to be forthcoming, the process had been sufficiently prolonged (over five years) as to suggest, at best, government ambivalence toward strong local organizations and at worst efforts to subvert the Federation (a tactic used by one SAED zonal director at an earlier date when he tried to introduce ethnic strife within the federation). This is in spite of wide spread agreement that development costs and

productivity per hectare is higher on small-scale village irrigation schemes than on larger-scale SAED settlement schemes (see for example, OMVS, 1980, Part C) and that local participation is associated with increased productivity.

C. LOCAL ORGANIZATIONS FORMED LARGELY THROUGH EXTERNAL INITIATIVE

Local organizations that have arisen as a result of external initiative range in size from small groups of women growing vegetables in tiny plots along the shores of Lake Victoria and the Senegal River to the large-scale Tenants' Unions of thousands of farmers on the Gezira/Managil and New Halfa Schemes. The record with such organizations is mixed at all levels. Some, like the Gezira Tenants' Union are sufficiently strong to be seen as a threat to the managing parastatal which refuses to hand over additional managerial functions even where required to do so. Others are so factionalized that they would fall apart without external assistance. In analyzing relative degrees of success and failure, scale (size of institutions) and homogeneity do not appear to be key factors. More important are a commonality of interests that are sufficiently strong to motivate members to work together, strong leadership at the right time, and the "correct" degree of external assistance. All three factors are analyzed in some detail in the paragraphs that follow which deal sequentially with projects of increasing complexity and scope.

Some externally inspired local organizations never even get off the ground. A case in point was the attempt of the Northern Rhodesian colonial government to establish fishing cooperatives on Lake Kariba. Because of an insufficiency of land for resettlement the provincial administration pushed fisheries development for the relocatee and host population. Before the dam was sealed, at least one "company" was formed to use a government boat and net in Zambezi river backwaters. So long as the net remained in adequate repair a group of ten older men cooperated in its use;

however, they never purchased their "own" equipment or formed their "own company." And after Kariba Lake was created, the few cooperatives that were formed at government initiative failed within a short period of time, with members either leaving the fishery or working on their own with or without one or two helpers. At the time I incorrectly believed that these failures were primarily due to the egalitarian social organization of the fishermen. More recent organizations (dealing with agriculture rather than fishing), however, have been more successful. They differ from the abortive fishery cooperatives in that they are demand driven: cooperation being perceived as necessary for operating an irrigation project, for example, while there is no evidence that fisheries cooperatives would be as productive as privately owned fishing units.

In all of the cases analyzed below, local producers had strong motivation to cooperate. The smallest scale units are women's groups for growing vegetables for home consumption and the market; the largest is a middle sized irrigation scheme.

1. Women's Horticultural Groups

In his SARSA report, Okidi describes a number of women's groups that grow vegetables along the shores of Lake Victoria. In Bondo Division six groups, each with their own committee, work together through an overarching committee. The government's Provincial Irrigation Unit "assists with surveys and technical design of the irrigation works, including canals, dikes and drainage. The only other party is the Kenya Freedom from Hunger Council (KFFHC), whose role it is to supply the materials and extension services. The women provide the labor and this is the most spectacular part of the project. Once the surveys and designs are done the women's committees allocate responsibility for actual digging and moving the earth for the canals, dikes and drainage" (p. 20). Plots are farmed individually. Though arrangements had been set in motion to acquire small pumps, at the time of Okidi's

visit plots were irrigated by drawing water from the canal system with buckets. In addition to improving the diet of the member families, such projects also provide some cash income, much of which is used for paying children's school fees. Similar women's groups grow vegetables in the Mwea Project (and also raise rabbits and poultry for sale) and along the Senegal River.

2. The Siatwinda Farmers Executive Committee (Zambia)

Though still small-scale the Siatwinda Irrigation Project on the Zambian shore of Lake Kariba is both technically and managerially a more complex project than those previously described. It was started in the early 1970s by the Department of Agriculture and the Gwembe South Development Project (GSDP) as a pilot scheme with two major functions. One was to assist nearby villages who had been relocated in connection with construction of the dam. The other was to experiment with crops, and with pump irrigation drawing water from the reservoir. While the Department of Agriculture provided an Agricultural Assistant, the Gwembe South Development Project (which was a joint venture between a German private voluntary organization -- the Gossner Service Team -- and the government of Zambia for the benefit of the residents of the southern portion of Gwembe District) provided an expatriate agricultural adviser. Significant government and expatriate funding was provided with construction and maintenance costs amounting to nearly Kwacha 200,000 by 1980 (at the time the kwacha was worth slightly more than the dollar).

By the mid-1980s there were a number of government/PVO sponsored pump irrigation projects along the Lake Kariba foreshore or along the Zambezi below the dam. In each case, irrigation was a component in a more diversified household-based production system in which rainfed agriculture continued to be the most important feature. Of the various projects Siatwinda was the most successful. In 1983 approximately 100 0.2 hectare plots had been allocated to as many farmers within the

32 hectare scheme, four hectares of which were run as an experimentation station. Both men and women were involved, with the proportion of women increasing over the years (Banda, 1984: 396).

Initially Siatwinda management had been centralized in a GSDP employee, with performance unsatisfactory. One problem was the tendency of the farmers to see the project as a government one on which they had the role of employees. This attitude changed after the farmers, through their own Farmers Executive Committee, took over management responsibilities. By the early 1980s, they were carrying out major operations and maintenance activities on their own initiative. For example, after the level of the reservoir dropped below the intake canal during the 1982 drought, forty men and women -- without the knowledge of the GSDP adviser -- turned out at the request of the Committee to deepen the channel. While members were also prepared to pay recurrent expenses, the rising cost of diesel fuel threatened project profitability. Furthermore, the ability of the farmers to acquire necessary parts for pumping equipment and to replace old pipes as required is questionable. Along with marketing problems, these constraints on further profitability and development, however, reflect not so much inadequate organizational abilities as the need for ongoing assistance with an externally planned project which exceeds local technological and perhaps financial capabilities.

3. The Lower Tana Village Irrigation Project (Kenya)

This project serves a number of village communities immediately above and below Garsen on the Lower Tana River, the goal being to rehabilitate a number of small-scale irrigation projects that date back to the 1960s. The main participants in 1985 were the Ministry of Agriculture through the Irrigation and Drainage Branch (IDB), the National Christian Council of Kenya (NCCK), the Dutch Government and the participating villages. IDB runs the project from a project headquarters at Minjila. Represented by

a first rate village organizer, NCKK is primarily concerned with the development of water user associations, while the Dutch have provided experts and funding. In spite of this impressive and expensive infusion of expertise and capital, none of the small-scale irrigation projects are economically or organizationally viable without major subsidies and assistance.

Costs per hectare, for example, probably exceed \$30,000 when construction and rehabilitation costs of physical infrastructure for small hectarages and expatriate salaries are totalled up. Organizationally none of the water user associations have reached the point where they can take over increasing management responsibilities. Based on field visits, discussion with government and expert staff, and reading of an extensive documentation, SARSA believes that failure to date is partly due to lack of demand on the part of the participating farmers and to too much outsider assistance.

As with the nonviable small-scale irrigation projects along the Middle Tana near Garissa, the stimulus for the Village Irrigation Project was due partly to the Sahelian drought which also adversely affected northern Kenya in the early 1970s. In the Garissa area, sites were selected for the settlement of formerly transhumant Somali pastoralists who had lost their livestock during the drought. In the Lower Tana, drought conditions were preceded in the mid-1960s by the shifta insurgency. This involved Somali insurgents whose raids along the Lower Tana interfered temporarily with the Pokomo's flood water cultivation (Kimani, 1987: 25). Some Pokomo males responded to lower yields by seeking wage labor outside the district, while the government, PVOs and bilateral and multilateral agencies (including FAO and the World Bank) sought to alleviate the problem through small-scale pump irrigation projects.

In neither case did demand come from the future participants. Indeed, in the case of the Village Irrigation Project participation on the irrigation schemes compares unfavorably with wages from labor migration, or in more self-sufficient villages with

yields per unit of labor from flood water cultivation and other components of the customary production system to which the people returned after the insurgency was contained. An additional adverse factor is the amount of factionalism within the various water user associations which may be partly induced by the levels of external assistance as hypothesized in the previously analyzed Seka Bondo and Soninke Federation of Bakel cases. High levels of assistance may have two types of negative impacts: on the one hand, it may lead to over-dependency on the part of the participating farmers which is a risk in the Mutuungu case which is discussed below. On the other hand, rapid appreciation in project resources may create competition and factionalism among participants.

4. Kibirigwe Farmers Cooperative Society (Kenya)

As in the Siatwinda case, Kenyan farmers have also taken over the management of the Kibirigwe Irrigation Scheme described by Kimani. There sprinkler irrigation "based on gravity extraction" (p. 31) was brought to 300 farmers with adjudicated land rights. Project size is 120 hectares with each farmer cultivating 2 hectares, 0.4 hectare of which are irrigated. Horticulture is stressed, with scheme produce either sold to local people or to traders or marketed by the scheme's truck to Nairobi. Stimulus for this project initially came from the Tana and Athi River Development Authority which sponsored the initial feasibility analysis before handing implementation and management over to the Ministry of Agriculture. Financial and technical assistance were provided by the Dutch government.

Kibirigwe started up in 1977. Initially management responsibilities were carried out by government and Dutch aid officials. In the early 1980s, however, increasing responsibilities were handed over to participating farmers who had organized themselves into the registered Kibirigwe Farmer's Cooperative Society. By 1986 this cooperative was running the project with the advisory assistance of the Ministry of

Agriculture (through a resident project co-manager and support staff) and the Ministry of Cooperative Development. "Although there was a significant drop in total production performance between 1983 and 1985, yield performance has now stabilized and the Co-operative is steadily acquiring skills and confidence in coping with the volatile horticultural market. Visual evidence of the impact of the scheme, which has been in existence for no more than nine years, is to be found in the expansion of the local trading centre at Kibingoti. Shopping centre, grocery stalls (kiosks) and even a combined bar and night club and the sprawling open air market, all attest to the economic spill-overs emanating from the Irrigation Project" (p. 31).

5. Mutuungu Water Users Association (Kenya)

The origins of the Mutuungu medium scale (3000 ha potential) irrigation project date back to before World War II when the colonial government dug an irrigation furrow to deal with drought conditions. Subsequently the British Tobacco Association encouraged nonirrigated tobacco small holder cultivation in the area. The Mutuungu Water Users Association dates back at least to the 1970s, with the furrow used for domestic water supplies, watering of livestock and some irrigation. During 1977-78 TARDA contracted for a feasibility survey by an expatriate firm funded through German bilateral aid to assess rehabilitating the furrow and advancing irrigation among the local people. Shortly thereafter the Germans agreed to provide financing and technical assistance for further feasibility studies and implementation.

During the SARSA visit in 1985, a very competent German volunteer was stationed at the project which involves approximately 300 households cultivating 2-5 hectare holdings on clan controlled land. Through use of sprinkler irrigation (gravity fed from a holdings tank which is also gravity fed), a mixed farming system is intended involving cotton/maize/beans, some citrus and irrigated fodder for dairy production. System operation and maintenance is supposed to be the responsibility of the Water

User Association. Because life of the sprinkler system is relatively short, the 400 members of the association (with some of the 300 households having more than one member) are required to pay 200/- per acre into a maintenance account for purchase of spares.

Mutuungu technically is a complicated project involving sprinkler irrigation, crop rotation, and application of fertilizers and insecticides. Since feasibility studies continued for a number of years, implementation and the four-year adoption period did not commence until just before the SARSA team arrived. For that reason, no assessment is possible. However, the intensive involvement of the expatriate volunteer, the complexity of the project, and the level of financial assistance raise risks about the project's ultimate sustainability once German aid ends. While the SARSA team inspected the project with the local chairman of the Water Users Association, and addressed many questions to him, most of the answers, along with details about the scheme's history and current operations, were provided by the German volunteer. The risk of his competence having an adverse effect on local initiative and local participation is a very real one unless increasing emphasis is placed on teaching and delegation of authority.

6. Mwea Amalgamated Rice Growers' Cooperative (Kenya)

A middle-sized (12,145 hectares) gravity flow project described in some detail in Kimani's report, Mwea may well be the most successful small-holder irrigation project in tropical Africa in terms of productivity, profitability and, to a lesser extent, settler living standards. Still under centralized management, the project began in the 1950s with laborers and the first settlers recruited from Mau Mau detainees (more recent recruitment of settlers is restricted to residents of the encompassing district). Except during an unsuccessful experiment with double cropping during the mid-1980s, rice yields are good -- about 5 tons per hectare from a single crop with the National

Irrigation Board (NIB) using profits from sales through the government marketing board to subsidize the other, less profitable projects under NIB management.

Except for a small minority with double holdings, 3234 settler households cultivate irrigated rice in 1.6 to 2 hectare fields. The remaining land is cultivated in rainfed crops and irrigated vegetables (including some contract farming of green beans on red soils), or devoted to village sites and project infrastructure. Mostly landless prior to recruitment, settlers are definitely better off on the scheme, with incomes comparing favorably with those from Kenya's most high potential rural areas. Though heritable, tenure is insecure, however, with annual renewal of tenancies still required in the 1980s. As a result the goal of an unknown proportion of tenants is to divert a proportion of their rice profits to off-scheme farms and land development companies, businesses and homes for support of their other children in the future (to reduce subdivision only one heir can inherit).

In 1985 and 1986 SARSA personnel asked the Scheme Manager, the local Chief and others to estimate off-scheme investments. Answers were quite consistent except for cattle ownership. Approximately 10 percent of the tenants were thought to have invested in some kind of on- or off-scheme business. Twenty-five to 30 percent were believed to have purchased land elsewhere, while more than 50 percent invested in children's education (as at Gezira a number of children are university matriculates). Thirty to 60 percent have invested in cattle, while over 90 percent hire labor. As for off-scheme homes, they are stressed because the nature of housing, public water supplies, and sanitation on the scheme is poor, with deaths from cholera, for example, reported to Little and Scudder in 1985. While education facilities have greatly improved over the years because of tenant initiative and PVO assistance, generally speaking social services have been neglected by management which continues to view the scheme primarily as a rice production scheme. Due to protein deficiency and over-reliance on rice, malnutrition continues to be a serious problem among children under

five, although diets have improved since the late 1970s when vegetable growing began to be emphasized. Planned by men for men rather than for farm families, the position of women on the scheme, both economically and socially, is still less than satisfactory although the recent development of women's groups have improved social conditions with an increasing proportion of first generation settlers retiring on the scheme after handing over cultivation to their nominated heir.

Throughout its history Mwea has been highly centralized, with management an exclusively government function. While management had allowed formation of a Tenants' Advisory Committee (perhaps modeled on an earlier Gezira prototype) for the scheme as a whole and Liaison Councils for each section, and allowed appointed tenant representatives to sit on the Irrigation Committee, tenants have no executive functions. Throughout the 1960s, however, tenants were encouraged by the expatriate Project Manager to form various cooperatives. In forming these two tenant leaders played major roles. Both were familiar with scheme policy, one being a tenant representative on the Scheme Irrigation Committee while the other was a member of the regional assembly. Still influential in the 1980s, both have provided important leadership and guidance over the years.

The first cooperative was a thrift society with the two tenant leaders as Chairman and Secretary. Because tenants needed loans to hire labor and for other requirements, this savings society was expanded in 1964 and renamed the Mwea Cooperative Credit and Savings Society. The Chairman (who gave up a teaching position to become Chief of the Location that includes Mwea) and the Secretary continued to play a major role in the development of the cooperative movement within the scheme. They had the support of the Scheme Manager who saw the coop having a double function: on the one hand, it would enable settlers to bank a portion of their relatively high incomes; on the other hand, it would provide a mechanism for enabling tenants to invest in the rice mill that the manager wished to see built on the scheme. According to Chambers and

Moris, the society "grew quickly in membership and funds. About 60 per cent of the tenants joined the Society in its first year and by 1968, 1,504 out of 1,721 tenants were members" (1973: 291).

Since the Mwea Cooperative Credit and Savings Society was precluded from owing shares in the rice mill (which commenced operations in 1968), tenants formed the Mwea Farmers' Cooperative Society. Initially Mwea Farmers' had the same membership and management. Because of problems created by this arrangement, separate managements were established in 1981 on the recommendation of the Ministry of Cooperative Services. The third cooperative was the Mwea Consumer's Co-operative Society which tenants formed in 1967 because of dissatisfaction over the prices and goods offered in local shops. Plagued by management problems, its assets were acquired in the early 1980s by Mwea Farmers'. To facilitate development of a banking section, in 1983 the two remaining cooperatives were reorganized into Amalgamated Rice Growers' Cooperative. At the time of the first SARSA visit (November 1985) membership was 3,100 including a few nontenant members who had recently begun to grow rice off the scheme.

Kimani, a former deputy manager of the Mwea Scheme, revisited Mwea in 1986. By then the cooperative's banking section (started in 1983) was "the most active arm of the co-operative society" with a 1987 budget for loans of 9.8 million shillings (there being approximately 16 shillings to the dollar at the time). Based on past experience, over three-quarters of that amount was budgeted for hire of labor and school fees, with the remainder allocated to loans for emergencies, purchase of cattle and enterprise and land development. Amalgamated also owned 40 percent of the rice mill shares, with the National Irrigation Board owning the remaining 60 percent. Other activities included a monopoly on transporting (via 5 coop trucks with extra trucking hired as needed) clean rice from the mill to the depot some 30 kilometers away; a contract from the NIB to dry paddy rice at five reception centers; purchase in bulk of animal feed

and other items for sale to members; ownership of a petrol and diesel distributorship; and rental of space to businesses in Wanguru Township where the cooperative owned two buildings.

Fiscally sound and relatively well run, Mwea Amalgamated is by all accounts a highly successful enterprise which is run by tenants with advisory services from the Ministry of Cooperative Services. In analyzing the reasons behind its success, Kimani (1987) stresses the following factors:

The co-operative society is perhaps the only institution within the Mwea project that the farmers wholly own and largely control. The co-operative, therefore, provides the farmers with a forum where they can at once indulge their creative impulses and also vigorously engage in political infighting. (p. 10)

The co-operative has met the test of utility since it comes to the farmer's aid at his most desperate moments. He has reciprocated this by his zealous interest in the management of the society's affairs.

The National Irrigation Board, though at first suspicious of the society's intentions, has over the years contributed to the latter's growth by agreeing to deduct farmers subscriptions from the rice proceeds and remit them to the co-operative. The Board's decision to allocate 40% of the rice mill shares as well as letting of the paddy drying contract to the co-operative society is further evidence of N.I.B. support. (pp. 13-14)

D. District Level Organizations

The major district organizations involved in river basin development are district (and lower level) development committees and rural councils. The former are usually

composed of a combination of government officials and local residents; the latter of local representatives alone. In spite of decentralization policies in Zambia, Kenya and Senegal, neither have played an important role to date in regard to either the planning or implementation of river basin development programs and projects. This is largely because higher level government organizations bypass (or pay lip service to) them, on the one hand, or give them insufficient technical assistance and, especially, financial resources, on the other hand. In Zambia's Middle Zambezi Valley recent decisions to establish a joint venture between the government parastatal responsible for cotton production, an American agricultural services company, and a German chemical company, were made in the capitol with institutions within the district subsequently pressured to accept the project even though it required the involuntary relocation of a number of villages without adequate compensation let alone involvement in the project as small holders.

In Kenya, TARDA -- as part of its masterplanning function -- encouraged District Development Committees in the Tana Basin to formulate resource inventories and development plans. Yet in planning dam projects in the Upper Basin and a large-scale irrigation project in the Delta, no District involvement was sought even though district residents would require relocation in the Upper Basin, while the Tana Delta Project would interfere with dry season grazing and flood recession cultivation.

In only one case did the SARSA team find a district organization that had played a major role in river basin development. This involved the Gwembe District Council in planning development in the Kariba Lake Basin preceding and following Zambian independence in 1964. While the Kariba Dam scheme was a classic example of "planning from above," the Secretary of State for the Colonies made it clear that the interests of the local population must be taken into account in what was then the Protectorate of Northern Rhodesia. Already sensitive to the people's situation, the Provincial Administration interpreted this policy to mean that the district council must

not only be kept continually informed about lake basin development but must actually be involved in its planning and implementation.

Prior to Kariba the Gwembe District Council was one of the poorest in the Protectorate. Following Kariba, however, compensation from the Federal Power Board for hardship inflicted by relocation and land inundated by the reservoir made it the richest council. As a result, it had both political clout (backed by the British Colonial Office) and funds. It applied those to the development of the Kariba Lake basin in several ways. First, the council effectively vetoed plans by the tripartite (composed of representatives from the Central African Federation, and the Northern and Southern Rhodesian governments) Kariba Lake Coordinating Committee to form a company to develop the reservoir basin, fearing that such a company would be dominated by expatriate interests at the expense of the local population. Second, the council used its compensation funds for a number of development projects, with special emphasis on reservoir fisheries.

Toward the end of 1959 the council approved a Fish Order for Gwembe District which restricted fishing to residents, a prohibition that lasted until 1963. By then, however, the productivity of the artisanal fishery had begun to decline so that the best years of the fishery were primarily for the benefit of the district population. The Fish Order also prohibited the export of fish without a permit and levied a tax on fish traders which became an important source of revenue. During the 1959-1963 period council fisheries employees increased from one to over 20. In 1962, for example, staff included a fish councilor, 10 fish orderlies, 9 boat handlers and 3 fish clerks. Fish orderlies were the council's equivalent to government fish guards. Stationed in the various fish camps they helped camp headmen maintain order as well as compliance with various regulations concerning camp lay-out and sanitary facilities including disposal of fish offal. They were also responsible for recording the weight of fish purchased by traders on export permits issued by the fish clerks.

The above activities were successfully planned and executed by the council. Meeting with only mixed success was the council's 1961 entry into the lake transport business whereby it acquired the first of eleven 26 foot inboard diesels. Ideally these boats were to provide a transport and marketing system for fishermen living at a distance from the major landing points and marketing centers. Though unreliable like several expatriate competitors and not cost effective, they did provide a valuable service that outlasted its rivals, continuing until the 1970s when the last of its boats was destroyed by Rhodesian raiders during the War for Zimbabwean independence.

While the Gwembe circumstances are exceptional, nonetheless they show that a local council can play a worthwhile role in river basin development if they have the necessary political and financial support. Unfortunately, since independence both types of support have waned so that today the role of the council is weak.

E. SUMMARY

The lack of information on successful local organizations in tropical Africa suggests their absence. Granted the recent literature on the positive relationship between local participation and project success (see especially Development Alternatives, 1975, in regard to rural development, and Radosevich, 1979, in regard to irrigation), such an absence could be a major constraint to development in tropical Africa. Fortunately, a closer examination of the African scene shows that an amazingly diversified and effective set of local organizations have appeared during the past 20 years. While some of these are rooted in indigenous social organization as in the Senegal Basin, in other cases they are *sui generis*. Furthermore, as at Kibirigwe with its use of sprinkler irrigation and dependence on the difficult market for horticultural produce, some have been able to handle technically sophisticated infrastructure and complicated market situations.

As Kimani has noted in connection with the Mwea Amalgamated Rice Growers'

Cooperative, in many of these organizations participants have shown themselves ready to shoulder additional responsibilities. Such a record should not lead to overconfidence, however, since many of the organizations are still comparatively new and have yet to prove their ability to sustain activities over time. Seemingly essential for success are three factors. The first is that local organizations should be "demand driven;" that is, that local people not only see the need for an organization but are motivated to initiate and maintain it. The second is the presence of strong leaders at the right time. The third is the proper amount of external help in the form of both technical and financial assistance. While external assistance at some point appears crucial, too little will prove insufficient to deal with the problems at hand, while too much runs the risk of creating factionalism, dependency or both. Such is especially the case with expatriate advisory assistance, no matter how well-meaning.

Okidi (1987c) presents the case well in analyzing the effectiveness of Kenya's Provincial Irrigation Units:

. . . the PIUs have evinced a central weakness in the foreign aid aspect. They are dominated by the foreign experts and money, therefore the control at overall policy level is largely foreign. The foreign irrigation experts take advantage of the absence of the local irrigation experts to perpetuate their stay and domination. The notion of training for the local counterparts does not work as the latter are easily diverted to other functions. Thus, a dependency situation is established and perpetuated.

While Okidi is referring largely to the Kenyan portion of the Lake Victoria Basin, a similar situation was observed by SARSA personnel in connection with several projects in the Tana Basin as well as in the Middle Zambezi Valley and the Senegal River Basin. Clearly, there is a major risk involved which need be carefully assessed

prior to project initiation, and, where expatriate experts become subsequently involved, monitored and evaluated. The situation appears so difficult, that technical assistance should be provided to the extent possible by the regular government technical agencies and even then major assistance should be sporadic rather than continual. The ideal situation would appear to be illustrated by the Kangocho case where the Irrigation and Drainage Branch, on request from participating farmers, helped with the design and construction of an offtake structure and then withdrew. Just as Island Farms did not have the skills to survey their fourth furrow, so Kangocho farmers did not have the skills to provide the necessary offtake structure. Assistance is needed. However, it should be carefully tailored to the task at hand and assessed in regard to its impacts on continued local participation.

CHAPTER 5

RIVER BASIN AUTHORITIES AND GOVERNMENT PARASTATALS

A. INTRODUCTION

Rather than deal sequentially with international river basin authorities, national river basin authorities, and government parastatals, the level of generalization in this section is such that all three are lumped together for purposes of analysis. Such an approach is justified since these institutions share many characteristics. They are highly centralized, hierarchical organizations that are closely articulated to the state with their chief executive officers more often than not presidential appointees. The similarities, on the other hand, should not mask obvious differences. River basin authorities involving two or more member states are far more complex as organizations, with both complexity and intractability increasing as the number of members increases - - as the history of the Niger Basin Authority illustrates. International authorities are also more subject to politicization, with member countries pressuring staff members to represent their interests and pet projects rather than the integrated development of the river basin as a whole.

There is an extensive literature on river basin authorities, with special emphasis on international ones. Though less has been written about government parastatals -- most of which are responsible for irrigation development or specific irrigation projects, there too the literature is more extensive than is the case with other types of institutions involved in river basin development. In writing this section a number of sources were especially useful. In addition to SARSA field notes dealing with the six basins, these

include Perritt's report on the Volta River Project, Quartey's report on the Volta River Authority (VRA), Kimani's on Kenya's National Irrigation Board (NIB), and Little's on the Tana and Athi River Development Authority (TARDA). External sources include the 1985 UNDP-funded HYDROSULT assessment of the Senegal, Gambia, Niger, Kagera and Lake Chad Basin Authorities, a series of papers by Okidi with special emphasis on the OMVS and the Kagera Basin Organization, sections in World Bank evaluations on institutional performance, the 1986 USAID Inspector General's "Audit of AID Participation in Sahel River Basin Development" (which critiques the OMVS, the OMVG and the NBA), and various reports, articles and chapters on specific river basin authorities such as the 1986 AID-funded DAC and SRFMP "Etude de l'Organisation et du Fonctionnement de l'O.M.V.S."

This literature is not easy to assess since some of the authors are less interested in development outcomes than in the enabling legislation or in institutional performance. Lawyers interested in international river basins, for example, emphasize the need for international agencies and assess the processes whereby the state is willing to give up certain prerogatives to international authorities and then the extent to which they actually allow international authorities to exercise those prerogatives. When lawyers like Okidi, Parnall and Utton, for example, commend the OMVS, they are praising it more as a model of what an international authority should be in a statutory sense than in regard to specific accomplishments.

The World Bank separates in its evaluations institutional performance from financial performance. As in the case of Zambia's Kafue Hydroelectric Project, the former can be designated as satisfactory while the latter is labeled unsatisfactory. It was because satisfactory institutional outcomes could be associated with unsatisfactory economic rates of return that it was deemed necessary to expand the scope of this evaluation to include development outcomes.

B. THE NEED FOR RIVER BASIN AUTHORITIES

Okidi emphasizes the need for state involvement when he notes that approximately one-half of the African continent is drained by "about fifty-four international rivers and lakes" (1987b: 1). International river basin authorities are needed for planning the development of those basins in an internationally equitable fashion and for coordinating the implementation of that development. SARSA takes this as a given. Therefore reports like the December 31, 1986 "Audit of AID Participation in Sahel River Basin Development" miss the point when they suggest cessation of donor commitment because of inadequate performance. While analysis of inadequacies is of obvious importance, and comprises much of the material in this section, its purpose should not be to undermine the justification for river basin authorities and for donor involvement in those authorities. In this regard, SARSA supports the following HYDROSULT statement: "At this moment, most River and Lake Basin institutions in West and Central Africa do not have all the financial and technical resources required to face their formidable challenge. Yet, there is a definite need for River/Lake Basin institutions and, where required, solutions should be found in order to help existing institutions exercise their mandate adequately." Where SARSA parts company with other assessments is in the definition of this mandate (and especially its relationship to riverine populations and the riverine habitat) and in role of river basin authorities, in particular, during the development as opposed to the planning and construction phases.

C. SUCCESS STORIES

1. Introduction

It is important to reiterate that "success" refers to institutional performance in carrying out certain objectives. It does not refer to the successful implementation of a program of integrated river basin development for no such program has occurred in tropical Africa. During the SARSA field studies two success stories were documented.

One was the Volta River Authority (VRA); the other was the Central African Power Corporation (CAPCO). These examples are important since they prove that strong and capable organizations can be developed and sustained in contemporary Africa. Indeed, the two cases are especially instructive in that they involve states characterized by major economic and political tensions and uncertainty. The VRA, for example, has continued to perform satisfactorily in the face of political coups and economic failure at the national level, while CAPCO continued to operate effectively during the War for Zimbabwean Independence in spite of a closed border between Zambia and Rhodesia. Furthermore, there are other "partial" success stories involving the Tana and Athi River Development Authority (TARDA) in regard to the hydro component of Tana River development and the OMVS in regard to securing funding for, and accomplishing on time, the construction of the Diama and Manantali dams.

All four examples relate to dam construction and -- with the exception of the OMVS where development benefits have yet to be realized -- hydropower generation, there being no examples yet of either international or national river basin authorities which have played an effective role in planning and coordinating the integrated development of a single river basin. There appear to be two explanations for this deficiency. While neither support the conclusion that the organizations involved are incapable of handling a wider range of responsibilities, implicit in the second explanation is the belief of donor agencies that such is in fact the case.

The first explanation relates to priorities. Although the Sahelian drought in particular has broadened the perspective of African statesmen, especially in regard to irrigation, in the VRA, CAPCO, TARDA, and most other cases, power generation continues to be the overriding priority. The second explanation involves donor influence. Hence, in the case of the VRA, donors, and especially the World Bank, discouraged the authority from taking a wider perspective in a number of ways. The most important was to curtail the use of revenues from sale of hydropower for the

funding of such other activities as relocatee development, lake transport, and the integrated development of the riverine and lacustrine zone. While this position placed a major constraint on a wider range of development activities, it was consistent with the Bank's own priorities and concerns -- priorities and concerns which in effect were superimposed from without on Ghana.

As for priorities, the World Bank saw the Volta Dam at Akosombo as strictly a power project. As for concerns, evaluation of other projects in Africa time and again has pointed up managerial constraints, with the Bank taking the position that projects should be kept as simple as possible to reduce the risks of "managerial overload." While this is a justifiable concern, it should not be taken to extremes where an organization has the mandate, the interest, and the apparent ability to pursue integrated river basin development. Another concern presumably related to debt repayment, the Bank not wanting power revenue to be spent on other development purposes.

2. Case History: The Volta River Authority

a. Introduction

The Volta case is important because it not only shows that an effective river basin authority can endure under African conditions, but that it also can handle a wide range of responsibilities and hand those over to other agencies. As with TARDA in Kenya, initially the staff was dominated by expatriates, with the first Chief Executive of the Volta River Authority (VRA) on secondment from Ontario Hydro-Electric Company. Staff, however, was rapidly Africanized. A former head of the predecessor to the Electricity Corporation of Ghana, Quartey became Chief Executive in 1966, not retiring until 1980. Under his direction two additional generating units were added at Akosombo to the original four: "The entire installation was carried out by Ghanaian staff of the Authority with only one Consultant's Resident Engineer. The work was completed in December 1972" (1987 written communication from Quartey).

As with local organizations, a major requirement for potential success is strong leadership at the right time. According to W. Haven North, who was AID Mission Director in Accra during part of Quartey's tenure, Quartey provided that leadership. In Quartey's own words, "while the priority of my predecessor . . . had been the construction of the Dam, Power Transmission Lines, and Substations, I made mine the operation and maintenance of the system and further development, especially of the 'non-power' activities, notably Volta Lake Transportation and Volta Basin Research" (ibid.). Quartey also was able to protect the VRA's autonomy and viability from other government ministries -- "to some the Authority looked like a 'State within a State'; indeed, at one time a later Government set up a one year-long Committee of Enquiry into the Authority partly, perhaps, to emphasize the limits of this Autonomy" (Quartey, 1987: 9). Even the fact that President Nkrumah was first Chairman of the VRA's Board of Governors did not provide complete protection. Then, as later, Quartey had to be constantly on guard against attempted encroachment by other agencies. This is a major problem for river basin and other regional authorities. Worldwide, sectoral ministries see such region-based organizations as a major threat to their interests.

Quartey's successor once again emphasized the VRA's power activities, speeding up in the process the handing over of non-power activities to other agencies. While these unfortunately did not appear to have the resources to support them, in terms of institutional analysis the important fact was that the VRA was willing to divest over time some of its responsibilities.

b. The VRA in Historical Context

The history of the Volta River Project and of the VRA make for fascinating reading, as is the case with river basin development throughout Africa. It is summarized in Perritt's and Quartey's Reports. Though the river basin includes six countries, no international agreements regulate the use of its waters. Most of the basin

lies in Ghana and Burkina Faso, both of which have established their own national river basin authorities -- the VRA and the AVV. To date two mainstream dams, the Volta Dam at Akosombo (1964) and Kpong (1981), have been built. Both are in the lower basin within Ghana and both, unlike other African dams which are located well inland, are within 150 km of the coast.

As initially conceived and as implemented today, Ghana's Volta River development goals were and are primarily concerned with the generation and sale of electricity. In between goals evolved in a context which paid more attention to Colonial interests and those of multinational corporations than to Ghanaian national, regional and local interests. Dam construction was first suggested by Colonial officials to produce hydropower for the exploitation of Ghanaian bauxite for British benefit. Momentum for a project built up during World War II as a means for securing for the United Kingdom safe access in the future to aluminum. Sir William Halcrow & Partners made an initial survey in the early 1950s which was followed by the multivolume report of the Preparatory Commission in 1956 under the chairmanship of Sir Robert Jackson. While the latter report paid considerable attention to the relocation component of dam construction, and while other reports noted other development possibilities including fisheries, irrigation and water transport, what became known as the Volta River Project continued to be primarily one for generating electricity for processing Ghanaian bauxite.

As is so often the case with mainstream dams, international interests overlapped with those of the riparian state or states. In the Ghanaian case, President Nkrumah saw the Volta River Project as the means for implementing the industrialization of Ghana (which became independent in 1956). When British interests began to wane because of increasing cost estimates and concern about the investment environment within Ghana, Nkrumah turned to the United States receiving support, on the one hand, of the Kaiser Aluminum Corporation and, on the other hand, of Presidents Eisenhower and Kennedy.

Kaiser reduced costs by "deferring" the processing of Ghanaian bauxite into alumina (and today the smelter at Tema continues to process only imported alumina) and the construction of a railway line between mines and smelter. While the Kaiser proposal was even less favorable to Ghana economically than the British one, it did ensure that dam construction would proceed. Furthermore, shifting the dam site to Akosombo would increase generating capacity which would be in the interests of the aluminum companies and of Nkrumah's industrialization program.

After discussions involving a number of aluminum companies, in 1959 two formed the Volta Aluminum Company of Ghana (VALCO): Kaiser with 90 percent of the shares and Reynolds Metals with the remainder. Kaiser further solidified its position by becoming consulting engineers to the project. In 1960 the Ghanaian government agreed to sell bulk electricity to VALCO at slightly more than cost. The government also agreed not to interfere in VALCO affairs for thirty years. That same year the World Bank completed an appraisal of the Volta River Project at government request and agreed to provide financing along with the United States (through AID and the Export-Import Bank) and the United Kingdom.

The Volta River Authority was established under the Volta River Development Act of 1961. It was organized as an "autonomous government agency with extraordinary legal and financial powers, intended to operate outside, and be fiscally independent from, the normal government civil service bureaucracy. The Authority combined many of the generalist functions of cabinet level ministries with the technical, legal, and finance staffing necessary to operate a large-scale hydro-electric . . . system" (Perritt, 1987: 25). That electricity generation was the VRA's prime responsibility was made clear in the establishing Act which was "to provide for the establishment of an authority charged with the duty of generating hydroelectricity by means of water power of the River Volta . . . and for charging the Authority with certain incidental responsibilities in relation to health and other matters." These "other matters" included

resettlement, research, fisheries, agricultural development, lake transport, and administration of Akosombo Township.

Though Quartey emphasizes in his report that the VRA was a multipurpose organization, Perritt emphasizes its prime responsibility for power generation, and the general difficulties that such unipurpose organizations have in carrying out additional responsibilities. Other activities were certainly de-emphasized. In terms of funding they were also at a disadvantage since they were not considered by the donors, and especially by the World Bank, to be part of the Project. Indeed, the Bank insisted that revenue generated from sale of electricity not be used for non-power activities, which conceptually were placed in a separate category. In part this was due to the Bank's view of the VRA as strictly an electricity generating organization (indeed in the mid-1970s the Bank favored merging the "strong" VRA with the "weak" Electricity Corporation of Ghana, although subsequently the Bank reversed its position). In part it was due to concern about overloading the VRA with other managerial functions, and weakening debt repayment capacity.

Notwithstanding these constraints, the VRA appears to have carried out its other responsibilities quite satisfactorily with the exception of resettlement in connection with the Akosombo Dam. This conclusion is important since it suggests that the success of organizations like the VRA and CAPCO is not necessarily correlated with their overriding concern with one as opposed to multiple responsibilities. In other words, the managerial potential for carrying out a wider range of functions is there. Certainly it was present in the case of the VRA which also was quite willing to hand over these other responsibilities to the appropriate agencies. While Perritt correctly points out the inability of most of those agencies to take over, it was not the policy of handing over that was faulty but rather its implementation.

c. Resettlement and Development

The construction of the Volta Dam at Akosombo required the relocation of over 80,000 people. Members of six ethnic groups, these people lived in 740 villages. Approximately 80 percent opted for resettlement in 52 government-sponsored new towns, with the remainder resettling themselves. The government-sponsored resettlement program was a failure, and continues to be a failure. Though reasons are many, three major ones stand out. First, there was insufficient time to plan and implement suitable resettlement with the result that relocation became a crash program to remove the people before flooding. Second, insufficient attention was paid to the most important component of any relocation program -- the design and implementation of viable economic systems for the relocatees. In the Volta case, the inadequacies of soil and site selection surveys were compounded by a poorly conceived program of agricultural mechanization. Without means to support their families, many men left; indeed, within the first few years of resettlement at least 50 percent of the relocatees had left the new towns.

The third major deficiency was that no single organization had responsibility for the development of the reservoir margin, including both the relocated people and the host population. While the VRA had jurisdiction over the drawdown area of the reservoir, Quartey notes that "the tardy development of this aspect would appear to be due to the non-specific allocation of responsibility for it to any particular body . . . This upland area requires more than just agricultural development. It requires a coordinated and integrated development of resettlement villages and host villages into coherent units, marketing of agricultural and farm products, and suitable local and cottage industries" (Quartey, 1987: 11-12). Since the reservoir margin falls within three regions, Quartey notes that a Volta Lake Upland Development Corporation might have been an appropriate organization. Perhaps so; however, the pity is that the VRA itself was not able to play a more effective planning, coordinating and funding role, with

funding needed to enable the three regional governments and their technical departments to implement development projects (which could, at least partially, have been based on VRA-supported research and pilot projects).

While the VRA must take some of the responsibility for a failed resettlement program, resettlement had not been defined as an "integral part of the project; hence, neither the consultant nor the Dam Civil Contractor had any responsibility for it. Initially, it was required to be carried out by the Government Department of Social Welfare and Community Development. But when by the end of 1962 little progress appeared to have been made in the matter, Government assigned the responsibility to the Volta River Authority" (*ibid.*, p. 12). At that time less than two years remained until the commencement of inundation.

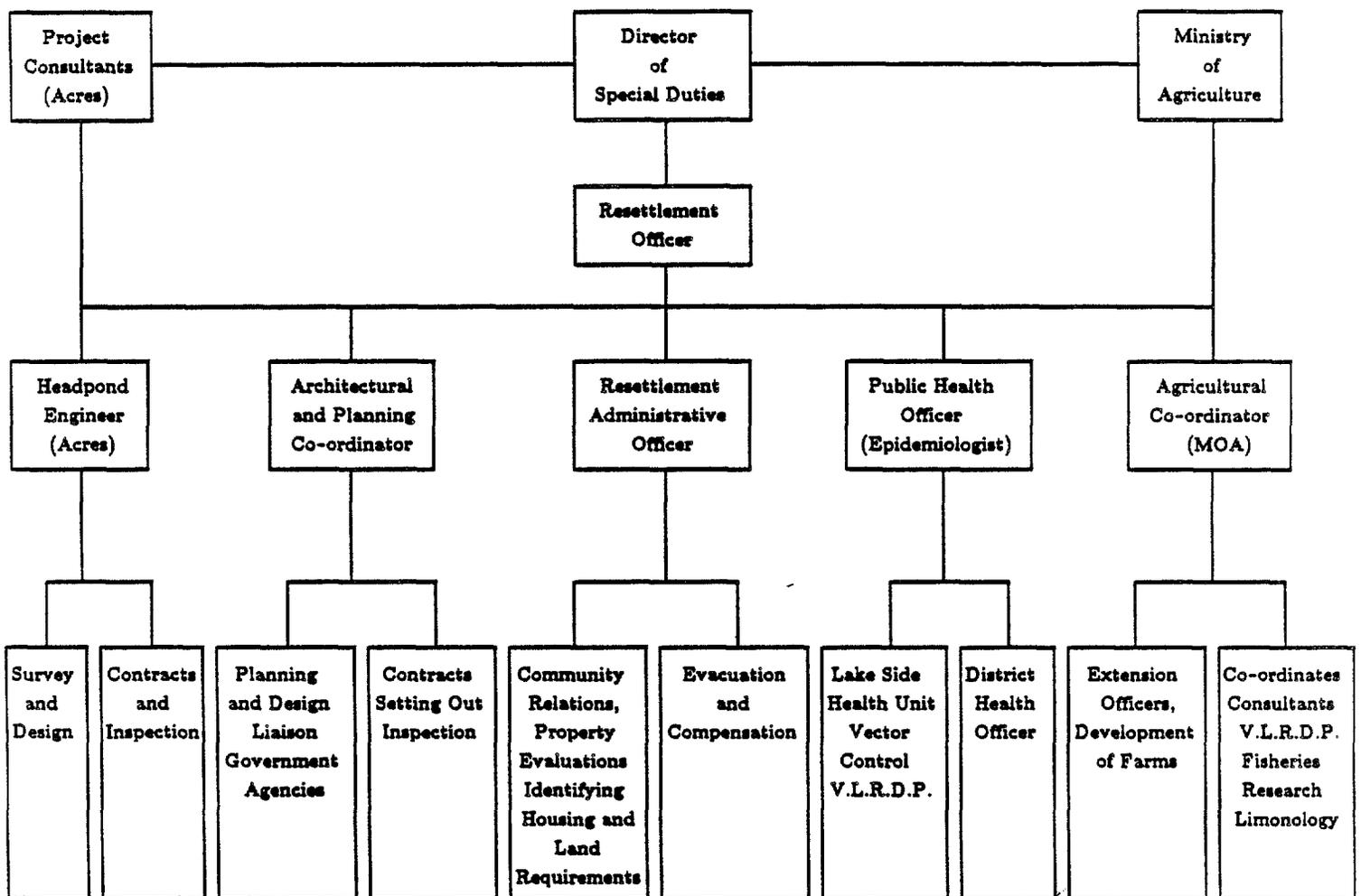
The lessons of Akosombo were well learned by the VRA and were applied to resettlement in connection with the construction of the Kpong dam (Futa, 1983). Though only 7,000 people as opposed to over 80,000 were involved, and while they had an easier time adapting since many were already fishermen and there were also agricultural opportunities and industrial jobs in the vicinity, Kpong is probably the best planned and executed dam relocation in Africa. In contrast to Akosombo, in the Kpong case resettlement was considered part of the project by both the VRA and the major donors: "thus all of it was included in the work of the Consultant, and also four out of the six new Resettlement villages were included in the contract of the dam Civil Contractor" (Quartey, 1987: 13). Within the VRA, the resettlement program came under the Special Duties Office (Figure 6) which was "activated to meet the needs to effectively resettle people displaced by the dam, then phased out as the infrastructure, services and housing for resettlement villages and towns were completed" (Perritt, 1987: 35).

157A

FIGURE 6

VOLTA RIVER AUTHORITY
KPONG HYDROELECTRIC POWER PROJECT
RESETTLEMENT PROGRAMME

ORGANIZATION CHART
JUNE 1977



d. Research

The VRA played an active role in lake basin research between 1964 and 1977. Prior to the closure of the dam the University of Ghana and the VRA set up the Volta Lake Research Project. With international funding from UNDP, the Volta Lake Research and Development Program was established in 1968 with the VRA and FAO as the executing agencies. Subsequently with further UNDP funding a schistosomiasis research program was initiated with WHO as the executing agency at the international level. As more and more organizations became involved in research, the VRA established a research unit through which all funds were to be allocated. The VRA was also responsible for establishing a Research Coordinating Committee.

Researchers concentrated on the hydrobiology of the lake, fisheries development, agricultural utilization of the drawdown area, and public health. Though the research program largely collapsed after the cessation of UNDP funding in 1977, impacts did extend beyond the publication of papers.

e. Fisheries Development

At the peak of productivity following inundation, fish landings from the Akosombo reservoir reached 60,000 tons per annum. Thereafter they ranged between 30,000 and 40,000 tons. Although many were immigrants from the Lower Volta below the dam and from elsewhere, those supported by the fishery approximated the number of relocatees, while income from fish sales exceeded that from power sales in the mid 1970s. While credit for fisheries development belongs primarily to the thousands of small-scale fishermen and marketeers, the research program and the VRA played an important role. Researchers demonstrated improved gear; indeed, the response to multifilament nylon gill nets was so great that nets were pilfered from research station stores. On the east side of the reservoir a fishing complex was built at Kpandu Torkor, with office space, boatyard, stores, market, and mechanical workshop, "all operated and

administrated on a Revolving Fund basis by a committee of townsmen, officials and technical advisers" (ibid., p. 19), this being one case where effective handing over appears to have occurred.

f. Agriculture

While Quartey believes decision-makers should have included more downstream irrigation within the Volta River Project, the VRA did encourage soil surveys and agricultural research within the drawdown area. A pilot project was carried out at Ampaem in the Afram Plains between 1977 and 1981. It had a significant demonstration effect with the number of farmers undertaking drawdown cultivation increasing from 33 to approximately 2,000. Although the Ministry of Agriculture's Extension Service and National Irrigation Authority did not continue such activities, more recently a private voluntary organization, Catholic Relief Services, has begun to provide technical assistance. Further inland, in the vicinity of some new towns, the VRA's agricultural unit experimented with live stock management, including poultry and pigs at Nkwakubio. Unfortunately here there were no major follow-on activities.

In the Kpong reservoir basin and downstream area the VRA has played a more active agricultural role. First, the VRA authorized an agricultural survey of irrigable land on both sides of the river below the proposed dam, the results of which were instrumental in two irrigation outlets being incorporated within the final design of the dam. Second, the VRA incorporated Kpong Farms as a VRA subsidiary under international management to grow commercial rice. While it is unfortunate that this project did not incorporate the relocatee and host populations to a greater extent, Kpong Farms and the adjacent University Research Station nonetheless have had a major demonstration effect. At the time of the SARSA 1986 field trip, for example, hundreds of local farmers had begun to irrigate paddy rice around the reservoir margin (using the daily rise and fall of the reservoir to manage water levels) and in nearby

depressions.

g. Health

Following the completion of Akosombo, schistosomiasis became a major problem, with incidence among children in some locales increasing from under 10 per cent to over 90 per cent. In the early 1970s the VRA facilitated, with UNDP funding and WHO execution, a schistosomiasis research program, and, with collaboration from such Ghanaian institutions as the Ministry of Health, the Medical School of the University of Ghana, and the Institute of Aquatic Biology, a public health program. Based on this experience, a more elaborate program was designed and implemented for the Kpong relocatees. Referring to Adu-Aryee's 1985 report, Perritt writes that this program was

applied to the settlements in the Kpong area by the Lakeside Health Unit of the VRA. These measures included surveillance and mass treatment of bilharzia which was quite successful in reducing the prevalence rate to a considerable degree. . . . Above all, an active health education campaign was launched for the first time with the aim of soliciting the participation of the people in the control programme on a self-help basis. . . . Equally important was the emphasis placed on the need for environmental sanitation in these settlements. To prevent the use of streams for washing, bathing and cooking, the villages were supplied with potable piped water originating from the Kpong Water Works. Other precautions taken were the provision of communal latrines, deep water boat landing points to prevent wading in the headpond, and the demarcation of a peripheral area around the lake restricting any sort of developing or building (p. 49).

h. Lake Transport

Though a major interest of Quartey's, lake transport is an example where the World Bank attempted to curtail the VRA's non power activities. Pilot projects with old construction boats indicated potential profitability as did various donor financed studies. In the meanwhile local entrepreneurs established ferries that crisscrossed the reservoir, but did not attempt traversing its length north and south. The VRA's wholly owned subsidiary, the Volta Lake Transport Company, was to run the length of the reservoir -- "from Akosombo to Yapei near Tamale, initially, and to Buipe on the Black Volta eventually" (Quartey, 1987:18).

Hesitant to invest in what they feared could be an overly ambitious and costly project, donors originally restricted funding to feasibility studies which considered such issues as the savings to Burkina Faso, for example, of shipping petroleum products up the reservoir and livestock down it. Not only would distances be significantly reduced, but round the year transport would be feasible. After \$600,000 of donor studies, the VRA persuaded the Dutch to provide a boat. This was the Akosombo Queen. Its performance, however, was not cost effective, with tonnage dropping from approximately 28,000 tons in 1973 to about 3,000 in 1979. According to Hart (1980) problems were unreliability of operation associated with a single boat, spares and maintenance, and a drop in reservoir level which interfered with port accessibility.

According to Quartey, "one very serious obstacle to the whole scheme was the very steep hill on the road from Akosombo township to the Akosombo Port. In due course this was re-graded with financial assistance from the Government of the Federal Republic of Germany as an advance from their main lending to the whole project, presently underway. Another aspect of the project which is presently underway is the establishment of oil terminals at Akosombo, Yapei and Buipe" (Quartey, 1987 written communication). At the time of the 1986 SARSA visit, German aid was funding the construction of additional lake ferry craft including a transport suitable to carry

petroleum" (Perritt, 1987: 38). More reliable Lake Volta services were soon scheduled to get under way. Whether or not they prove profitable and/or sustainable remains to be seen.

i. Akosombo Town

The VRA has effectively administrated Akosombo town. So successful was the Akosombo Hotel, that the Hotel Corporation of Ghana was eager to take it over, whereby quality of service and profitability declined to the extent that two years later the VRA was asked to resume management -- a request that was refused because of the extent of the deterioration.

D. INSTITUTIONAL CONSTRAINTS TO INTEGRATED RIVER BASIN DEVELOPMENT

1. Management and Fiscal Constraints

Success stories notwithstanding, management constraints are characteristic of most African river basin authorities and parastatals. It would be wrong, however, to single out such organizations for criticism simply because they are river basin development agencies. Poor management is a global problem that constrains large scale development projects throughout the tropics. For example, not only did management inadequacies characterize nearly half of 34 World Bank-assisted settlement projects in Latin America, Africa, the Middle East and Asia (World Bank, 1985), but management was emphasized as one of the two most constraining factors, being inadequate in 90 percent of the less satisfactory (in terms of economic rates of return) projects. More specifically, managerial constraints were generalized for all sorts of institutions, including ministries and parastatals, in the Bank's review of World Bank project experience with "Institutional Development in Africa" (1984a: iii).

Analysis of management and fiscal constraints is enhanced by looking at

organizational constraints at different points in time. River basin authorities and parastatals tend to be at their greatest strength during the years following their establishment (the major exception here being the Niger Basin Authority). Politically they have strong (indeed, more often than not presidential) backing which is supported by firm initial funding. Functionally they tend to have their greatest impact at this time as effective public relations and fund raising institutions in behalf of large scale infrastructure. In this regard they are assisted by multilateral and bilateral donors with funds to spend.

River basin authorities and parastatals also have a reasonably good record in regard to the construction of physical infrastructure although there the actual work is done by international contractors supervised by international firms of consulting engineers. Where they tend to fall down seriously, however, is when the construction phase ends and the development phase begins. There are many contributing factors. As time goes by and new projects and programs are launched elsewhere, political support weakens as does funding. Staff attrition occurs and equipment wears out. Equipment deterioration is an especially serious problem with irrigation parastatals like the Sudan Gezira Corporation and the New Halfa and Rahad Agricultural Production Corporations since land preparation and a sequence of other agricultural activities are adversely affected. Another major problem, analyzed in more detail below, is the extreme difficulty such organizations have in dealing with local populations and in handing over managerial and other functions to local organizations and the various line ministries. This is a major failing which is not sufficiently addressed by rehabilitation projects such as Office du Niger in Mali and Gezira and New Halfa in the Sudan since these tend to focus primarily on the rehabilitation of physical infrastructure and replacement of equipment. The logical solution to such problems would appear to be a phased handing over and decentralization of management functions accompanied by a program of institution building and reorientation.

Looking at international river basin authorities in particular, management and fiscal problems are especially serious. According to the HYDROSULT evaluation of the five major international river basin authorities "the two main weaknesses hampering the effectiveness of these organizations are financial and managerial. Financial, since in most cases, member States are behind with their payments, and managerial, because the failure of the organizations to play their counterpart roles can sometimes be directly attributed to the lack of disciplined managerial skills of the various Executive Secretaries involved, as well as the lack of adequately trained technicians" (1985: V). Although the strongest of the five, the AID 1986 "Audit of AID Participation in Sahel River Basin Development" lumped the OMVS together with the OMVG in stating that "both organizations had management and funding problems. These problems limited the impact of AID assistance and, unless corrected, will lessen AID's ability to achieve its objective in assisting in Sahel river basin development" (covering memo to AID/Dakar).

There is an irony in regard to fiscal constraints (in terms of delayed and inadequate payments on the part of member states) since the greatest success of international river basin authorities may well have been as fund raising institutions. The OMVS, for example, has been able to raise over \$800,000,000 for studies and the construction of the Diama and Manantali Dams, while the OMVG and the NBA have raised through 1984 approximately \$30 million and \$22 million, respectively, for pre-investment studies (HYDROSULT, 1985: iii-iv).

Fiscal problems are not restricted to international river basin authorities backed up by ambivalent member states. They also plague parastatals even where they are responsible for managing projects on which the government is dependent for its foreign exchange earnings. Though second only to the Sudan Gezira Board as a cotton producer, the New Halfa Agricultural Production Corporation is a case in point. According to Sørbø, "there has been a general lack of financial resources which has

affected the scheme very badly. It has caused the inability to provide sufficient machinery, repeated shortages of vehicles and fuel, invasion of pests and weeds, delayed arrival of seeds, fertilizers and pesticides and poor storage facilities" (1985: 38).

2. Politicization

Politicization is a double edged sword. In the case of the OMVS support from the Heads of State and the Council of Ministers was essential to the establishment of a necessary organization for planning and coordinating the development of the Senegal Basin. On the other hand, to secure the cooperation of those three nations major developmental decisions (including navigation to Kayes, development of major mining industries in eastern Senegal, and perhaps the Diama Dam itself), were made on the basis of inadequate information or on strictly political grounds.

It is not exceptional for fund-raising to commence on the basis of political decisions to proceed with dam construction even though the necessary feasibility studies have yet to be completed or are even unfavorable. In the 1980s Somalia's Baardheere Dam and Gambia's Balingho Dam are examples where presidential decisions in favor of dams preceded the completion of feasibility studies. The Balingho situation is especially instructive. Detailed socio-economic studies by the University of Michigan in the early 1980s were followed by further studies by RONCO. Since both emphasized on environmental, economic and social grounds the nonviability of Balingho, RONCO's initial series of development options did not include a "with Balingho" option. This was not acceptable to OMVG with the result that a Balingho option had to be added. While economic rates of return are more favorable for Baardheere, there too it is clear that government biases in favor of the dam, and more specifically of hydropower generation and state-run irrigation, preceded the completion of the relevant feasibility studies.

Politicization within river basin institutions is another major problem. While managerial inadequacies certainly reflect inadequate experience and training, and organizational structures, Okidi (1987) emphasizes political patronage as another major failing. Because this problem is so often played down because of political sensitivities, it warrants some attention. In discussing the problem Okidi notes that "over-politicization of the institutions commences with the determination of personnel to be employed on the basis of political patronage to the exclusion of merits and expertise." Knowing that they are protected and are evaluated more on grounds of loyalty to their protector than of competence, such persons "resort to misuse of office, unfair enrichment, misappropriation of resources, and negligence of the assigned responsibilities." They also stop the initiative of their more experienced subordinates, their actions in this regard leading to "collapse of morale and apathy in the professional and support staff, with fatal implications for the organizations." While Okidi's use of the word "fatal" is an overstatement since the organizations continue functioning, albeit inadequately, SARSA field teams confirmed that the problem to which he refers is or has been a major one in the OMVS, the OMVG, the NBA, and the Kenyan National Irrigation Board. On the other hand, it did not appear to be a major one in either of the success stories (VRA and CAPCO).

3. Policy Biases

During the 1950s and 1960s most river basin authorities and parastatals with river basin development responsibilities prioritized electricity generation for the urban industrial sector. By the 1970s and 1980s these biases were still observable, although more emphasis was being placed on irrigation and in regard to irrigation on small-scale projects in addition to medium and large-scale ones. TARDA, for example, had advocated in the 1970s feasibility studies for small-scale irrigation in the Upper Tana Basin which resulted in the implementation of the Kibirigwe project. In the 1980s

TARDA had also begun to implement its own small-scale project in the Middle Athi Valley. In the Senegal River Basin, OMVS publications have emphasized since the 1970s the lower costs and higher yields per hectare of small-scale projects.

The trend is a good one. Nonetheless, a hydropower for the urban/industrial sector and medium to large-scale irrigation bias continues. To date little rural electrification, even of irrigation projects, has occurred. Though Mauritanian interests may tip the balance toward the valley, in the Senegal Basin discussion continues as to whether or not the power line from Manantali will run down the river or follow the railroad cross-country to Dakar. In Somalia discussion continues as to the routing of the power lines from the Baardheere Dam to Mogadishu and to the division of power between the capitol and the Juba Valley. While such discussions probably would not have even occurred in the past, in both cases one would wish that current assessments paid more attention to a wider range of development alternatives.

The same applies with irrigation. Now that dam construction is over, at least temporarily, TARDA, with Japanese financing, is not only pushing for the 20,000 hectare Tana Delta Project but is also considering implementing it. In the Senegal Basin SAED, with EEC funding, is proceeding with a medium-scale irrigation project in the Middle Senegal Valley. Elsewhere the Ministry of Juba Valley Development sees medium sized state projects (such as Homboy) as the end product of irrigation development in the Juba Valley. In none of these cases are other types of agriculture, including flood recession cultivation, rainfed agriculture and livestock management, let alone the interests of the local population, receiving sufficient attention from the government planning institution (although other agencies are pushing a wider perspective which may still have an impact).

4. Planning

A very basic constraint within many river basin authorities are inadequate planning capabilities. AID and other donors have withdrawn support from the Niger Basin Authority in part because of the inability of the Secretariat in Niamey to establish a planning unit. Within the OMVG planning is largely in the hands of expatriate advisers and their riparian state counterparts among whom morale is low since planning has not received support from the High Commissioner whose major task is to secure funding for the construction of the Balingho dam. According, he is suspicious and critical of any reports, whether narrowly based on economic rates of return or on broader multiobjective criteria, that question the economic viability of Balingho. Within the OMVS, senior officials have been slow to implement recommendations based on an AID-funded study (which has received broad donor support) advocating an upgrading of the planning unit. Within the Ministry of Juba Valley Development, the Minister has made it clear from the beginning that planners are not to question the feasibility of the Baardheere Dam. It remains to be seen if there may be more flexibility in regard to using the results of planning to determine development options for the Valley.

The above examples suggest serious tension between higher level officials, and planners (including donor consultants like SARSA who advocate improved planning as a matter of course). In international river basin authorities this tension is apt to reflect hesitation on the part of member nations to turn over planning functions to international agencies. Such hesitation has, for example, plagued the Niger Basin Authority, with member states not only hesitant to institutionalize a planning unit within the NBA but also to provide information to the NBA Documentation Centre which can be used for purposes of coordination. Within national institutions the tension is between political appointees acting on presidential and ministerial instructions and planning staff members. Solutions to the problem must take such tensions as given.

5. Monitoring and Evaluation

During the construction phase, monitoring tends to be restricted to progress on the construction of physical infrastructure, the relocation of affected populations and other construction-related topics. During the development phase it tends to be restricted to production output as opposed to a broader consideration of indices relating to income levels, employment generation and enterprise development. Feedback into planning is weak in comparison to use of monitoring information for compliance with donor requirements and for public relations purposes. As for evaluation, SARSA came across no evaluation units during the field studies.

6. Decentralization, Devolution and Working with Local Populations

Decentralization refers to transfer of responsibilities from central to regional or project offices. Devolution refers to handing over of managerial and other responsibilities to other government agencies and local institutions. River basin authorities and parastatals are deficient on both counts. They also have generally shown an inability to work with, as opposed to dictate to, local populations. The problem is a serious one not just because of institutional inadequacies on the part of many river basin institutions during the development phase but also because project success is associated positively with the increasing involvement of local participatory organizations.

Examples illustrating the problem are many with agency staff at the center resisting decentralization within the organization and all staff resisting devolution of tasks to other institutions. At the parastatal level, one of the most informative examples involves the Gezira Board where staff have resisted for years government orders to hand over increasing responsibility to the strong Tenant's Union. As a result the Board and the Union find themselves in a adversarial rather than a cooperating relationship.

Okidi analyses in some detail decentralization and devolution deficiencies in Kenya's National Irrigation Board. Following a presidential tour of the Bura Project, the Kenya Times quoted one finding that noted that "the project managerial control was over centralized in Nairobi which resulted in major weaknesses in the procurement of materials, delayed reactions to the crises on site, poor financial and budgetary controls, and misapplications of project funds" (February 18, 1986). Okidi goes on to observe that generally speaking the National Irrigation Board very often was "totally insensitive to the woes of farmers" (1987: 27).

Both national and international river basin authorities have the same failings. At the international level the Central African Power Corporation keeps detailed records on reservoir levels and downriver flows, and forecasts when the reservoir can be expected to commence filling and drawing down. While these records are generally available, virtually no responsibility is taken to ensure that lake basin and downriver farmers are notified about matters of critical concern to them. At the national level Adams has dealt in a number of publications with Nigeria's eleven federally-funded river basin development authorities (RBDAs) which "have tended to concentrate on large-scale single-purpose projects, particularly irrigation schemes" (1985c: 299). While the 1979 enabling legislation requires RBDAs to assist the state and local governments in the implementation of a wide range of development objectives, in fact, "there was been little success in the establishment of effective partnership with state agencies" (*ibid.*, 305). As for relationship with local populations in an earlier draft of the same paper Adams notes that "RBDA schemes in Nigeria, particularly irrigation schemes in the north, have been extensively criticized for their insensitivity to farmers' needs, failure to understand the economic environment of farmers involved on schemes, attempts (often badly organized) to alienate and control land, and adverse distributional effects whereby larger producers and traders gain at the expense of the poorer groups affected."

As the above references illustrate river basin authorities and parastatals fail to cooperate with and hand over responsibilities to other agencies, including local organizations, even where required to do so in their enabling legislation or subsequent government orders. At best lip service is paid to the principles involved. According to Okidi, the Lake Basin Development Authority in Kenya "accepts, in principle, that it should decentralize its project supervision and administration but in actual fact, the practice is far from realization" (1987b: 28). As highly centralized, hierarchical organizations, it is very difficult for river basin authorities and parastatals to share responsibilities with other organizations. Requirements that they do so are not sufficient. More effective incentives are needed, such as budgetary, staff and other restrictions in the event that schedules dealing with decentralization and handing over are not met.

7. Coordination versus Implementation

There is widespread agreement that a major function of national and international river basin development authorities, and of parastatals, is to plan and coordinate development. Implementation activities present a much more difficult problem. To date the general situation has been for such agencies to supervise the construction of physical infrastructure and in the case of dams to operate them. Generation of hydropower is considered part of operation. In some cases such as Kariba and Kafue, the operating organization is also responsible for the distribution of bulk power. In other cases, Volta for example, and Kainji and the TARDA dams, electricity is sold to the national electricity corporation which has distributional responsibilities. In either case revenue from bulk sales is the major source of funds for debt repayment.

Looking to the future two opposing tendencies are at work. In one, management of facilities and implementation of the development phase is increasingly seen as the responsibility of other agencies. This view is receiving increasing support from

management consultants and donors, as well as from competing agencies within the riparian states. The contrasting approach is for the river basin authority or parastatal to take on increasing management and implementation responsibilities.

In their recently completed study on institutional options for the operation of Somalia's Baardheere Dam Project Price Waterhouse present five different scenarios which involve either the modification of existing organizations or the creation of new ones. In the Senegal River Basin Sir Alexander Gibb and Partners has recommended that a new organization be created to operate the Manantali and Diama Dams. Meanwhile, in the riparian states the Senegal Ministry of Plan has established a special cell (Cellule d'Après Barrages) to plan national projects which would be implemented by the relevant national agencies, while Mauritania is considering the establishment of a similar planning unit. As a result the role of the OMVS is seen more as a coordinating, monitoring and evaluating one. Similar forces are influencing SAED to involve local communities in the planning and implementation of small-scale irrigation projects although SAED continues to play the major design and construction role.

The Tana and Athi River Development Authority has been taking the opposite approach. On the one hand, TARDA has designed and implemented the small-scale Kibwezi Project as a pilot project to study the benefits and costs of irrigation in the Middle Athi Basin should the Munyu dam be built. On the other hand, TARDA would like to implement the 20,000 hectare Tana Delta Project which has received initial pilot project funding from the Japanese Government. It is easy to argue that Kibwezi is a legitimate expansion of TARDA's activities. Certainly it is a most interesting and relevant experiment since design and implementation were done at relatively low cost without the involvement of expatriate consultants and firms. Not only are results encouraging, but they are grounded in the Kenyan experience. Though of course the scale is very different, Kibwezi presents a logical alternative to Bura.

On the other hand, Kibwezi also sets an implementation precedent which is

worrisome since involvement in specific projects is seen as a mistake for two reasons. First, as already emphasized, centralized river basin agencies are more effective during the planning and construction stages than during the following development stages. Second, once a river basin authority becomes an implementing agency it loses its impartial ability to coordinate the integrated development of basin resources and to mediate between conflicting uses. Instead it becomes a competitor for scarce water and fiscal resources.

E. SUMMARY

The critical question is not whether or not satisfactory river basin organizations can survive in Africa. The histories of the Volta River Authority, the Central African Power Corporation, and the Tana and Athi River Development Authority show that they can. Rather the critical question is whether or not such organizations can address themselves to a wider range of river basin development options, including those that do not involve the construction of major dams. The record to date is not encouraging, there being no examples yet of either international or national river basin authorities which have played an effective role in planning and coordinating the integrated development of a single river basin. Explanations for this deficiency include national preoccupation with hydro-power generation as the major priority of river basin development and donor support for that prioritization. The end result is that river basin authorities become the executing agencies for that coalition of developers that continues to advocate the construction of dams and medium and large-scale irrigation projects. In the process, such other options as rainfed agriculture, flood water cultivation and livestock management tend to be ignored as is the participation of local organizations in the planning, implementation and evaluation of development projects and programs.

This is a problem that needs further analysis. Is there a fundamental

incompatibility between the pursuit of multiobjective development goals and river basin authorities? At the moment, the answer appears to be yes although for reasons that are not very clear. In part the deficiency may be due to the nature of river basin authorities as centralized, hierarchical organizations whose senior staff find it very difficult to decentralize responsibilities to regional and project offices and to hand over managerial and other responsibilities to other organizations, including local organizations. Another problem relates not so much to the nature of river basin authorities as organizations but rather to their establishment by heads of state and other senior officials, with the strong backing (indeed, in some cases the insistence) of donors, with the mandate to build dams. A major result of these characteristics is that river basin authorities are more effective during the construction phase of development than during the subsequent development phase. A solution to this deficiency may be to restrict the functions of authorities to planning, coordination, the raising and disbursement of funds, and monitoring, with the implementation and management of development programs and projects, including dam construction and operation, the responsibility of other organizations.

For political as well as economic reasons states which participate in international river basin authorities allocate most implementation of development projects to national institutions with the major exception of dam construction. The member states in the middle and lower Senegal Basin and the Middle Zambezi are examples. In regard to the OMVS, member states have apparently accepted the recommendation of Sir Alexander Gibb and Partners that the Diama and Manantali Dam also be operated by a separate agency. While the OMVS has belatedly recognized the importance of small-scale irrigation and has begun to recognize advantages which might be associated with 'the hydropower plus controlled reservoir drawdown and downriver flood option,' would such options, along with others, have received more serious attention at an earlier date if the OMVS had not been given the responsibility from the start for

building mainstream dams?

National river basin authorities are more apt to engage in a wider range of implementation activities. Examples include the VRA and TARDA. While their efforts show that both organizations have the managerial capacity for carrying out a wider range of responsibilities, there is an increasing risk of conflicts of interest when authorities add implementation responsibilities to planning and coordinating ones. While the VRA has divested most of its non-power responsibilities (exceptions being Kpong Farms and Volta Lake transport), TARDA has been moving toward greater involvement in project implementation -- at the expense of its ability to coordinate and to mediate between different users within the Tana River Basin.

A major recommendation of SARSA is that serious consideration should be given to initially restricting the responsibilities of both national and international river basin authorities to planning and coordination, to raising and disbursing funds, and to monitoring project implementation. The question as to what organizations should construct or otherwise implement, manage and evaluate specific projects (including dams) would be left until after plans have been assessed and specific options selected. While such a recommendation would not preclude river basin authorities from being implementing agencies in regard to pilot projects, dam construction, and other development efforts (such as lake transport), there is an underlying assumption in the SARSA recommendation that implementation and management should be handed over to other agencies and that the intention of such handing over should be stated from the outset.

Since planning skills within river basin authorities are inadequate, they need to be upgraded. The same is true of planning units, especially in such international river basin authorities as the OMVS, OMVG and NBA. On the one hand, such units need the political support of senior officials -- often a delicate matter since those officials are apt to be under political pressure to proceed with dam construction before the

necessary feasibility studies have been completed. On the other hand, they need a greatly improved capability to gather, store, access and analyse information and to present the results of analysis to policy makers in the form of a broad range of alternatives. Improved monitoring is also required. While evaluation is best left to other organizations (such as national universities and research institutions), planning units should also have a capability to assess evaluations. In all of these areas there is need for increased donor assistance.

CHAPTER 6

BILATERAL AND MULTILATERAL DONOR AGENCIES

A. INTRODUCTION

While the emphasis in this chapter is on AID and the World Bank, many of the deficiencies examined can be generalized to other bilateral and multilateral donors. Lack of strategies for approaching river basin development is a case in point. While various donors have biases pro or con different approaches toward river basin development, no policy or strategy papers were found by the SARSA team. As in the United States case, which is examined in the next section, internal inconsistencies were not uncommon. In its 1984 *Toward Sustained Development in Sub-Saharan Africa*, the World Bank, for example, noted that large infrastructure projects, which have "represented a large part of past donor programs . . . must be reexamined." Yet there is little evidence that the Bank is reexamining its own program since the energy section of the Africa Bureau is currently contributing to the momentum building up for the construction of Somalia's Baardheere dam for purposes of hydropower and irrigation (recent Bank-funded studies relate to the routing of the transmission lines, post dam organizational structures, lake basin resettlement, and the Homboy irrigation project).

B. UNITED STATES INVOLVEMENT IN RIVER BASIN DEVELOPMENT

1. The Post-World War II Era

The purpose of this section is to analyze United States involvement in river basin development (and more specifically African river basin development), and the general

outcomes of this involvement, since the 1950s. In addition to AID and its precursors, United States involvement included both the White House and the State Department, as well as profit and nonprofit private sector organizations. Problems related to the implementation of specific AID initiatives are dealt with only tangentially where they are mentioned for purposes of illustration.

Though not an AID focal point for policy or evaluation in the same sense as area development projects (Kumar, 1986) or irrigation projects (Steinberg, 1983), river basin development has nonetheless received significant U.S. development assistance during the post-World War II era. Between 1949 and 1979, 25 projects at a cost of approximately \$72 million were implemented under the Helman Valley Development Project for developing the Helman River Basin in Afghanistan (AID, 1983). In the Philippines, AID involvement in the Bicol River Basin Development Program began in 1974, with over \$30 million dollars committed through 1981 (AID, 1982), while AID has committed over \$100 million to the development of Sri Lanka's Accelerated Mahaweli Project in the 1980s.

2. The 1950s and 1960s

Unlike the situation in the 1970s and 1980s when developmental goals were more prominent (but funds scarcer!), in the 1950s and 1960s United States government initiatives in African river basin development were more political than economic in nature. In that sense they paralleled the approach of African statesmen who then, as now, are guided as much, if not more, by political as opposed to developmental goals. Such goals tend to involve both international and national considerations. On the one hand, the successful construction of a large dam is seen as a monument to the originating head of state and as an indicator of that state's "coming of age" as a "modern" nation. On the other hand, national policies which favored the urban industrial sector (as well as powerful elites within that sector) created a demand, and

capacity to pay, for electricity which justified, from the donor point of view, the construction of dams for the major purpose of generating hydropower.

In the 1950s and 1960s the United States government was directly involved at the highest levels in negotiations for funding what continue to be two of Africa's three largest river basin development projects. During 1955 Secretary of State Dulles, United Kingdom Prime Minister Anthony Eden, and World Bank President Eugene Black worked together on a financial package (totaling \$270 million, including a \$56 million grant from the United States) for funding the first stage of the Aswan High Dam Project (Waterbury, 1979: 101-108). Although the United States, followed by the United Kingdom, abruptly withdrew its offer the following year, this related more to Cold War politics than the soundness of the project; indeed, at a later date Dulles regretted his decision which brought major U.S. involvement in development in the lower Nile basin to an end aside from the ongoing Abis Project outside of Alexandria.

In 1958, President Nkrumah of Ghana took advantage of a visit to the United States to discuss the Volta River Project with President Eisenhower. As a result, both governments retained the Henry J. Kaiser Company to examine previous project assessments. After Kaiser submitted a favorable report, financing for the power component of the project was worked out during 1960 between the government of Ghana, the World Bank, the Export-Import Bank, and AID, while the Export-Import Bank subsequently made a major loan to expedite the Master Agreement between the Volta River Authority and the main recipient of Volta power (the Volta Aluminium Company) through the construction of a smelter at Tema (VRA, 1965: 6-7). In this case President Kennedy continued the support initiated by President Eisenhower, with Kaiser's investment protected by US government "political risk" guarantees (1987 communication from W. Haven North).

Such major United States involvement continued into the late 1960s. After the World Bank turned down the request of the government of the Ivory Coast for financial

assistance in the construction of the Kossou dam and turbines on the Bandama River, the United States agreed to provide assistance through the Export-Import Bank. As with the Aswan High Dam, political considerations were of paramount importance. In providing funds for Kossou, the United States saw a relatively low cost (Davis and Huttenback, 1983: 68) opportunity to gain influence in the heart of France's former African Empire -- a policy goal which was sufficiently important at the time for Vice President Humphrey to deliver in person the first disbursement from the Export-Import Bank.

While involvement in the design and financing of major infrastructure was the most significant component of U.S. assistance for river basin development during the 1950-1972 period, there were also other United States-financed activities. These included technical assistance financed by AID for two major irrigation projects within the Nile Basin. These were the Abis Project in Egypt (1952-63) and the Rahad Project in the Sudan (1973). Elsewhere in the Nile Basin major U.S. assistance enabled the Ethiopians to survey potential dam sites along the Blue Nile between 1957 and 1964. In Ghana AID provided some assistance for studies of schistosomiasis during the 1960s. AID funding was also available for a variety of study projects and workshops involving teams of experts assembled by such organizations as the Office of the Foreign Secretary of the United States National Academy of Sciences (NAS) and the Smithsonian Institution.

In 1965, for example, members of the NAS's African Science Board included Volta and the forthcoming Kainji Dam Project in Nigeria in their West African itinerary, the purpose being to assess impacts in cooperation with host country scientists and to propose corrective actions where required. In the early 1970s the Smithsonian Institute carried out a series of environmental assessments to help AID develop environmental guidelines for future development interventions. Included was an evaluation of the impacts of the Volta Project on the surrounding ecosystem, including host and relocatee

communities. Results (including field study and an annotated bibliography which dealt more with aquatic than with human ecology) were discussed in an October 1972 workshop.

3. The 1970s and the 1980s

While activities in the 1950s and 1960s were not guided by any overall policy, they did enable the United States to play a major role in assisting other nations with river basin development. That role ceased with the Congressional Mandate which was incorporated within the Foreign Assistance Act of 1973. As interpreted by AID, the intent of Congress in that mandate was that AID was to "undertake far-reaching reforms" so as to redirect its financial resources more specifically toward the poor majority in the poorest countries. Though arguments to the contrary were presented, investment in large scale physical infrastructure was not considered to be an appropriate mechanism for achievement of that mandate; indeed, initially even such small-scale infrastructure as feeder roads was opposed by Congress as being insufficiently beneficial for the poor. Quick (and unrealistic) results were sought and only later in the 1970s was AID allowed to finance, at lower funding levels, secondary roads and other intermediate scale infrastructure.

Ironically, the 1968-1973 Sahelian drought made donors and host countries alike much more aware of the primary importance of the major river systems flowing through the Sudano-Sahelian zone. AID shared this awareness. In a 1976 brochure on "Opportunity for Self-Reliance: An Overview of the Sahel Development Potential," AID noted that "the primary assets are in the four major river basins. Their comprehensive development can quadruple food and cash crop production" (p. 6). Assuming, however, that it could no longer participate in the construction of either mainstream or tributary dams in those basins, or in the construction of such other infrastructure as major irrigation and road and other communication systems, AID turned its attention, as it

related to river basin development, to lobbying for, and funding activities relating to, a regional perspective and regional institutions (and the strengthening of those institutions); to the funding of a pioneering series of environmental and socioeconomic studies; and to small-scale irrigation projects at the community level and other "downstream" activities including agricultural research. Because they focused more on riparian habitats and production systems, these activities were important. Their impact, however, was disappointing.

AID's inability to provide leadership among donors and policy direction to river basin authorities is not easily explained. Lack of a consistent strategy for river basin development, and the will to push that strategy, were presumably factors, as were low funding levels and loss of political influence with riparian states and other donors. Loss of influence with riparian states would be due primarily to AID's decision to cease funding major infrastructure at the very time those states, especially in the Sahel, were pushing for big dams and irrigation projects. Loss of influence with other donors could be related to a number of factors including what were considered to be inappropriate funding levels and inability to move quickly in regard to such initiatives as the Dirol Plain Project (Mauritania) and the Upper Valley Master Plan (Senegal River Basin) that represented AID's new emphasis on downstream development.

With the French, the United States played a major role in establishing the Club du Sahel in the mid-1970s which took both an integrated and a sectorial approach to development issues (Shear, 1978: 237). AID's Africa Bureau, and especially its Sahelian Office, was a major force pushing a regional perspective for the development of Africa's river basins as a response to drought conditions. AID also provided institutional support to three international river basin authorities in West Africa. These were the OMVS, the OMVG, and the NBA. Of these organizations the OMVS (and the Senegal basin) has been the major recipient of AID assistance which has included funding the aerial photography of the basin, a major environmental assessment, a fiscal

allocation study (to determine how costs were to be apportioned between the member states), a recently completed institutional reorganizational study, and a still-to-be contracted planning effort for the Upper Valley from Bakel to the end of the Manantali reservoir (while AID has also shown interest in two other international authorities -- the Lake Chad Basin Authority and the Kagera River Basin Commission, such interest has yet to lead to major financial assistance).

One of the first donors to address environmental concerns, AID also provided funding for some of the most extensive environmental and socioeconomic impact assessments carried out in the tropics. Proposed by AID in 1974, the first was an *Assessment of Environmental Effects of Proposed Developments in the Senegal River Basin* which was initiated several years later by Gannett Fleming and Carpenter in association with Société Africaine d'Etudes Techniques. The second assessment, carried out by the University of Michigan in the mid-1980s, investigated the socioeconomic and environmental impacts of five dams proposed for possible construction on the Gambia River and of a major expansion of irrigation within the Gambia Basin. Still underway, the third assessment -- advised by a Panel of Experts from the U.S. National Academy of Sciences -- is being carried out by Associates in Rural Development in Somalia's Juba Valley. To an extent each study has built on its predecessors with the result that over the years more emphasis has been paid to socioeconomic impacts (although not at the expense of environmental impacts). At the same time more emphasis also has been placed on how such assessments can influence master planning as opposed to mere mitigation associated with the implementation of pre-existing master plans.

In regard to downstream development, AID's major project in tropical Africa since the Congressional Mandate has been assisting 25 communities in the Bakel area of Eastern Senegal, and the government parastatal responsible for irrigation development along the Senegal and its tributaries (SAED), with small scale irrigation (périmètre

irriqué villageois). Within Bakel, attention has also been paid to improved practices for rainfed agriculture and to improving community health -- in particular by improving nutrition through increased consumption of vegetables (via women's cooperative gardens) and fish (via Peace Corps-assisted fish culture). Through 1985 AID had allocated \$8 million to the project (AID, 1985: 3) which is ongoing, with two 12-month studies focusing on land tenurial issues initiated by the University of Wisconsin's Land Tenure Center during 1988.

On a smaller scale, AID/Mauritania has also been involved in a series of feasibility studies to improve flood recession agriculture in the Dirol Plain in the Middle Valley of the Senegal Basin. In the same country an AID-funded agricultural research project under the University of Arizona is undertaking research of importance to the development of the Senegal Basin, while in Mali AID provided \$19 million for the relocation of 12,000 people in connection with the construction of the Manantali Dam.

4. Impacts of AID Activities Since 1973

With the exception of several of the Senegal Basin activities (and especially the fiscal allocation study which worked out a cost-sharing formula subsequently accepted by the OMVS member states), the impact of AID's activities since 1973 has been disappointing. Little use is made of a regional perspective by donors (including AID itself) or host nations, development still being planned and implemented primarily on a project-by-project basis. As for regional (international) river basin authorities, the expectations of their main supporters (UNDP and AID) have exceeded those of the member states which are slow to grant such authorities the autonomy and the funds needed for planning and coordination activities. Of the three river basin authorities assisted by AID, the Niger Basin Authority has essentially collapsed while the OMVG has yet to integrate an effective planning and coordinating capacity with its overriding concern for obtaining funding for the Balingho and Kekreti Dams. Only the OMVS

continues to operate as a regional coordinating authority (which also shares planning responsibilities with the three planning ministries), and currently it is slow to respond to AID-financed recommendations for reorganization following the successful financing and construction of the Diama and Manantali Dams.

Though costing over \$11 million, little use has been made of the high quality aerial photographs of the Senegal Basin. The set of photographs delivered to the Malian government vanished after delivery, while jurisdictional disputes between government agencies restricted access to sets delivered to Mauritania and Senegal. As for the OMVS set, AID/Senegal had to complete this set a second time after 40 percent of the original set was lost (1987 written communication from Vito Stagliano).

Potentially more serious, the impact of AID-funded "state of the art" environmental and social impact studies remains in question, in part because of AID's inability or unwillingness to publicize and act upon study recommendations. Over five years after their submission, scant attention has been paid by OMVS, host country agencies, and other donors to the Gannett Flemming studies of the Senegal Basin. While serious questions raised by the Gambia study about the feasibility of the Balingho Dam have influenced, at least for the time being, donor readiness to provide the required funds, they have had little effect on the OMVG's ongoing quest for funding the construction of the same dam. In the case of the Juba study, it is too early to know the extent to which conclusions and recommendations will be incorporated within the master plan and then implemented. It is significant, and disappointing, however, that these studies were initiated after the government's decision to build the Baardheere Dam -- their function (as defined by AID's Scope of Work) not being to further assess feasibility but rather to suggest ways in which adverse impacts might be mitigated (and possibly to influence policy on how the dam might be better operated to realize multiobjective criteria).

Aside from the Bakel Project (the accomplishments of which are important

according to a number of evaluations though their economic viability remains in question), little has been achieved by AID's other initiatives to facilitate small-scale irrigation. In Mauritania, AID has been "dragging its feet" for four years in regard to implementing a technically simple, economically and socially desirable, and cost-effective, project on the Dirol Plain, while in Kenya, AID's 1985 interest in small-scale irrigation became disinterest during 1986 -- with little policy related research to justify either stance.

Any evaluation of AID's river basin development accomplishments in Africa must address at least two issues. The first issue -- difficult to assess without first-hand comments from riparian states and other donors -- relates to political clout. To what extent is AID's legitimate concern with regional, institutional, environmental, "downstream" and a wide range of other issues undermined (by being largely ignored) by the fact that AID, in responding to the 1973 Congressional Mandate and with reduced funding, is no longer a major player in the development of Africa's river basins?

The second, and most important issue, is the absence of guidelines and policies (as presented in a Strategy Paper in AID parlance) to help AID systematically follow through on initiatives, like river basin development, which require not years but decades of careful policy formulation, conversion of policies into plans, and implementation, evaluation, and modification of those plans. More specifically, absence of a Strategy Paper is a serious constraint. Because of the lack of an agreed-upon strategy, good projects have been inexcusably delayed in implementation; poor projects have been implemented; conceptually important projects have been poorly designed and mired in controversy; and AID has been unable to defend itself against both informed and uninformed criticisms of its efforts. One of the major recommendations of this study is that AID must, in spite of constraints within and without the agency, either formulate a strategy or withdraw from river basin development activities.

The Dirol Plain project is an example of a "good project" which four years after the first design study is still in the design stage. It is a technically simple project which will increase production from flood recession agriculture and raise local living standards in an environmentally and socially sound fashion. It meets all the various goals superimposed by Congress (assisting the poor in the poorest countries, meeting basic needs, etc.) and the administration (private initiative, income and employment generation, and enterprise development, for example), while having the support of both the local population and the Mauritanian government (neither of which have been able to understand the delay).

This delayed implementation (implementation, at reduced levels of funding, is finally supposed to start during Calendar Year 1988) should be viewed by AID as an embarrassment. While successive mission directors, project officers, and other United States officials have advanced "legitimate" explanations for the delay (and the explanations are indeed many and varied, including congressional involvement and initial incorporation within an ill-fated Integrated Development Project), it is probable that implementation would have occurred at a earlier date if the project's supporters themselves had the support of a strong "Strategy Paper."

An example of a "poor project" which probably would not have been implemented in its current form if the agency had had at least a set of guidelines is the Manantali resettlement project. Dealing with the relocation of approximately 12,000 people in connection with the now-filling Manantali reservoir, AID selected this project as one means for participating in the OMVS's program for the Senegal River Basin. Ten million dollars was initially allocated which was subsequently increased to nineteen million. The weakness of the project is that it does not have a developmental component, its motivation being largely "humanitarian" -- to help the Malian government get the people out of the way before the reservoir began to fill.

As funded, Manantali resettlement dealt primarily with the physical removal of

people rather than with first their resettlement and then their development. In spite of concern within AID, and knowledge by AID officials that the most important feature of any resettlement program is the establishment in the new habitat of a viable economic base, Manantali resettlement funds were provided mainly for the physical construction of new villages for the relocatees and feeder roads to reach those villages. No development assistance was provided. Guidelines dealing with river basin *development* presumably would have served as a corrective since relocation has the potential to improve the living standards of relocatee and host populations. This is especially the case in the Manantali zone where population densities are relatively low and land for resettlement and development is available. Furthermore, AID got off to a good start in breaking down larger settlements designed by French experts into more manageable units that reproduced existing villages (Horowitz and Koenig, forthcoming). Not only were development issues not addressed, but construction standards were not met in spite of frequent statements of concern by the AID-funded consulting engineers. As a result, houses and associated structures have begun to fall apart within one to two years of their completion.

In the absence of a river basin development strategy, AID was nearly immobilized in the 1980s by the Project Paper for the very complex Integrated Development Project (IDP) for the Senegal Basin which was presented by AID/Dakar, and especially by the River Basin Development Office within that mission. Conceptually important and meticulously designed in regard to its components, this project was overly ambitious. In effect it tried to mobilize three governments, the OMVS, and three AID missions to carry out what may well be the most complicated project, administratively, that AID personnel have conceived. Because AID had no policy on how to cope with such proposals for river basin development, and because, in the absence of policies, there was no institutional support for the project within AID/Washington, no formal decision of support or rejection was ever reached, although parts of the project were

incorporated, along lines suggested by the IDP, within the programs of the three AID missions, while the Upper Valley Master Plan involving all three countries was broken off for separate funding through AID/Dakar.

Without an approved strategy, AID's river basin development initiatives are more vulnerable to criticism from both within and without the agency. The IDP for the Senegal River Basin is an example of an initiative which brought out more informed and uninformed criticism within the agency than the decision-making process could handle. The December 1986 Regional (Dakar) Inspector General's "Audit of AID Participation in Sahel River Basin Development" is an example of an external review which appears to have had an intimidating impact on AID. While the authors made a number of valid points, their general conclusions were too negative because evaluators did not understand the importance and complexity of African river basin development and hence the need to assist African governments to develop the necessary management and planning skills. This point was well made by the Director, AID/Niamey, in a 28 December, 1986 cable which stated, "USAID/Niamey finds that subject report does not provide sufficient context or information to the level of detail merited by the subject. It treats a highly important and complex activity involving investments of multi-billions of dollars in far too superficial a manner to be useful to AID planners and strategists with regard to current and future actions in river basin development activities." In dealing more with symptoms than causes, the report did not deal with "the lack of ability of African governments to come to grips with the economics and technology of river basin development, and *of AID to complete and approve a river basin development strategy*" (SARSA italics).

5. AID's Inability to Formulate a River Basin Development Strategy

The quote from the Niger Mission Director's cable raises the question of why AID has been unable to institutionalize a Strategy Paper on river basin development.

Constraints are both internal and external to the agency. External constraints are both conceptual and fiscal. Members of congress and the administration tend to be ill-informed of the developmental implications of the policy and ideological shifts which tend to occur at four-year intervals (or multiples of such) and which, inadvertently, can have adverse impacts on AID effectiveness and on long term U.S. development goals. The Congressional Mandate of 1973 is a case in point. Though with laudatory goals, including focusing development assistance on the poor majority and emphasizing participatory development, the *new directions* were confusing to AID officials while the view of development implicit within the mandate was too simplistic. Four years later, AID officials were still wrestling with its implications. In the 1977 AID senior administrators' development seminars, for example, one of four major objectives was "to clarify and to increase understanding of the new directions in AID programs growing out of the changing international economic environment and the basic changes in Foreign Assistance legislation that began in FY 1973 and continue" (April 4, 1977 brochure on The Administrator's Development Seminar).

As AID pointed out in its 1975 "Report to the Committee on International Relations on Implementation of Legislative Reforms in the Foreign Assistance Act of 1973," in Africa in particular major physical infrastructure is needed to help establish the small farmer "as a viable producer." Not only did the 1973 mandate, and the reduced (in real terms) and often-delayed congressional funding for AID during the years that followed, keep AID from funding major infrastructure for African development, but it can also be argued that AID's lower profile reduced the agency's influence in advocating the types of infrastructure that could most assist the poor majority. Be as that may, in spite of AID's concerns for environmentally sustainable development for the poor, river basin development throughout Africa has continued largely to ignore local riverine populations and environmental issues. A related external constraint is the difficulty that annual budget allocations pose for formulating long

term development programs, while other constraints include AID procedures and shifting opinions among academic experts and development practitioners as to priorities.

Rapidly shifting Legislative and Executive goals and uncertain funding are serious external constraints. As an example of an internal procedural constraint, Stagliano maintains that it is very difficult for AID to combine construction with farmer participation since projects with a construction component require solid cost estimates. "This requirement makes it very difficult if not impossible to design irrigation projects whose implementation is driven by farmer's capability development calendar rather than by the construction schedule. Some farmers may not be ready to embark on the infrastructure development until five years after the project starts in which case capital costs cannot be accurately calculated during project design. The current project approval system cannot tolerate this uncertainty" (1987 written communication).

AID's sponsorship of "state of the art" workshops and training sessions bombard its officials with changes in the latest thinking. Changing development priorities as presented by the academic community and development practitioners can be illustrated by examining the agenda and summaries of two AID-funded conferences. The first, held in Abidjan, in April 1968, was organized by the U.S. National Academy of Sciences in cooperation with FAO and the government of the Ivory Coast. Though it dealt with Agricultural Research Priorities for Economic Development in Africa, the role of Africa's river basins in increasing agricultural production and people's living standards received scant attention in either the plenary sessions or the proceedings of the eleven commissions, being dealt with along with agro-climatology and other water resources in a special seminar held one evening. Aside from a few scholars and UN officials, Africa's river basins were seen primarily as sources of electricity for the urban/industrial sector rather than as potential agricultural heartlands warranting integrated development in their own right.

Ten years later in Washington, AID sponsored a two-day conference (called a

"colloquium") on "Towards a Rational U.S. Policy on River Basin Development in the Sahel" (Joyce, 1978) at which both academics and development practitioners addressed a wide range of topics. That conference had been preceded by the 1968-1973 Sahelian drought which had focused attention on the river systems of the Sudano-Sahelian zone as a major resource by the mid-1970s. Michel Doo Kingue, former head of UNDP's Africa Bureau and a major proponent of river basin development, was present as were representatives from other UN agencies and various universities.

Notwithstanding the title of the March 31-April 1, 1978 conference, AID was unable to develop at that time even a set of guidelines for African river basin development. While the effort has continued in a sporadic fashion over the intervening ten years, little has been achieved. Stimulated by the preparation of ambitious project papers for various West African river basins, in 1981 another major attempt was made to come up with a policy paper. This involved the Africa Bureau's River Development Task Force (assisted by the author of this paper). Though innumerable meetings were held and a number of report sections were prepared, including a short paper on "Sahel River Basin Policy," no final strategy paper emerged. Subsequently AID's Dakar-based River Basin Development Office produced a strategy statement in support of its Integrated Development Project for the Senegal River Basin. It failed to receive the necessary support in Washington in part because critics felt it did not adequately address the trade-offs throughout the Sahel between irrigation and rainfed agriculture. Again an agency-wide or Africa Bureau strategy would have facilitated discussion since rainfed agriculture and irrigation are complementary not contradictory components of African river basin development.

Several years later, in April 1985, the Africa Bureau in collaboration with the Science and Technology Bureau held a two-day conference on river basin development, irrigation, and land tenure in Africa (once again various academics and UN officials attended, as did representatives of other U.S. agencies, the Club du Sahel, and private

consulting firms). By then AID was more in search of guidelines and issues to address than policies and strategies. According to the cable which was sent to AID missions in Africa several months later the conference was convened for three reasons. The first was to inform AID of past experience "so that we learn adequately . . . as we develop African activities in the areas of river basin development and irrigation." The second was to begin the preparation of documents incorporating that experience which would "lay out the broad parameters within which future work should be undertaken." The third reason was "to get an initial fix on the range of issues involved in these activities and some understanding for how A.I.D. resources might most effectively be marshalled in tackling river basin and irrigation development problems in the years ahead."

While the Water Management Synthesis II consortium of universities handled the irrigation aspects of the conference and the University of Wisconsin's Land Tenure Center the land tenurial issues, SARSA presented a series of papers on "Problems and Issues in African River Basin Planning." Included were a number of recommendations which were summarized in the cable referred to above. Missions were requested to respond and were informed that, as a second phase, SARSA would be funded by the Africa Bureau "to assess, on a comparative basis, the accomplishments of a number of mature Africa River Basin Development activities." The results of that assessment is reported in this series of reports.

Granted over ten years of striving within AID to define a river basin development strategy, why did the Agency repeatedly fail? While one is tempted to blame external constraints and the complexity of river basin development, neither has kept AID from formulating policy or strategy papers on such topics as integrated area development or rural development. Among other factors what may be involved are a lack of experts within AID with river basin and regional development skills and the continuing preoccupation of some AID officials with river basin development as water resource management rather than as the integrated development of a basin's land, water, and

human resources. Such an orientation, still common among many engineers, would help explain the range of reactions within AID to specific river basin development projects and programs, and to policy options. The resulting confusion also allows for personal agendas to create additional confusion that further thwart efforts to formulate guidelines.

Equating river basin development with water resource management is a long-standing failing that has plagued African river basin development from the start. Within African countries, this bias is illustrated by the fact that river basin development usually is the institutional responsibility of ministries, commissions, and authorities concerned not with integrated area development and planning but rather with energy, irrigation, and public works. Kariba was the responsibility of the Federal Power Board and later, after the independence of Zambia, of the Central African Power Corporation. The more recent development of Zambia's Kafue Basin has been the responsibility of the Ministry of Power and Transport. While the Volta River Authority was more broadly conceived, since the retirement of Chief Executive Quartey in the early 1980s, its mission has also been redefined to deal primarily with power generation.

In Nigeria, Kainji was the responsibility of the Niger Dams Authority with close cooperation with the Electricity Corporation of Nigeria, while the Selingue Dam on a tributary of the Niger in Mali was built for the sole purpose to supplying electricity to Bamako. In the Sudan, the Jonglei Canal Commission was an outgrowth of the Ministry of Irrigation, while members of the OMVS Council of Ministers has been drawn almost exclusively (until 1986) from ministries concerned with public works and energy development. As for the first President of the Kagera River Basin Commission, he was concurrently Minister of Public Works, Equipment and Housing of one of the member states.

The same bias exists among Multilateral and Bilateral donors. The World Bank,

still the main proponent of large-scale dams in Africa, places such projects under its Division of Energy. Though feasibility analyses may address multiobjective criteria, the final project remains essentially an energy project in the Bank's portfolio, Kainji being a major example. It was the Bank which pressured the Volta River Authority to narrow its focus, while in the 1980s the Bank's Energy Division has ignored the Bank's own environmental and resettlement guidelines in regard to the recently completed Kiambere Project.

Historically, AID had the same bias during the 1950s and 1960s. In the 1960s, for example, AID contracted the Bureau of Reclamation, an agency with virtually no resettlement expertise and one associated with widely criticized relocation of Native Americans in connection with such projects as Missouri's Garrison Dam, to assess the Volta River Authority's plans for resettling over 80,000 people. Its 1963 report, "Evaluations, Suggestions and Recommendations," pronounced the planned resettlement - - which subsequently proved to be the one of the worst resettlement programs to date -- basically sound.

While broadening perspectives and the Sahelian drought reduced this bias in the 1970s and 1980s, they did not eliminate it. A case in point concerns AID's involvement with the Niger Basin Authority in the second half of the 1970s (at which time it was called the Niger Basin Commission). Though AID officials at the top saw the development of the Niger Basin from a multiobjective point of view, and the organization chart of the Authority included a Division of Agriculture, Fisheries and Livestock, in 1977 none of the disciplines of the first 12 NBA staff members to be recruited and trained, at AID and Canadian expense, dealt with the local people and their production systems. Up until that time, advice from without AID had been primarily solicited from engineers. While the recommended fields of expertise were all important, so too were the social science fields that were omitted. The point is not unimportant since on their return, the first NBA staff trained overseas would

presumably influence the orientation and policies of the Authority (Brokensha et al, 1977: 73-74).

In the absence of a Strategy Paper, AID's river basin projects and programs have depended largely on the interests and initiatives of individuals rather than those of the Africa Bureau and AID in general. As a result such projects and programs have been vulnerable to personnel transfers, changes in administration, and a wide range of interpersonal conflicts.

6. Summary

AID has yet to develop a strategy toward river basin development in Africa or elsewhere. As a result project and program funding within river basins has been influenced primarily by shifting executive and legislative priorities and by responses of key personnel within AID to those priorities. Results to date have been disappointing. In the 1950s and 1960s US involvement was at the highest levels, with the White House directly involved in the Aswan High Dam, Volta and Kossou projects. Though the United States was a major participant in African river basin development during those years, political priorities -- uninformed by any longer term development perspective -- took precedence on a basin by basin basis.

Developmental and humanitarian goals received greater priority during the 1970s and 1980s. By then, however, the United States and AID had become a minor participant in African river basin development. With no policies for supporting contrary views, the Foreign Assistance Act of 1973 was interpreted to preclude the construction of infrastructure aside from small-scale irrigation schemes and secondary roads. By default, funding for major infrastructure became the responsibility of the World Bank and various bilateral donors which favored dams primarily for the generation of electricity for the urban industrial sector.

Inside AID, the Sahelian drought spurred a major attempt between 1974 and 1982

to develop a strategy. Initially the Africa Bureau and especially the Sahelian office pushed an integrated regional approach to both development and institution building. The approach was important for broadening perspectives and embracing a wider range of alternatives, but AID also had little clout in pushing its case with riparian states and other donors. A strategy incorporating such an approach was never institutionalized within the Africa Bureau. Although a regional approach continued within the Dakar-based River Basin Development Office, and to an extent within the Sahel Office which had been moved to Bamako, reduced support in Washington (including an uncritical rejection of all sorts of integrated area development projects at higher levels within the administration), and the increasing preference of country missions for bilateral projects, undercut the Integrated Development Project for the Senegal River Basin.

In the absence of a strategy AID administrators favoring some river basin involvement have found it necessary to tie projects to the U.S. national emphases and slogans of the times. These included environmental quality (hence AID's pioneering environmental impact assessments) and basic human needs (hence downstream development and agricultural research). Impacts of such an ad hoc and low priority approach have been disappointing. SARSA assumes that they will continue to be disappointing until AID not only formulates a strategy but also forcefully advocates its implementation. Looking to Africa's future, river basin development is too important to be dealt with in such a piece-meal fashion. AID should either withdraw its involvement or formulate a clear-cut strategy relating to such current developmental and humanitarian objectives as "food self-sufficiency for Africa" and follow through on its implementation.

C. OVERVIEW OF DONOR DEFICIENCIES

Though deficiencies are emphasized in the headings that follow, with illustrations drawn from both bilateral and multilateral agencies, in all fairness it should be stressed

at the start not only that there are individuals within both types of agency who are well aware of such deficiencies, but also that a corrective trend is underway within both AID and the World Bank. AID, for example, has pioneered the increasing incorporation of socioeconomic studies within environmental impact assessments with the former prioritized in the Associates in Rural Development studies in the Juba Valley.

At the multilateral level, the World Bank has begun to look more closely at the environmental impacts of dam construction. The Bank also has been taking increasing responsibility for ensuring that populations displaced in connection with dam construction do not suffer as a result of removal. In the 1950s and 1960s the Bank ignored population relocation which was considered strictly a host country responsibility in the Kariba and Volta cases. Indeed, in the Volta case, less than 50% of relocation costs were considered project costs. By the 1970s, however, the Bank not only insisted at Kpong that relocation be considered a project cost and its implementation a project responsibility, but resettlement expertise was included within Bank appraisal missions. In the 1980s the Bank took the lead among donor agencies in pressing for equitable resettlement policies, being the first to formulate a set of guidelines for resettlement. Issued in 1982 as Operations Manual Statement 2.33 (Social Issues Associated with Voluntary Resettlement in Bank-financed Projects), these emphasized that riparian states must submit suitable resettlement plans at the time of appraisal. Still more recently these guidelines have been revised and strengthened, with the Bank publishing in 1987 an explanatory paper on the Bank's policy guidelines and operational procedures regarding project-induced resettlement (Cernea, 1988).

Recent Bank efforts in regard to the resettlement component of a number of projects in Africa, Asia and Latin America illustrate that the Bank is taking its own resettlement guidelines very seriously, even in the face of strong resistance from member countries. This statement applies both to new projects like Nangbeto

Hydroelectric Project in Benin/Togo and to old ones, like Kiambere Hydroelectric Power project in Kenya where belated efforts are being made to assess the damage done where the 1982 guidelines were ignored by Bank personnel during both appraisal and supervisory missions. On the other hand, it is too early to know whether or not riverine states will actually implement the plans that they have formulated in response to Bank guidelines and it is too early to know whether or not the Bank will take the necessary steps after dam construction commences to require compliance. The same problem pertains to environmental guidelines which also pertain more to plans than to the implementation of those plans. Furthermore, river basin development in Africa continues to be primarily the responsibility of the Energy Division so that dams are still viewed primarily as single purpose projects for hydropower generation -- as illustrated by the titles of the Nangbeto and Kiambere projects. Rather than to facilitate sustainable development, the purpose of environmental and resettlement guidelines is to mitigate dam-induced adverse impacts. As a result, the Bank continues to be 'part of the problem' and will continue to be so until responsibility for river basin development is taken out of the hands of Bank divisions responsible for energy and irrigation.

1. Coordination Deficiencies

Though there are exceptions like Kpong, inadequate coordination among donors is a major problem which is not easily resolved since major political as well as economic issues are at stake. Riparian states are, at best, ambivalent about improved coordination among donors since they fear it might lead to donor leverage on policy issues. As a result, while they may complain about the worse excesses of lack of coordination, they continue to encourage individual donors to adopt specific projects or geographical regions. As for bilateral and multilateral donors, their differing agendas regarding African development assistance, and more specifically, their differing attitudes toward river basin development, make coordination difficult.

Concerning different agendas, the World Bank has recently critiqued bilateral donors, noting that they "must recognize that, if they allow commercial or strategic considerations to outweigh considerations of priority, efficiency and relevance in their assistance decisions, they weaken the ability and willingness of governments to implement reforms" (1984: 4). As for differing attitudes toward African river basin development, the HYDROSULT mission briefly outlined the stance of various donors in their 1985 evaluation of the multidonor/multidisciplinary approach. Some, like the French and the Germans, are heavily involved throughout the continent, no doubt in part because French and German firms are major contractors in connection with the design, construction and supervision of large-scale river basin infrastructure. In the case of France "FAC has been involved in almost all the river and lake basin development activities in Africa. FAC's interventional varies from basic studies, establishing of data bases to the participation in infrastructure construction. . . . In general the authorities of the Federal Republic of Germany are in favor of river basin development activities, both the planning and the infrastructure aspects . . ." (pp. 38-39). Like the United States, the British, on the other hand, have become increasingly cautious over the years: "As far as river basin development programmes are concerned, the United Kingdom believes that such programmes, and especially the OMVG's, offer a low economic rate of return and that the budgetary burden on countries like Gambia is quite heavy" (ibid., p. 40).

Notwithstanding the difficulties, improved coordination is crucial if more successful river basin development is to be implemented. Reasons are many. In the absence of coordination, each donor is all too apt to go its own way on a project by project basis. Haphazard and financially costly development is the result. Though riparian states may have political concerns about improved coordination, preferring a "divide and rule" strategy, economically they cannot afford the long term results of a haphazard and too narrow approach to the development of their few river systems.

Because of escalating costs for large-scale infrastructure, some coordination has occurred to expedite multidonor funding. To date coordination has been provided primarily by UNDP which takes the lead in behalf of the relevant riparian states in convening meetings of potential donors. In the case of the newly reconstituted NBA, for example, the council of riparian ministers decided in 1976 to request a multidonor conference which was then convened later that year by UNDP with the Executive Secretary of the NBA in the chair. Subsequently a Consultative Committee of riparian, bilateral and multilateral officials was formed, with UNDP again the convener. A similar Consultative Committee has played a major role in regard to the OMVS, with the World Bank joining in the mid-1980s.

According to the HYDROSULT report, bilateral donors have found UNDP coordination useful to indispensable. On the positive side small donors like Austria "mentioned that without UNDP's involvement, bilateral donors would not have participated, and especially small donors like Austria" (p. 36). On the negative side, there is a feeling "that UNDP's coordinating role is not adequately played and, as a result, there exists an atmosphere of lack of coordination among the different donors" (p. 39). Furthermore, UNDP spreads itself too thin, indiscriminately attempting to work with any regional organization that comes along. UNDP can also be criticized as being too much an advocate for river basin development, and especially for the construction of large-scale infrastructure, with the function of multidonor meetings being more to secure pledges of assistance than to consider a wider range of alternatives.

River basin development is too crucial an issue for the present situation to continue. Various approaches need strengthening. In their previously cited 1984 report, the World Bank notes that "Consultative groups, United Nations Development Programme (UNDP) roundtables, and similar meetings should aim for more explicit and monitorable commitments by recipient governments and donors to implement their

respective responsibilities under an agreed program of action." While this statement is directed at programs for national development, it is equally applicable to river basin development projects which are apt to be the major ones within national development plans. The problem here, however, is how to consider a wider range of options before agreeing upon a program of action.

One approach, noted by FAO in the HYDROSULT report, is for the UN system to attempt to formulate a more consistent strategy "to be elaborated through high level discussions between UN agencies involved in river basin planning" (p. 48). The problem there is whether or not those agencies have the capacity to consider a wider range of options. The World Bank, through its energy sector offices, remains a major funder of large scale infrastructure while UNDP and the UN both continue to be strong advocates of a conventional water resource management approach. In critiquing the UN's 1970 report on *Integrated River Basin Development*, Saha, for example, notes "a bias in favour of the construction business and the professional groups providing services to it . . . the report totally ignores the redistributive aspects of river basin development" (1981: 17). To correct for this deficiency, a wider range of organizations should be involved in strategy formulation, discussions of which could start during various conferences planned for 1988.

Should multidonor coordination improve, as a last resort donors should be willing to use their financial clout where riparian states are following unwise courses. The fact that no one donor can go it alone in financing large-scale river basin infrastructure gives donors the opportunity to exercise leverage where necessary. Though use of leverage is never a popular option with African states, currently it is being applied indirectly in regard to structural reforms as they relate, for example, to rural/urban terms of trade and parastatal organizations. AID is following such an approach through its concept of favored recipients, with assistance provided to nations which formulate appropriate policies. A similar approach warrants consideration in regard to river basin

development, contemporary examples that would benefit being the Gambia, Tana and Juba River Basins.

2. Project Versus Regional Orientation

Only UNDP has taken a consistent regional approach to river basin development both in regard to research and institution building. Under research UNDP has funded, largely through FAO as executing agency, both river basin surveys (as in the Senegal and Kafue Basins) and impoundment/lake research programs (as in the Kainji, Volta, Victoria and Kariba Lake Basins). Though the former tend to be superficial, they have included some socioeconomic surveys with those carried out in the Sudan under the auspices of the Jonglei Commission having major development implications -- implications which unfortunately have not been realized because of the renewal of civil war. As for impoundment studies, they have emphasized hydrobiology and fisheries development in part because the lead within FAO has been taken by the Department of Fisheries. Under institution building UNDP has emphasized technical assistance (in the form of experts, including planners), staff training and documentation centers.

After UNDP, AID has probably been the most consistent in pursuing a regional approach although this has suffered in recent years in the absence of a supporting strategy. As a result, AID like the World Bank and other bilateral donors currently emphasizes a project by project approach.

3. Excessive, Inadequate Studies and Unrealistic Planning Expectations

During discussions with chief executive officers in various river basin authorities one soon hears complaints about the over-emphasis of donors on studies. High officials in the OMVS and the Ministry of Juba Valley Development frequently complain about "the 50 million dollars" which have been spent in studies, while Quartey told Scudder how finally he was able to persuade the Dutch to contribute a boat rather than add to

the \$600,000 worth of feasibility studies relating to Lake Volta transport.

Three major problems are, first, too many studies; second, the wrong kind of studies; and, third, the inability of host country agencies to utilize available studies. The number of studies carried out by the multiplicity of donors is incredible. The number of donors funding studies is not the only problem since AID, for example, has financed over a four year period at least three studies of the relatively simple Dirol Plain project in Mauritania. As for the wrong kind of studies, all too often they are both superficial and inappropriate. In terms of superficiality river basins tend to be over-surveyed and under-researched. For example, there are many superficial socio-economic studies of the Senegal River Basin, with new studies summarizing past information and adding to it by reviewing more recent literature and carrying out brief field surveys. Yet there are no detailed studies of local production systems in the Middle Valley and hence there is insufficient information on which to develop policies concerning post-Manantali river regimes (especially in regard to the advantages and disadvantages of a Manantali controlled annual flood).

As discussed in Chapter 3, too much emphasis is placed on economic rates of return which are easily manipulated while redistributive effects and multipliers tend to be ignored. Far too often existing studies also place too little emphasis on the natural resource base, on indigenous knowledge relating to that resource base, and on local production systems for utilizing that resource base. Two examples, one dating back to the 1950s and another to the second half of the 1970s, from Ethiopia and Kenya illustrate this deficiency.

a. Ethiopia's Awash River Basin

In analyzing reasons why the development of Ethiopia's Awash Valley under the Awash Valley Authority (which was established in 1954) has not been a success, Winid mentions first inappropriate studies. In his words, "knowledge on the part of the

French firm of consultants (SOGREAH) of the political, economic, social, cultural, scientific and technical aspects of the Awash valley region was lacking" (1981: 163). Among eight reasons why knowledge was lacking are: "introduction of extensive techniques . . . frequent changes of advisers from different schools of thought . . . limited contact with Awash valley peoples which was mainly restricted to a small proportion of the population" (ibid.).

b. Kenya's Bura Scheme (Middle Tana River Basin)

The Kenyan example concerns the Bura Project for which the World Bank completed its appraisal in the mid-1970s. Since then the project has proved to be a disaster for the Kenya government, the World Bank, and many of the settlers. Reasons are many including unwillingness on the part of the Kenyan government to heed initially unfavorable assessments, deficient studies, an unrealistic economic rate of return in the World Bank appraisal (the current rate of return is negative, with costs per settler household exceeding \$30,000), bad management on the part of the National Irrigation Board (which relied overly on expatriate advisers with inadequate familiarity with Kenyan conditions), and serious cost overruns (these have placed an especially serious burden on the Kenyan government, disbursements having increased 2.5 times over the original estimate with the government's estimated contribution to project support increasing from approximately 20 percent to nearly 50 percent).

Deficient studies deserve much of the blame. Not only did these ignore lessons learned from previous settlement projects in the tropics (ironically the Bank was carrying out a major evaluation of Bank-financed settlement projects at the time which was published in January 1978), but they also ignored national and local knowledge and expertise. For example, soil surveys -- one of the most basic requirements in land settlement planning -- were inadequate. It was the Kenya Soil Survey, of which inadequate use had been made during the prefeasibility stage, which finally pointed out

the soil problems which were instrumental in the size of the scheme being cut back from 6540 hectares to 2500 hectares. Socioeconomic studies were also deficient. The global experience is that land settlement in problem-prone environments should not be used for experiments in nationbuilding that draw participants from throughout the country. Yet that is precisely what the Kenyan government wanted and the World Bank agreed to. Predictably drop out rates have been higher among immigrants than among local Pokomo who were incorporated within the scheme. Studies of settler housing ignored Kenyan experience with low cost housing in favor of high cost housing made by international firms.

The problem of too many studies and the wrong kind of studies is compounded by the relative inability of host country personnel to use even the better ones. This is where unrealistic planning expectations on the part of donors come in. While riparian states tend to underemphasize the importance of planning studies (the decision to proceed with a particular project often being a political one), it is ironic that donors require of African countries, with relatively weak planning skills, more planning than they require at home. Few riparian states can cope with the demand, being unable to access all the studies and reports let alone use them for planning purposes. According to the 1985 HYDROSULT study, no UNDP-funded documentation centers were operational in 1985, while this report has already referred to the initial inability of the OMVS to access, let alone use, the AID-funded aerial photography (currently, however, the OMVS, with technical assistance from a French agency, is doing a better job with SPOT imagery). A related problem is the failure of donors to disseminate and stand by the results of studies which are politically unpopular within the riparian states (the University of Michigan and RONCO Gambia River Basin Studies being a case in point).

The solutions to these various problems need involve better coordination and strategy formulation on the part of donors (with studies reflecting that coordination and

those strategies, and with donors disseminating and standing by study results), and better planning capabilities on the part of riparian states. In the latter case there is no substitute for the institutionalization of effective data storage, analysis, planning, monitoring and evaluation units within river basin authorities and planning ministries. While their existence does not ensure that the plans generated will be used, especially where implementation is the responsibility of other agencies, they are required if the record with river basin development is to improve.

4. Delayed Decision Making and Inadequate Supervision

Because SARSA's assessment tended to emphasize AID and World Bank-funded projects, most of the examples of delayed decision making relate to AID, while examples of inadequate supervision pertain more to the World Bank. Other examples were not hard to find, however. In the Zambian portion of the Middle Zambezi Valley, the Canadians (CIDA), and the Swedes (SIDA) have yet to make major, or even minor, investments in spite of years of feasibility studies. Not only has this situation had a depressing effect on both central and local government, but it was probably instrumental in the decision of one local chief to accept a government-international private sector joint venture which was poorly planned in regard to the incorporation of those who were displaced by the project.

In the Senegal River Basin, AID/Nouakchott has unduly delayed decision making in regard to the Dirol Plain Project, while AID/Dakar has been slow to contract out the Upper Valley Master Plan. The Upper Valley Master Plan was originally a component of the Senegal River Basin Integrated Development Project (IDP). When AID/Washington deferred making a decision on that in 1984, AID/Dakar took over the Upper Valley Master Plan as a bilateral component to be funded through the OMVS. Several firms were prequalified for bidding for the multi-million dollar contract in early 1986. The final request for proposals, however, was not made until April 1988.

In the absence of a strategy, it is difficult to set priorities with the result that decisions are delayed, especially where personnel turnovers are involved.

Inadequate supervision relates not just to the inadequacy of supervisory missions, but also to the inability of decision makers to act on the recommendations of supervisory missions. In regard to the World Bank, several examples relate to the Bank's involvement in development of the Tana River Basin. In regard to the Kiambere Dam, it was not until late 1986 that Bank Supervisory Missions realized that Kenya resettlement policy and practice did not meet the Bank's guidelines on "Social Issues Associated with Involuntary Resettlement in Bank-financed Projects." By then it was too late to implement a satisfactory resettlement program since approximately 90 percent of the relocatees had left their homes with inadequate compensation to purchase new land and scant opportunity to gain alternate employment. As for supervisory warnings, they were frequently raised in supervisory reports on the Bura Project -- yet the project continued to go from bad to worse.

5. Inadequate Training and Lack of Continuity of Effort in Regard to Training and Institution Building

Looking to the future, training deserves much more donor attention not just for staffing institutions with river basin development responsibilities, but also to reduce the heavy financial burden of high expatriate salaries. To date the training component of both bilateral and multilateral programs time and again has been inadequate. The situation is especially deficient when donor funds are used to employ international experts and firms since generally speaking these place relatively low priority on on-the-job training. At least three major problems are involved. The first concerns the poor phasing of training in relationship to the expatriate expert component. This is especially a problem with senior counterpart staff who are sent out of the country while most of the contracted research is being executed. A case in point were the

studies carried out by the University of Michigan in the Gambia River Basin. The obvious solution is to emphasize more on-the-job training and less university degrees in the donor country.

The second problem concerns the time constraints placed on expatriate researchers and advisers. Understandably eager to further their own careers by doing a good job, they tend to accord low priority to training. Finally expatriates, and the organizations that they represent, are seldom eager to train their replacements, so again training and institution building receive low priority. These constraints to institution building relate to all sorts of expatriate personnel including university, private company and private voluntary organization personnel. In the Middle Zambezi Valley, for example, Gossner Service Team advisers had a tendency to by-pass counterpart staff in regard to decision making and other tasks -- involvement in which would have gradually allowed counterparts to take on greater responsibilities. Another example, previously discussed, relates to expatriate involvement in small-scale irrigation projects in the Upper and Lower Tana River Basins.

While too short a project cycle is a major contributing factor, continuity of effort is a tricky issue since too much continuity can interfere with handing over and with the development of local initiative. In this regard, we are definitely not recommending prolonged donor involvement as an end in itself; on the contrary, donors should withdraw as soon as feasible. For withdrawal to be effective, however, host country staff must not only be trained but also take up employment in the agency that sent them out for training. And when they do return they need suitable equipment, funding and terms of employment. While the latter is the responsibility of the host country, all too frequently governments like Ghana cannot afford to provide the necessary equipment and funding -- hence the need for continuity of effort on the part of donors. A case in point refers to the UNDP-funded Volta Lake Research and Development Project. During the course of the project expatriate researchers produced

a commendable number of publications, while Ghanaians were sent out for appropriate training. Funding had ended, however, by the time most of those trainees had returned to Ghana. During SARSA's 1986 field trip we found a number of Ghanaian scientists unable to carry out the task of lake basin research for which they were trained because of inadequate funding. That is what is meant by inadequate continuity of effort, with both SARSA and Quartey (in his capacity of former Chief Executive of the VRA) agreeing that the cessation of UNDP funding was premature. Project design in this case was deficient since it did not address the integration of trainees on their return to Ghana. As a result an initially satisfactory research program, well-supported institutionally by the VRA, collapsed when UNDP funding stopped in 1977.

6. Insufficient Attention to Local Production Systems

Lack of attention paid to local production systems in river basin development is a basic theme stressed throughout this report. It characterizes the World Bank (ignoring reservoir relocatees and downstream producers in the Kiambere Dam case) and it characterizes most bilateral donors (AID and the Scandinavian aid agencies being a partial exception), a situation that reinforces tendencies on the part of riparian states to design river basin development strategies which ignore local populations. In their emphasis on market forces and private sector initiatives both AID and the Dutch, for example, run the risk of thinking more in terms of facilitating local entrepreneurs and elite than the village sector. In both Mauritania and Senegal, for example, debate is going on as to the extent to which Senegal River Basin aid should be given to immigrant white Moors (Bidan) in the former case and immigrant religious leaders (Marabouts) in the latter case. Indiscriminate favoring of such elites will exacerbate tensions over land resources, already a problem in the Middle Valley in both countries. Ignoring them, on the other hand, is not feasible politically; nor desirable economically, granted their capital and development potential. The obvious solution to the problem is

to apply market and private sector approaches to both the elite and the village sector. Since land pressure is less in the delta, elite could be encouraged to develop lands there while emphasis in the more densely populated middle and upper basins would focus on the village sector.

7. Inadvertent Suffocation of Local Initiative and Participation

This deficiency has already been dealt with in Chapter 4 (Local Organizations). Examples involving bilateral aid agencies relate to small scale irrigation development in the Senegal, Tana and Zambezi Valleys, and to multilateral rehabilitation projects in the Sudan. In the bilateral cases, the Dutch in Kenya have learned a valuable lesson over the years whereby they have gradually withdrawn expatriate personnel to Nairobi where they act as advisers rather than project implementers. In the case of such major rehabilitation projects as Gezira, New Halfa, and, in Mali, Office du Niger, it remains to be seen if the World Bank insists that governments apply rehabilitation concepts to parastatal organizations (in regard to greater involvement of tenant and other local organizations) as well as to physical infrastructure and equipment.

D. SUMMARY

Most donor deficiencies are shared by bilateral and multilateral agencies alike. While donors have biases pro or con different approaches toward river basin development, no policy or strategy papers were found by the SARSA team. This is a serious failing. On the one hand, it perpetuates an out-dated water resource management emphasis as opposed to the integrated development of land, water and human resources. On the other hand, it makes it difficult for donors to follow through systematically on programs for river basin development which require not years but decades of careful policy formulation, conversion of policies into plans, and implementation, evaluation and modification of those plans.

Another major problem, not easily resolved since major political and economic issues are at stake, is inadequate coordination among donors. Notwithstanding the difficulties, improved coordination is crucial if more successful river basin development is to be implemented. In the absence of coordination, each donor is all too apt to go its own way on a project by project basis. Haphazard and financially costly development is the result. Though riparian states may have political concerns about improved coordination, economically they cannot afford the long term results of a haphazard and too narrow approach to the development of their few river systems. The fact that no one donor can go it alone in financing large-scale river basin infrastructure gives donors the opportunity to exercise leverage where necessary. Should multidonor coordination improve, as a last resort donors should be willing to use their financial clout where riparian states are following unwise courses.

Other deficiencies concern a project versus a regional orientation; excessive and inadequate studies and unrealistic planning expectations; delayed decision making and inadequate supervision; inadequate training and lack of continuity of effort in regard to training and institution building; insufficient attention paid to riverine habitats and production systems (a theme that recurs throughout this monograph); and inadvertent suffocation of local initiative and participation (which was dealt with in Chapter 4). Only UNDP has taken a consistent regional approach to river basin development both in regard to research and institution building. As for studies, problems are too many studies, the wrong kind of studies, and an inability of host country agencies to utilize available studies.

While riparian states tend to underemphasize the importance of planning studies (the decision to proceed with a particular project often being a political one), it is ironic that donors require of African countries, with relatively weak planning skills, more planning than they require at home. Few riparian states can cope with the demand, being unable to access all the studies and reports let alone use them for

planning purposes. Solutions to excessive studies and unrealistic planning expectations need involve better coordination and strategy formulation on the part of donors (with studies reflecting that coordination and those strategies, and with donors disseminating and standing by study results), and better planning capabilities on the part of riparian states. In the latter case there is no substitute for the institutionalization of effective data storage, analysis, planning, monitoring and evaluation units within river basin authorities and planning ministries.

Looking to the future, training deserves much more donor attention not just for staffing institutions with river basin development responsibilities, but also to reduce the heavy financial burden of high expatriate salaries. To date the training component of both bilateral and multilateral programs time and again has been inadequate. The situation is especially deficient when donor funds are used to employ international experts and firms since generally speaking these place relatively low priority on training. Three major problems are involved. The first concerns the poor phasing of training in relationship to the expatriate expert component (trainees are apt to be studying overseas while expatriate staff members are in the field so that on-the-job training is rare). The second problem concerns the time constraints placed on expatriate researchers and advisers. Understandably eager to further their own careers by doing a good job, they tend to accord low priority to training. Finally expatriates, and the organizations that they represent, are seldom eager to train their replacements, so again training and institution building receive low priority.

In illustrating various donor deficiencies, most SARSA examples have involved AID and the World Bank. Neither AID nor the Bank have a strategy or set of guidelines for their involvement in river basin development. In the AID case lack of a strategy has weakened the agency's impact -- an unfortunate situation granted AID's concern with environmentally sustainable downstream development. In the case of the World Bank, river basin development has remained primarily the prerogative of divisions of energy

and irrigation. As a result, the Bank continues to contribute to the momentum favoring major dams for hydropower and irrigation as opposed to a genuinely integrated program of river basin development which may or may not involve major dam construction.

CHAPTER 7

PRIVATE SECTOR AND RESEARCH ORGANIZATIONS

A. INTRODUCTION

Because of poor performance of parastatals and various other government public sector organizations with such river basin development activities as the design, construction, and management (including provision of services and marketing of produce) of irrigation projects, bilateral and multilateral donors recently have been pushing for greater involvement of the private sector. AID has played a leading role here. This new emphasis on the involvement of the private sector is welcome for river basin development is too complicated a task to leave to government bureaucracies alone. On the other hand, unless the nature of that involvement is carefully defined, there is a very real danger of private sector involvement becoming a "privileged solution" in the same sense that Moris applied to African irrigation. The logical corrective here is to assess more carefully the strengths and weaknesses of private sector involvement, especially as it relates to facilitating smallholder development, with policy informed by that assessment.

Leaving aside private voluntary organizations, what is meant by private sector is not carefully defined. Does it include the millions of small-scale African households that socio-economists have been analyzing as family firms and that have been responsible for pioneering agrarian democracy on other continents at other times? If not, it should. In terms of the realization of both private profit goals and national, regional and local development goals, what is the appropriate involvement of donor

private sector firms, other international firms and local firms in river basin development? What kind of contribution can private sector firms make in joint ventures with government organizations and local populations? Finally, what has been the impact to date of private sector firms on local populations living within African river basins? None of these questions have been adequately analyzed to formulate strategies for private sector involvement.

As an example, one of the more interesting contributions of a private sector organization concerns research sponsored in Central Africa by the Rhodesian Selection Trust (now incorporated within American Metal Climax). During the colonial regime, Rhodesian Selection Trust carried out a number of research activities which had very little to do with its main interest in copper mining. For example, it funded and managed the Kafue Polder Research Station which eventually evolved into the Government of Zambia's National Irrigation Research Institute. While this and other activities have subsequently proved to be of value to Zambia and its people, we do not know if the management of Rhodesian Selection Trust found them worthwhile over the longer term. They illustrate, however, the type of imaginative activities that private sector firms could undertake to aid development.

In the paragraphs that follow, emphasis will be placed on the role that private sector and research organizations have played in African river basin development. Emphasis is also placed on international firms, private voluntary organizations and African universities and research institutions, farm families having already been dealt with in Chapter 3. Organizational types that are left out are not omitted because they are unimportant, but rather because limited information was collected or was available on their activities. Foundations are a case in point, the Ford Foundation having played a role in funding river basin regional planning in Zimbabwe, in encouraging local village and intervillage associations in the Senegal River Basin, and in institutionalizing socioeconomic research units within large-scale Sudanese irrigation projects.

With the wisdom of hindsight, more data should have been collected on the activities of local private sector firms in river basins and on ways in which donors could enhance their contributions. The conventional wisdom is that they are not competitive with international firms. The few cases examined by SARSA indicate that the validity of that assessment relates more to design and construction of major infrastructure than it does to small-scale irrigation projects, feeder roads and housing. In the case of the latter activities, Kenyan and Zambian examples suggest that comparative advantage may well lie with local firms, especially where their efforts are informed by local experience and knowledge. Both bilateral and multilateral donors should re-evaluate how their programs can contribute more to increasing the capability of local firms as well as that of local private voluntary organizations and local universities and research institutions. The World Bank, for example, rarely works with local nongovernmental institutions. Why is that? While bilateral donors understandably favor use of equipment by their own firms, more attention need be paid to the type of donor country equipment and technical assistance that can contribute to equitable and environmentally sound development within recipient nations.

Since results are mixed, suggestions are included as to how private sector involvement might become more effective in the future. The discussion is tentative since the SARSA study tended to concentrate more on local organizations, parastatals, river basin authorities and donors than on private sector firms, private voluntary organizations and universities and research institutions.

B. PRIVATE SECTOR FIRMS

1. In Regard to Construction-Related Activities

International corporations have been involved in all the major stages of river basin development, including feasibility studies and planning, construction, and post construction development. Though the construction of large dams and large and

medium scale irrigation systems is based on an easily transferred technology, few firms, if any, in tropical Africa have the resources to carry out the necessary feasibility analysis, and design and construct the necessary infrastructure. When African leaders opt for large-scale river basin development projects, they make decisions which favor international corporations over local corporations. When they opt for smaller projects like Kibwezi in Kenya and village irrigation projects in the Senegal River Basin they make decisions which favor local firms over international ones. The developmental implications of such policy decisions in terms of developing a stronger African private sector have not received sufficient attention.

While international firms have obviously played a crucial role in planning and building such dams as Kariba and Volta in the 1950s and 1960s, and Diama and Manantali in the 1980s, their perspective has been largely restricted to profit margins as opposed to development benefits to the riparian states. Scant attention is paid to the training of a local labor force or of local people to operate and manage the finished dam and power station. Hence the civil engineering contractor responsible for constructing Kariba in the 1950s imported hundreds of Italian artisans, with the labor force including one European for every six Africans during the height of construction. After the completion of the Kariba North Bank Hydroelectric Project in the early 1980s, operators had to be recruited from Sri Lanka and other countries.

In the Sudan, Chevron's attitude toward social and environmental impact studies in connection with development of, and pipeline construction from, the Unity Oil Fields just north of the Sudd was one of minimal compliance with requirements. Sociocultural impact studies were rejected as were suggestions that Chevron participate more directly in the development of the surrounding population. Subsequently those same populations closed down activities with the renewal of the ongoing civil war. While shut-down had little to do with Chevron's position, it can be argued that greater attention paid to local interests and concerns would have facilitated start-up in the

future, and labor recruitment and local relations in the event that the civil war had not intervened.

In Ghana, Kaiser not only carried out most of the later feasibility analyses, but also protected its position by becoming the consulting engineers to the Volta River Project. Both Kaiser and VALCO, 90 percent controlled by Kaiser and the main beneficiary from Volta hydropower until the 1980s -- when new agreements were made that favored Ghanaian consumers, paid little attention to how the Volta River Project could benefit riparian communities. Certainly the opportunity was there and in fact Quartey mentions in his report that a VALCO Fund was established. When queried about the Fund's activities, Quartey replied that it "appears to have operated so far on an ad hoc basis with financial and equipment assistance to Secondary Schools, assistance to individuals to attend overseas conferences or seek medical treatment. Its impact on the country as a whole has been minimal. Perhaps an appeal to it . . . to give priority to certain areas like Hospitals, Resettlement Areas and the economic development of the lake basin would not be out of place, the rationale being that it is because of the sacrifice of these displaced persons that the operation of VALCO has been possible" (1987 written communication).

Though consulting engineers are supposed to represent the interests of the riparian governments, it is hard to see how Kaiser could play that role in regard to advising, for example, on such alternate, and competitive, uses of water as for irrigation. Elsewhere international consulting engineers tend to favor expatriate firms even in cases where local contractors could do the job. Their advice at Bura, for example, ignored local Kenyan experience in house construction, and local firms that could build low-cost housing, in favor of what has subsequently proved to be unsuitable higher-cost housing designed and built by international firms. In the Senegal River Basin, Okidi (1987a: 44) quotes OMVS officials complaining at a October 1983 meeting of the Consultative Committee that subcontracts to riparian state firms "did not exceed 2% of the amount

of the Diama and Manantali contracts. Even contracts of minimum value were entrusted to foreign firms."

The reply to such comments of favoritism toward expatriate firms is that host country firms were noncompetitive and that their involvement would have raised costs, with their lack of experience and resources resulting in high failure rates and cost overruns. Furthermore, such firms that exist are largely controlled by expatriates, anyhow, as with construction firms in Mauritania and Zambia, for example. Such arguments are not convincing. If river basin development is actually supposed to foster the development of the riparian states, then a greater effort should be made to involve local firms in the development process. In both Kenya and Zambia local firms have shown their ability to build roads, housing and small scale project infrastructure. As for their domination by expatriates, in East and Central Africa those "expatriates" tend to be citizens of Asian and European origin. Even where they may not be citizens, as in the case of French, Greek, Lebanese and Syrian contractors in Francophone Africa, as managers of local firms they are more apt to recruit and train local people and bring in local partners.

2. In Regard to Production and Marketing Activities

Both international and private sector firms tend to be the most efficient and the most profitable agricultural production enterprises in Africa. In East Africa examples include Delmonte, Brooke Bond and the British American Tobacco Company. In Zimbabwe private sector firms continue to dominate the agricultural economy, examples including the Triangle (12,000 ha), Hippo (12,000 ha) and Mkwazine (6,400) sugar estates, the Mazoe citrus estates, and white settler dominated company estates elsewhere in the country. In this section, however, the emphasis is on international firms and local subsidiaries since they are more apt to have direct impacts, both positive and negative, on small holder agriculture and on regional and river basin

development.

Throughout the tropics international companies and their subsidiaries have been active in the development of agricultural production schemes both as sole developers and as members of joint ventures. In both cases they have shown ability to play the lead role in development which not only has benefited large numbers of farming households but has also catalyzed a process of regional development. As sole developer, the Parana Land Company (after World War II the Companhia Melhoramentos Norte do Parana) was responsible for developing in Brazil what Katzman considers to be "perhaps the most successful example of regional development planning in Latin America" (1977: 53), with Nelson noting that the resulting land settlement scheme "is in all probability the most extensive and economically successful in the humid tropics of Latin America " (1973: 121).

One of the four most successful of 34 Bank-financed projects analyzed in the 1985 *Experience of the World Bank with Government-sponsored Land Settlement* was a joint venture. This was the New Britain (Papua-New Guinea) Small Holder Development Project which is more applicable as a model for Africa than the Northern Parana Case. Participants in the project, which commenced in the late 1960s, were the Harrisons and Crosfield Group (HCG), the Government of Papua-New Guinea and over 1500 settler households. The Government and HCG were to share ownership in the newly formed New Britain Palm Oil Development Company on a 50/50 basis. HCG was a major private sector oil palm and rubber group which managed tree crop holdings in Indonesia, Malaysia, and Sri Lanka. Its involvement in the project was both major and enlightened, HCG being the project's chief planner and the manager of the company. As for enlightenment, this was shown in 1974, for example, when the company allowed half of its estate harvest to rot so as to give priority to settler production at the then problem-plagued mill. By 1980 over 20,000 acres had been planted with 6163 controlled by the Company's nucleus estate, nearly 14,000 by immigrant settler

households and 1,300 by host villagers. Not only was the project economically profitable from the point of view of all participant categories (with most of the pioneering group of settlers paying off their loans -- which covered full land development costs-- within five years), but the company-sponsored port became the major regional center in West New Britain.

Both the North Parana and New Britain cases deal with rainfed tree crop (coffee and oilpalm) projects. Both began under colonial auspices and both pioneered development in areas with relatively low host populations, the North Parana area being very sparsely populated and at least part of the New Britain host population being incorporated within the scheme. While both show the development potential of private sector involvement, could similar projects succeed in Africa? World Bank evaluators attribute some of the success of the New Britain project to its close association with the Australian trustee before independence, and especially to the close association between the responsible government agency in the joint venture and the Australian Assistant Administrator for Economic Affairs. That post was abolished after independence, with the position of the government project authority weakened by further bureaucratic changes that reduced interdepartmental cooperation and flexibility.

For such reasons, the Bank's evaluators doubted that a similar management structure could be replicated in the post independence era. The argument is not convincing since it ignores the government option for creating a more enlightened environment for joint ventures, should they be deemed desirable, through relatively simple policy decisions. Zambia, for example, has given a green light to joint ventures at the highest levels in the past two years, with a number of international firms already involved in bringing on projects in different parts of the country. In the Middle Zambezi Valley, Lummus Agricultural Services (U.S. based) and a subsidiary of Hoescht (the multinational German Chemical Company) have formed a joint venture with Zambia's cotton parastatal -- which has a good record in serving cotton producers

throughout the Valley. The problem there is not management structures but the incorporation of local producers as participants.

The involvement of private sector international organizations in African agricultural development is a complex issue. While the most successful enterprises, as a category, tend to be at the expense of local populations in that they lose their land to the enterprise, on the one hand, and are not incorporated within it, on the other, there are exceptions which indicate a wider potential for the private sector to contribute to integrated river basin development. In the paragraphs that follow a range of cases in different river basins are explored.

The classic example of an African joint venture is the Gezira Scheme which served as a model for development interventions elsewhere in Africa (the Office du Niger in Mali, for example) and in the world (including the very successful Northern Parana Scheme in Brazil to which reference has already been made). Today the Gezira/Managil Scheme is the largest irrigation project in the world under single management. Hectarage is near 900,000 while the number of tenants approximates 100,000. Total population within the area exceeds a million. Though everyone agrees that the Gezira scheme has played a major role in the history of the Sudan, reviews of the scheme have been mixed, with the more recent ones being the most critical. Sørbø pointed out to the author in 1979, for example, that there had been no increase in yields during the previous decade, with settler on-scheme incomes decreasing and indebtedness increasing, especially after the rise in petroleum prices (and hence in the costs of agricultural requisites) in the mid 1970s. By the late 1970s the World Bank had become increasingly concerned about the future of the scheme along with that of New Halfa (the second largest in the Sudan), urging the government to emphasize rehabilitation as opposed to the development of new schemes (this notwithstanding the fact that the Bank was a major donor in the Rahad Scheme which was undergoing development at the time, luring away Gezira staff in the process).

In this analysis, however, we are not concerned with the recent history of the Gezira Scheme since private sector involvement through the Sudan Gezira Syndicate ended with nationalization in 1950. Prior to that the scheme had been a joint venture between the government (which owned or leased the land, built the scheme, provided irrigation water, and retained responsibility for the local population), the Syndicate and the tenants. The history of the Syndicate between its founding in 1904 and that date points up some of the strengths and weaknesses of private sector involvement (Gaitskell, 1959).

Throughout most of its history the Syndicate was a consortium involving various London firms, wealthy businessmen and the British Cotton Growing Association. It played the major role in developing the Gezira prototype (at Zeinab and Tayiba), in obtaining financial backing for the scheme (including loans from the British government; no easy task at the time), and in managing the scheme after its initiation in the 1920s.

On the negative side, the Syndicate paid too little attention to the social development of the tenants (including housing, potable water supplies, education and medical facilities). Though on-scheme managers working for the Syndicate pressed for such development during the World War II years and the late 1940s, their London superiors were not interested in either social development or the devolution of management and other responsibilities to the tenants. Partly because of this, the Syndicate was notified by the government in 1944 that its role would be nationalized in 1950. At that time a new management organization -- the Government-controlled Sudan Gezira Board -- took over, establishing a Social Development Department shortly thereafter. Significant social development followed in the form of improved housing, community water supplies, recreation programs and adult education, and financial assistance to self-help projects suggested by village councils (the initiation of which dated back to 1941). Nutrition also improved as a result of Board assistance with

horticulture and animal improvement. Though the Board, like the Syndicate, did not devolve management functions to tenant organizations as desired by the central government (both colonial and post independence), five of the Board's 14 directors were drawn from the Tenant's Union, the Employees' Union, and the Laborers' Trade Union.

Though the Syndicate's London directors down played tenant social development and participation in scheme management, the tenants were the only producers on the scheme. Elsewhere the tendency for private sector firms has been to exclude small holders entirely in preference for a highly mechanized nucleus estate with a hired labor force. The Kenya Delmonte case is especially relevant here since it shows a multinational corporation actually phasing out a previous smallholder component.

In the late 1940s and early 1950s the colonial administration under Kenya's Swynnerton Plan emphasized increased small holder production of a number of cash crops including pineapples. At the same time Kenya Cannery was established with capital provided by a British firm (which also provided management) and a group of white settlers and with a factory built near Thika. Initially most supplies came from settler farms, but by 1957 smallholders were producing approximately 75 percent of the pineapple crop with the combined acreage being 7000 (Swainson, 1980: 157). Unfortunately, by then the British market (the main recipient of Kenyan canned pineapple) was saturated so that exports fell with the cannery reducing its purchase of smallholder fruit. Subsequently the government, because of its ongoing commitment to the small holders scheme, established a floor price which enabled the cannery to continue purchasing fruit until the market recovered in the 1960s.

In 1964, after negotiations, the multinational U.S. based corporation Delmonte (known at that time as California Packing Corporation) provided capital for expansion and took over management, increasing its control of share capital to 90 percent by the end of the decade. While government had assumed that Delmonte would develop its

own nucleus estate, it was also assumed that the company would continue purchases from the small holders' scheme which continued to expand under government encouragement. The government also provided loans and leased land to Kenyan Cannery to increase the size of its own estate. As estate crops came into production, Delmonte gradually phased out purchases from small holders. With no other major buyer, the small holders' scheme was no longer viable.

While estate management obviously gave Delmonte more control over the means of production (ibid., 164), throughout its history the survival of Kenya Cannery was dependent on favorable government treatment that involved subsidized prices, loans, and leases on government land (with the estate growing to approximately 80,000 acres). In the process Delmonte was able to achieve over a ten year period "more or less monopoly conditions" (p. 166). Under the circumstances, it is hard to believe that Delmonte could not have played a more constructive role in accommodating rather than destroying the small holder scheme. While company officials claimed that the quality of small holder fruit was too low, that may well be due more to inadequate technical assistance and underfinancing of the scheme by government than to small holder inadequacies. Certainly that is the case with other crops, Swainson noting that "Brooke Bond . . . found that they could use small holder tea production to their own advantage, by ensuring high production standards in the initial stages" (p. 167). Other firms in Africa and elsewhere have had similar experiences with oil palm, sugar, vegetables and other fruits.

More recently the Government of Zambia, at the highest level, has been advocating a new policy encouraging joint ventures between multinational firms and government parastatals. While results elsewhere in Zambia have shown that joint ventures can be expanded to include smallholders as outgrower participants, through 1986 the new policy was being implemented at the expense of local producers in at least three provinces. A case in point is the previously mentioned Gwembe Valley Development

Company in the Middle Zambezi Valley of Southern Province. Here the Central Government had pressured local government to hand over to the Company 2500 hectares as an estate for the sprinkler irrigation of groundnuts, wheat and cotton. At the time most of that land was used by local cultivators, while the rest provided grazing and forest products for building and other purposes. Nine villages with a total population exceeding 2,000 people along with a cattle and smallstock population estimated at over 5,000 animals were dependent on the area. No social impact analysis was carried out, the original estimate of the number of people requiring rehabilitation under estimating the total by at least a factor of five.

Part of the problem in the Gwembe Valley Development Company case was that feasibility studies were carried out by company personnel with relevant government agencies (such as the Mount Makulu Agricultural Station and the National Irrigation Research Station) and research institutions (like the Rural Development Studies Bureau) bypassed. In allocating land, normal government procedures were also bypassed while proposed compensation at the time of the SARSA visit was both inappropriate (cash as opposed to land) and inadequate (amounting to little more than the value of one's year crop of locally grown cotton). In this case both private firms and the government are operating contrary to the interests of the affected population.

While the Gwembe scheme should have a positive impact on the labor market, on local businesses (which will profit from electrification and increased demand), and a local cooperative which, on establishment, will control 10 percent of company shares, it is a pity that more attention was not paid by both the private sector firms and the government to the Zambian experience. In addition to using local expertise at Mt. Makulu dealing with such topics as soils, especially relevant would have been the recent experience with adding a small holders outgrowers component to the Zambia Sugar Company. Since the Gwembe Valley Development Company is newly formed, it is not too late to add a small holder component which in the longer run should be to the

benefit of both the people and the Company (on this point see Scudder, 1986).

Delmonte and the Gwembe Valley Development Company represent instances where multinational firms have had an adverse effect on local producers. Such need not be the case. During SARSA fieldwork a number of instances of positive impacts were noted, all of which have replicable features. In Kenya these included the Kenya Tea Growers Association (backed up by the expertise and name of Brooke Bond), the British American Tobacco Company and a number of Asian and European controlled firms for purchasing and marketing flowers, fruits and vegetables, of which Kenyan Horticultural Exporters (KHE) is the leading firm. A Central African case was the Zambia Sugar Company, while Richard Toll grew and processed sugar in Senegal.

Both Richard Toll and the Zambia Sugar Company complement larger estates with smaller outgrower components. Richard Toll is owned and managed by a French Firm (Compagnie Sucriere Senegalaise) while the Zambia Sugar Company is a parastatal involving the Government of Zambia and a subsidiary of the British firm, Tate and Lyle. According to Miller, Richard Toll "has developed into a 7,400 hectare agro-industrial complex. . . . Nearby, there is the Richard-Toll farmers' association, which has the rights to cultivate 400 hectares on the west side of the irrigation scheme and take advantage of the water resources and technical assistance provided for the sugar-cane plantation" (1984: 53).

The Zambia Sugar Corporation estate is approximately 9000 hectares. Production is supplemented by two comparatively large outgrowers totaling 400 hectares and the newly developed Kaleya outgrowers scheme of 1900 hectares. The Company as a whole is profitable, meeting Zambian demand and exporting sugar. The Kaleya outgrowers scheme is especially interesting since it is separately owned and managed "by a private organization, the Kaleya Small Holders Company. There are four equal shareholders in the Company: the Zambia Sugar Company . . . ; the Development Bank of Zambia; Barclays International Development Fund; and the Commonwealth Development

Corporation" (Wood, 1984: 222). Credit has been obtained from the African Development Bank, while management is the responsibility of the Commonwealth Development Corporation. Outgrower households are responsible for four hectares each.

All the Kenyan examples are primarily concerned with processing and/or marketing produce, relying on contracts with primarily small-scale farmers to obtain produce. While widely divergent views exist on the extent to which contract farming is in the longer term interests of small producers, and caution is urged about generalizing from cases, to date it has led in Kenya to increases in cash incomes. Most dramatic in recent years in the Upper Tana Basin has been the contract farming of green beans for export to the European winter market. While growers include both large- and small-scale producers, the latter dominate in number (4,000 to 6,000), hectares cultivated, beans produced and income generated. According to Jaffee's figures, small-scale contract farmers "typically grow 1/2 to one acre of French beans as part of a mixed-farming pattern including maize, dry beans, dairy cows, and other crops." Between 1968 and 1985 national exports increased from 109 tons to 6558 tons (Jaffee, 1987: 18-19).

KHE's activities in the Mwea area are described by Jaffee as follows: "One contract farmer . . . has developed a procurement network of over 200 small-scale farmers in the area. The subcontractors, most of whom are women and many of whom grow the beans on plots provided by the National Irrigation Board, typically have 1/4 to 1/2 acre under beans. The KHE contract farmer provides seed, fertilizers, and chemicals on credit to 'loyal' subcontractors. He maintains the collection stations where KHE trucks pick up supplies. The contract farmer takes a margin of 5-10 percent of KHE's contract price" (1987: 21). In 1987 Jaffee estimated that KHE had perhaps 150 such contract farmers, although the Mwea example is exceptional in regard to the number of "subcontract" farmers.

C. PRIVATE VOLUNTARY ORGANIZATIONS

Private voluntary organizations are active in each of the river basins visited by SARSA teams. They include secular organizations like OXFAM (active in the Senegal Basin), lay organizations with a strong religious underpinning like the Gossner Service Team (Middle Zambezi Valley), ecumenical organizations like the Kenyan Council of Christian Churches (Lower Tana Basin) and individual churches or church organizations like the Catholic Church (Middle Zambezi Valley) and the Catholic Relief Services (Volta River Valley).

Generally speaking such organizations have played an important role in facilitating program and project development, as have dedicated individuals and couples loosely affiliated with PVOs. Most useful are efforts which concentrate on building up local community or organizational capacity to the point where local people can handle their own affairs and compete for scarce local, regional and national resources. Here a case in point is OXFAM's assistance to farmers' associations in the Senegal River Basin. Another example concerns a couple and their coworkers who helped the residents of a remote village in the Zambezi escarpment build a road to the Zambezi Valley and move beyond subsistence in regard to cereal production. By the time they moved on to another community on the edge of Lake Kariba, this couple had also been instrumental in bringing a clinic with nurse to the community and upgrading the school.

PVOs can also play an important managerial and technical assistance role where government resources are inadequate (as in the Middle Zambezi Valley), although here there is a danger that local initiative will be adversely influenced by expatriate volunteers who want to do the job "right" -- as has partially been the case with the Gossner Service Team in the Middle Zambezi Valley. There is also a continuation of the more conventional role of provider of social services that private voluntary organizations (and especially religious denominations) played during the colonial era.

At that time colonial officials allocated different areas to different church groups which were expected to provide educational and medical services in addition to missionary activity.

In the Middle Zambezi Valley's Gwembe District, the Salvation Army, the Jesuits, the Pilgrim Holiness Church, and the Methodists all had their territories in which they managed schools and provided other services. In recent years the most expansive PVO has been the Catholic Church which has grown in association with major development activities. In the 1950s the Italian priest who served Impresit, the Italian contractor that built the Kariba dam, suggested that the Church establish a presence among the village population in the northern portion of the district. Subsequently a mission station was established near Chirundu with the resident priest playing a major role in planning the Zambezi Training Farm, a joint venture between the government of Zambia and the Church which provided training in irrigation for local villagers who were then settled on two small-scale irrigation projects. Financial costs of over \$200,000 were shared between the two partners, with the Italian government paying for the salaries of Italian volunteers.

The Catholic Church also built and staffed a small hospital at Chirundu, with substantial churches built nearby, at Lusitu, and in Siavonga township. In Gwembe South the Catholics built another major church in the new mining town of Maamba with outreach services provided in the vicinity. Also in Gwembe South the nondenominational Gossner Service Team played a major planning, financial, and technical assistance role in the ongoing Gwembe South Development Project, an umbrella program which includes management of the Nkandabwe, Siatwinda and Buleya-Malima small-scale irrigation projects.

As the Gwembe case shows, PVOs can be a major force for economic and social development in specific areas, the Catholic Relief Service on the Afram Arm of Lake Volta in Ghana being another example. Where PVOs federate as in the case of the

National Christian Council of Kenya, a degree of coordination and influence is applied over a wider area, the NCKK working with communities in both the Tana and Juba River Basins as well as elsewhere in Kenya.

Looking to the future, it is not unlikely that PVOs will become involved in river basin development activities as advocates of the interests of local populations. As in India, this is apt to occur as local private voluntary organizations emerge, since international organizations find themselves in a very delicate political position in newly independent African nations. In India, however, local PVOs are playing an increasingly important role as guardians, for example, of the environment and of village populations caught up in large-scale state and national development projects. In the Narmada River Basin at least four such organizations staffed by doctors, lawyers, and other professionals are advocates for communities that will be displaced by the Sardar Sarovar Dam. One has actually brought a class action suit against the Government of Gujarat for not following agreed upon policies, and is involved, with other PVOs, as advocate for the thousands who were affected by the Bhopal disaster.

D. UNIVERSITIES AND RESEARCH INSTITUTIONS

The emphasis here is on the role of African universities and research institutions, and of individual faculty members and staff, in river basin development. In each of the major river basins studied, local universities, research institutions and local researchers have played a more important role as consultants and as organizers of seminars and research programs than donors appear to realize. This conclusion is important since it suggests that the time has come for donor funding of feasibility, monitoring and evaluation studies, and of conferences and workshops, to involve local research institutions to a greater degree.

In Zimbabwe, various faculties of the University (including the Faculty of Agriculture and the Center for Applied Social Science), with funding from the Ford

Foundation, IDRC, and other sources, have cooperated with local government and national ministries in regional planning for the Sebungwe Region which drains into the Kariba Lake Basin and the Zambezi below the dam. University activities since 1981 include broad surveys, more detailed studies of particular areas (the Upper Sengwa, Siabuwa, and Mola, for example) and topics (including soils, small-scale irrigation, and smallstock productivity), and presentation of results in workshops including workshops within the Sebungwe co-sponsored by local rural councils. Initiated after Zimbabwean independence, these activities were preceded by more academic pre-impoundment research by institutions in both Northern and Southern Rhodesia on the geology, ornithology, fish populations, archaeology and anthropology of the Middle Zambezi Valley. Subsequently the predecessor to the University of Zimbabwe established a biological research station on the lake which continues, with university and international funding, a broad range of research activities from its headquarters in Kariba township.

In Zambia, reference has already been made to the various studies and workshops carried out under the auspices of the University's Kafue Basin Research Committee which in recent years has broadened its scope to include the Zambezi below Kariba Dam. These studies, as much as any, have pointed up the development potential, in terms of biological productivity, of African wetlands. The Institute for African Studies (formerly the Rhodes-Livingstone Institute) has been sponsoring anthropological research relating to the Kariba Dam since the 1950s (Colson, 1971, and Scudder, 1985). In addition, the Rural Development Studies Bureau (the director of which has been a participant in the SARSA study) has been active in the Kariba Lake Basin since 1984 when the Bureau sponsored a national workshop on the concept and practice of integrated rural development for district and ward level cadres in Zambia, with special reference to the Gwembe Valley. This workshop was of special significance since for the first time it provided the opportunity for those working in Gwembe District,

including private voluntary organizations, to meet and discuss mutual interests. More recently, with the encouragement of their vice chancellors, the universities of Zambia and Zimbabwe have been exploring the possibility of collaborative programs dealing with the Middle Zambezi Valley -- starting with seminars for sharing research results.

In Kenya, university personnel have played active roles as river basin development researchers (including Okidi's research on the Nile, Kagera and Senegal River Basins), as members of national committees (including Professor Shem Migot-Atholla's involvement on the five member committee on national irrigation policy that delivered its report in the mid-1980s), and as consultants (evaluating, for example, small scale irrigation in the Lower Tana Basin, the Bura scheme, and Kiambere dam resettlement). In Ghana, the University of Ghana has been active throughout in Volta Lake Research and, more recently, in managing the university farm and research station adjacent to the Kpong reservoir. In Senegal, the University of Dakar's Center for Applied Economics (CREA) has commenced research in the Senegal River Basin.

In view of the above, the time has come for donors to play a more active role in funding research for river basin development in a way that also contributes to building the research capacity of local universities and research institutions. Where donor organizations like SARSA are involved, a greater effort should be made to involve both local researchers and African research institutions. While the SARSA team has included Milimo from the University of Zambia and Okidi from the University of Nairobi, in drawing up research proposals neither SARSA nor AID considered the merits of involving such organizations as the pan-African Nairobi-based African Academy of Sciences or the Dakar-based Council for Development of Economic and Social Research in Africa. Ignoring such organizations for Africa wide studies is a mistake just as ignoring local organizations is a mistake in connection with national studies. The expatriate academic world can hardly press for donors, private firms, and private voluntary organizations to pay more attention to the enhancement of local production

systems and local participation unless it is equally willing to work closely with counterpart organizations within Africa.

E. SUMMARY

It should be continually kept in mind by both national planners and donors that the main private sector entity in Africa's river basins, in terms of numbers and importance, is the local household. Not only are household members the principal risk-takers in regard to development programs and projects, but it is their rising disposable income, more than any other factor, that spurs development during the early stages of industrialization. More attention should also be paid to the involvement of local firms than has been the case to date; indeed their involvement should be a requirement with technical assistance and credit provided to improve their capabilities. Heads of state and national policy makers are insufficiently aware of the importance of household production systems; they also do not appear to realize the extent to which the construction of large-scale infrastructure favors international firms over local firms.

It is necessary to stress the importance of local households and firms because of the tendency for the major bilateral and multilateral donors to define private sector involvement primarily in terms of international firms and to advocate the involvement of those firms, as opposed to local firms and households, as "a privileged solution." This emphasis on local firms and households is not intended to denigrate the importance of involving international firms in river basin development. On the contrary, case studies show that international firms can play a key role in catalyzing regional development. Unfortunately this potential has only seldom been realized, the commoner outcome being the operation of international firms at the expense of local farm households. The logical corrective is to relate policy more closely to research on what works to the benefit of international firms, on the one hand, and national, regional and local development goals, on the other hand. AID-funded research on

contract farming is an important start which should be expanded.

As an instrument for river basin development, to date international firms appear to have been most successful in the production and marketing of certain crops. In terms of production these are coffee, tea, rubber, tobacco, and sugar with the private sector (either alone or through a joint venture with government agencies) linking a small holders' outgrower program to a nucleus estate and processing facility. In terms of marketing, higher value flowers, vegetables and fruit for European winter consumption dominate.

For ideological reasons there is a tendency for donors to play down the role of government in successful private sector ventures, pushing instead for the removal of government involvement. Yet that same government involvement has played a crucial role in some of the more successful private sector cases including Gezira and the Zambia Sugar Company. Even where the private sector has gone it alone in the sense that no legally constituted joint venture with government is involved, government involvement is still very much a factor whether in terms of favorable policies for leasing of land, for protection of new enterprises (including subsidized prices and import controls) and for credit as in the Delmonte case or for provision of feeder roads and electrification which benefit, for example, the Kenya Tea Growers Association.

Where tripartite joint ventures are involved (private sector, government and small holder), the weakest partner is clearly the small holder. Donors should keep this in mind. While it is understandable that international firms, local subsidiaries, and local firms should place priority on their own interests, not infrequently those interests have been defined in ways that are contrary to the interests of local populations, especially in regard to involvement in agricultural production projects, and quite possibly even in terms of the longer term interests of the firms involved. As in the recent Zambian case, in their rush to implement a new policy national governments may also act in ways that put local producers at a disadvantage. In giving assistance, donors must

continue to bear the main responsibility for ensuring that adequate social and environmental impact assessments are completed, and are incorporated into plans for implementation.

Once the relationship between private sector, government and small holder collaboration is better understood, donors should encourage private sector firms to participate more frequently in African agricultural development and in river basin development. There is much room for imaginative experiments involving research relating to the crops grown, joint production ventures, banking (along the line of experiments by Hatton's Bank in Sri Lanka in connection with the Accelerated Mahaweli River Basin Development Program, and other banks elsewhere in South Asia), management of former state farms (as in the case of Somalia's Juba River Basin sugar production project), and facilitation of outgrower production around petroleum and natural gas, mining, lumbering, and nucleus estates.

As for private voluntary organizations (PVOs), they are important actors on the development stage, especially in situations where unfavorable rural-urban terms of trade and other constraints are associated with inadequate government services and funds. PVOs can be especially effective in introducing alternate technologies and in building up local community or organizational capability to the point where local people can handle their own affairs and compete for scarce local, regional and national resources. On the negative side, weaknesses are several. First, overzealous personnel can delay or suffocate local initiative, hence delaying the institutionalization of self-help activities. Second, activities are apt to be restricted to a small number of communities. Third, monitoring and evaluation capabilities are weak. Granted the range of PVO activities, and the creativity of many PVO personnel, this is a major inadequacy since it not only leads to perpetuation of mistakes but to inadequate information about successes and the extent to which they are replicable. Fourth, generally speaking there is very little coordination between PVOs, with each working in

its own area and relatively uninformed about other activities which may be of relevance.

For PVOs to become more effective in the future, these weaknesses need be addressed by themselves and by donors like AID and the World Bank which are paying more attention to the involvement of PVOs in development activities. As with private sector firms, there is the risk of donors taking a "privileged solution" perspective in regard to PVOs. Clearly they have an important role to play, but as partners with local people, their institutions, governmental agencies and other private organizations.

In advocating greater involvement of PVOs, once again donors must not favor international organizations as the expense of local ones. So that local PVOs can emerge and be effective, donors should also consider carefully the legal and political environment in which they operate. With its multifaceted democracy, India, for example, is a more favorable environment for PVOs than exists in most African states. Just as donors diplomatically are pressing for structural reforms to facilitate economic development, reforms relating to freedom of expression and to a reasonably independent legal system are needed if the potential of PVOs, and especially local PVOs, is to be released.

African universities and research institutions have played a more important role in river basin development than donors, and international researchers and consultants, realize. This conclusion is an important one, suggesting that an increasing proportion of donor funding for feasibility, monitoring and evaluation studies, and for conferences and workshops, should be used to utilize and build the research capacity of African universities and research institutions.

CHAPTER 8

CONCLUSIONS

A. INTRODUCTION

The development of Africa's river basins is justifiable only if it can lead to the integrated development of each basin's human, land and water resources in a way that is environmentally sustainable. The narrow focus of most planning studies, and of most development, on river basins as hydrological systems has tended to restrict development, on the one hand, to water resource management, and, on the other hand, to national accounting in terms of electricity generation and crop production on large-scale irrigation projects. Local, regional and environmental accounting has been ignored, with adverse effects on riverine habitats and communities and on national development goals.

Equating river basin development with water resource management is a long-standing failing. Within African countries, this bias is illustrated by the fact that river basin development usually is the institutional responsibility of ministries, commissions, and authorities concerned not with planning and integrated area development but rather with energy, irrigation, and public works. Kariba was the responsibility of the Federal Power Board and later, after the independence of Zambia, of the Central African Power Corporation. In Nigeria, Kainji was the responsibility of the Niger Dams Authority with close cooperation with the Electricity Corporation of Nigeria. In the Sudan, the Jonglei Canal Commission was an outgrowth of the Ministry of Irrigation, while members of the OMVS Council of Ministers have been drawn almost exclusively

from ministries concerned with public works and energy development. While the Volta River Authority was more broadly conceived, since the retirement in the late 1970s of Chief Executive Quartey (himself the former head of the national electricity agency), its mission has been redefined to deal primarily with power generation.

The same bias exists among multilateral and bilateral donors. Still the main proponent of large-scale dams in Africa, the World Bank places such projects under its energy divisions. Though feasibility analyses may address multiobjective criteria, the final project remains essentially an energy project in the Bank's portfolio, Kainji being a major example. As for Volta, it was the Bank which pressured the Volta River Authority to narrow its focus, while in the 1980s the Bank's energy division has ignored the Bank's own environmental and resettlement guidelines in regard to the recently completed Kiambere Project. Historically AID had the same bias during the 1950s and 1960s. While broadening perspectives and the Sahelian drought reduced this bias in the 1970s and 1980s, they did not eliminate it.

The inadequacy of techniques for project appraisal and the lack of evaluations of the impacts of large-scale dam construction have contributed to this bias. Far too often appraisals place too little emphasis on the total resource base, on indigenous knowledge relating to that resource base, and on local production systems for resource utilization. Too much emphasis is placed on economic rates of return (which are easily manipulated in studies) at the national level while redistribution effects and multipliers are ignored. Especially inadequate are least cost solutions for electricity generation since they tend to compare dams with thermal stations and other power sources as if they existed in a vacuum. As for benefit-cost analyses as currently carried out, too often they do not deal with the development outcomes that heads of state wish to realize -- namely multiplier effects. The lack of evaluations dealing with environmental, economic and socio-political impacts of large-scale river basin development projects is disturbing since it suggests a lack of interest in accountability. Donors should address appraisal

and evaluation deficiencies as soon as possible. If existing assessment methodologies, including rapid appraisal, are not sufficient, new tools need be developed that make use of a wider range of expertise (including social science and natural resource management expertise).

B. THE RECORD TO DATE

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The most important single conclusion resulting from this assessment is that African

nations have been developing the hydroelectric potential of their rivers at the expense of their ecological resiliency, human populations and agricultural potential (agriculture being broadly defined to include livestock management, forestry and agro-forestry, and fisheries in addition to crop agriculture). Furthermore, since very little electrification has occurred among the rural majority, this hydroelectric potential has been tapped largely for the benefit of the urban commercial, industrial and residential sectors. Not only do these sectors cater to the minority of Africa's population, but the provision of cheap hydropower has not stimulated industrial development to the extent expected.

Though irrigation has been receiving increasing emphasis as a secondary objective, the priority given to medium and large-scale projects is hard to justify on either economic or financial grounds. Capital development costs have been escalating with some exceeding \$20,000 and even \$30,000 per hectare. Even with double cropping of high value crops, it is not possible to pay off such costs; indeed, frequently projects do not even cover recurrent costs. While families on irrigated settlement schemes may be better off than they were before the project, still many do not move beyond subsistence. And in comparison to households dependent on rainfed and flood water agriculture, irrigation, except in the Sudan, benefits a relatively small minority.

While planners have over-estimated the benefits to be derived from hydropower generation and irrigation, and underestimated the environmental and socio-economic costs of dams, they have also underestimated a number of benefits associated with reservoir formation. Fisheries are an example. During the mid-1970s sales of fish from Lake Volta exceeded revenue from sales of electricity, while fish landings at Kariba currently exceed the most optimistic pre-inundation estimates. The potential of reservoir drawdown areas for flood recession cultivation and grazing has also been underestimated. Such benefits have been overlooked by critics of dam construction, as have the potential benefits of a regularized downstream flood for riverine habitats and communities.

Because of aridity and irregular flooding, African nations must develop their river basins. While it is possible that the potential of the major basins can only be realized through the construction of appropriately designed dams, to date dam construction has been premature in two senses. On the one hand, decisions by national policy makers have been made to proceed before the necessary studies have been completed. On the other hand, in favoring the urban-industrial sector, the plans that were implemented have made agricultural development harder for river basin inhabitants due to the reduction or elimination of natural flooding. The implications of this resource transfer from rural to urban areas for future development are not encouraging in regard to both economic and social equity considerations.

During the early stages of industrialization the driving force in development is the increased productivity, disposable income and consumption of millions of small scale rural producers, many of whom live within river basins. Drawing on case material from a number of countries including Zambia, India, China and Malaysia this conclusion has been generalized for the tropics and subtropics (see, for example, Johnson and Kilby, 1975). Not only does most agricultural production come from such small-scale producers, but their increasing consumption of locally and nationally produced goods and services as they move beyond subsistence can catalyze a process of regional development. For such a process to occur in river basins, much more attention need be paid to the enhancement of riverine and lacustrine (including reservoir) habitats and the development of local production systems.

Most African nations have access to only one or two river basins. Potential heartlands in the world's most arid continent, these river basins are major national resources whose development is essential for increasing agricultural and industrial production, and for increasing the living standards of rural and urban households. As previously noted, development to date has concentrated more on tapping the hydroelectric potential of Africa's rivers (at least 30 percent of the world potential)

than on a broader utilization of each basin's human, land and water resources. Generally speaking, future dams are not justified unless they can combine hydropower generation more effectively with irrigation and with the enhancement of local production systems and riverine habitats. Whether or not this is possible remains to be demonstrated. If such a combination is not possible, the construction of additional mainstream dams becomes an unattractive option because of their very serious adverse impacts on downstream habitats, productivity, and populations.

C. THE NATURE AND POTENTIAL OF RIVERINE HABITATS AND PRODUCTION SYSTEMS.

Riverine habitats from small upland tributaries to the deltas of Africa's major rivers are a most valuable resource throughout the continent. This is especially the case with such major wetlands as the inland delta of the Niger, the Lake Chad basin, the Sudd, and the Kafue Flats which are found in arid and semi-arid Guinea and Sudano-Saharan habitats. Though much smaller in scale than the other examples, Bingham has labeled the Kafue Flats Zambia's "most valuable agricultural entity," while Howard and Williams note that "the biological productivity of an area such as the Kafue Flats may in the long run prove to be vastly more important to mankind than its short-term value as a modified water storage for the generation of electric power."

The development potential of this biological productivity has been largely ignored by both national and international development planners. The same is true of the riverine populations that have been tapping this productivity for thousands of years, supporting moderate population densities without environmental degradation. The key to their survival has been the very annual flood that dam construction throughout the continent has either eliminated or altered in an adverse fashion.

Much of tropical Africa is drained by a relatively small number of major river systems, in most of which seasonal rainfall is reflected in extreme variation in annual

flows. Though problem-prone habitats, these river basins have played a major role in the origins of sedentary communities, crop agriculture and state formation. Currently they are inhabited by tens of millions of people, and by large numbers of domestic animals. The livelihood of both people and animals is tied to the annual flood.

The production systems of riverine populations are multi-faceted and dynamic. Their most important components are rainfed and flood water agriculture; small-scale irrigation; livestock management; artisanal activities, trade and other small-scale commercial ventures; fishing; hunting and gathering, and -- of increasing importance in recent years -- wage labor. Such systems are found in river basins throughout tropical Africa, their origins in the Nile Valley and the inland delta of the Niger going back thousands of years. Over the millennia, riverine communities have evolved their own cultivars for flood water cultivation including floating rice, flood-tolerant varieties of sorghum, and various early maturing varieties. While cereal production is relatively low (tending to range between 400 and 800 kilograms per hectare), yields from flood water cultivation are more reliable than those harvested from larger rain-fed fields. Double cropping is also frequently possible on annually flooded riverine alluvia, hence enhancing their value to cultivators as reflected in elaborate land tenural arrangements.

As for livestock management, after the recession of the annual flood, floodplains provide critically important pasture lands during the latter part of the dry season when vegetation elsewhere is scarce. At that time livestock converge on floodplains from the surrounding uplands, with floodplain pastures able to sustain relatively high stocking rates. The productivity of riverine fisheries, like agriculture and livestock raising, is also dependent on annual flooding, with fishing providing both employment and low cost, highly nutritious protein. Annual yields, for example, from the Lake Chad, Niger, Nile and Zambezi fisheries alone provide over 500,000 tons of fish, while African inland fisheries provide an important source of employment for both rural and urban populations during recessions and depressions.

In terms of development, riverine production systems have a number of important advantages. First, they already support millions of people who are familiar with the major components hence providing the opportunity to build on existing economies. Second, there is room for both expansion and intensification. The potential of flood water agriculture, for example, is reflected by the fact that millions of hectares are available for cropping including approximately two million hectares in Nigeria alone of which only about half is currently under cultivation. As for intensification, research suggests that yields can be increased two to three fold by improved water management, improved varieties (in terms of early maturation, and drought- and bird-resistance), and improved cropping techniques. In the case of Nigerian riverine habitats, Adams notes that "the productivity and extent of floodplain land cultivated using traditional techniques . . . can be contrasted with the poor performance, small area, and high cost of formal irrigation schemes About one million ha are cultivated under some kind of traditional irrigation of flood-adapted cropping in Nigeria, compared with only 30,000 ha developed for formal irrigation" (1986: 30).

D. CONSTRAINTS TO DEVELOPING RIVERINE PRODUCTION SYSTEMS

While policy makers and researchers alike have underestimated the potential of riverine habitats and riverine production systems, care must be taken not to underestimate constraints to realizing that potential. Afflicted by serious diseases and characterized by irregular flooding and irregular rainfall throughout much of their length, Africa's riverine habitats have never been paradises. Furthermore in recent decades they have come under increasing pressure due to a combination of factors including population increase, drought, environmental degradation and current strategies for river basin development. In regard to river basin development strategies, not only has dam construction failed to realize expected benefits, but it has adversely affected riverine habitats and communities. Due to less flooding, flood plains have

shrunk in size. Fish landings, and the availability of critical grazing for livestock toward the end of the dry season and of land for flood recession agriculture, have been significantly reduced. Production and living standards have dropped as a result. Well documented cases include the Middle Zambezi, the Kafue Flats, the Lower Volta, the Sokoto-Rima system, and the Niger below Kainji. The impacts on downstream floodplains and communities of the Bakolori Dam in the Sokoto-Rima system have been so adverse that Adams concludes that their inclusion within the economic appraisal "should have been enough to prevent development of the project" (1985b: 300).

Local populations alone are not able to deal with such constraints. If they are to be resolved a range of local, national and international institutions must be involved. Control of river blindness and human sleeping sickness, and of grasshoppers and locusts, for example, require international cooperation and the involvement of both bilateral and multilateral donors. The same is true in regard to formulation of sustainable policies and the implementation of plans for truly integrated river basin development.

E. THE ENHANCEMENT OF RIVERINE HABITATS AND PRODUCTION SYSTEMS

1. New Policies and Strategies

To correct the unsatisfactory record to date will require new policies and strategies on the part of both national and donor agencies. It will also require improved water management and institutional development. In regard to new policies and strategies, the starting point is a willingness to consider a wider range of alternatives relating to river basin development. These need not be mutually exclusive since a range of options might be implemented over a period of several decades. For example, initial emphasis might be placed on the intensification of rainfed agriculture, which continues to

support the majority of Africa's citizens. Subsequently major infrastructure including irrigation projects and dams might be built, provided the necessary studies justified their construction. One option involving major infrastructure would be dam construction that combines hydropower generation (the revenue from which is needed for debt service) with irrigation and the enhancement of riverine habitats and production systems.

In the policy arena the donor community (and especially the World Bank whose new president has at least enunciated the goal of the Bank becoming part of the solution rather than remaining part of the problem) will probably have to play the lead role. Especially important are high level consultations with heads of states and ministers to demonstrate to them that existing policies are not achieving the expected multiplier effects. Since river basin development projects tend to be the lead projects in national development plans, donors should also consider linking new strategies with structural reforms relating to closer linkages between agriculture and industry, to the reorganization of such government parastatals as river basin authorities and irrigation agencies, and to a stronger role for nongovernmental institutions including local organizations, private sector firms and nongovernmental organizations.

2. Improved Water Management

While more favorable policies are a requirement, the key to the enhancement of riverine production systems is improved water management. While local economies are dependent on annual or biannual flooding, all too frequently those economies are adversely affected by ill-timed flooding, excessive flooding or inadequate flooding. Simmons notes, for example, that farmers in the inland delta of the Niger are adversely affected by irregular flooding every three to five years. Because of the extreme variation in riverine flood regimes, infrastructure providing partial control has proved unsatisfactory in tropical Africa. As a result, the question arises as to whether or not

the construction of major dams for the release of a controlled downriver flood, which could also be combined with drawdown regularization in the reservoir basin, might be the best management tool.

Aside from convincing hydropower advocates that a proportion of stored water is better used for a controlled downriver flood than for hydropower generation, controlled flooding faces two major problems. First is the extent to which it will actually enhance flood water agriculture, livestock management and fisheries development as well as a range of options like tubewell irrigation and reforestation associated with aquifer recharge. A controlled downriver flood is not the same as natural flooding. For one thing, the very irregularity of natural flooding may play an important ecological role in flushing out salts and maintaining riverine forests -- a role which controlled flooding may not simulate. Another unknown is whether the duration of flooding will be sufficient for aquifer recharge and enhancing the productivity of flood recession agriculture. Natural flooding in good years may cover extensive floodplain areas for several months. Will a controlled flood of 15 to 30 days provide sufficient benefits, since longer-duration flooding probably is not justified in terms of decreased reservoir storage for hydropower generation.

The second major problem concerns the trade-offs between hydropower generation and controlled flooding. The latter requires release of water through floodgates rather than through turbines hence reducing the amount of electricity generated. It is estimated by the World Bank, for example, that inundating 50,000 hectares for flood recession agriculture in the Middle Senegal Valley will reduce the generating capacity of the Manantali Dam by about 25 percent. Trade-offs in such a situation are complicated. Assuming that benefits from the two alternatives can be measured, hydropower provides benefits primarily to the urban industrial sector while the principal benefits of controlled flooding go to rural populations living within the river basin. In contemporary Africa not only do political elites live in urban areas but urban

residents have far more political clout than does the rural majority.

Another problem relates to loan repayment. While such direct benefits from controlled flooding as increased production, rising living standards, and such multipliers as enterprise development and increased nonfarm employment, may more than offset reduced hydropower generation, sale of electricity in a city like Dakar not only provides a much more easily tapped source of revenue for debt servicing, but also provides revenue at an earlier date. At the expense of longer term development, donors are currently pushing for a single line from Manantali to Dakar (which would by-pass the most densely settled portions of the Senegal River Valley) as opposed to two lines (with one serving the Middle and Lower Valley) in part because of their concern about debt repayment.

The recent completion of the Manantali Dam provides an exceptional opportunity to provide answers to such fundamental questions. Dam construction was completed in 1987, with the reservoir beginning to fill during the 1987 rains. Due to funding constraints, the first turbine will not be operational until 1993 at the earliest. Starting in August-September, 1988, a controlled downriver flood will be released for the benefit of downstream users, and especially for flood recession cultivators in the Middle Valley. It is of great importance for the riparian states and for the rest of Africa that the impacts of this controlled flooding be carefully studied over the next five years. This is because Manantali provides the first opportunity in tropical Africa to monitor and evaluate the impacts of controlled flooding from a major mainstream dam and to compare those impacts with the expected costs and benefits of other development outcomes, including hydropower generation and irrigation without controlled flooding.

Impact assessment at Manantali need address a broad range of issues including increased biological productivity associated with controlled flooding and the proportion of that productivity that is tapped through such activities as flood recession cultivation;

well irrigation permitted by aquifer recharge (and involving buckets, shadoof, tubewell and other devices); livestock management (related to improved pasture resources during the dry season); fishing; and agro-forestry. Through SARSA, AID is funding three years of studies relating to the response of local populations to controlled flooding in the Middle Valley. While this is an important initiative, it need be complemented with other studies that address such topics as aquifer recharge and the impacts of flooding on biological productivity. Still other studies are needed in the Upper Valley and within the Manantali reservoir area. While some of these may be funded by GTZ (Manantali reservoir planning) and AID (Upper Valley Master Plan), a more systematic attempt is needed to identify, fund and execute the research necessary to assess the "electricity cum controlled downstream flood and reservoir drawdown" option, the implications of which extend well beyond the Senegal River Basin.

3. Institutional Involvement

In regard to institutional involvement, river basin development is too important and too complex a process to leave to river basin authorities and national parastatals, and international donors, consultants and contractors alone. Riparian populations as represented by local organizations must be involved throughout. There is also an important role for private voluntary organizations to play in enhancing local production systems and facilitating local level institution building. Indeed, over 30 different kinds of institutions have played an important role in attempts to develop Africa's river basins.

F. THE ROLES OF INSTITUTIONS

Granted the frequency with which inadequate management is mentioned as a African constraint, the topic of institutional capabilities is a crucial one. In the paragraphs that follow, however, emphasis is placed not just on problems but also on

"success stories" where local organizations, river basin authorities and other types of institution have played an effective role in river basin development, even though their policies may have been wanting. Because of the importance of riverine communities, local organizations are considered first. Though most need periodic external assistance, the timing, nature and duration of that assistance need be more carefully assessed so that, unwittingly, it does not undermine the initiative and enterprise that outside agencies are trying to encourage.

1. Local Organizations

The lack of information on successful local organizations in tropical Africa suggests their absence. Granted the recent literature on the positive relationship between local participation and project success (see especially Development Alternatives, 1975, in regard to rural development and Radosevich, 1979, in regard to irrigation), such an absence could be a major constraint to development in tropical Africa. Fortunately, a closer examination of the African scene shows that an amazingly diversified and effective set of producers' organizations have appeared in river basins during the past 20 years. While some of these are rooted in indigenous social organization as in the Senegal Basin, in other cases they are of recent origin. Furthermore, as at Kibirigwe (Kenya) with its use of sprinkler irrigation and dependence on the difficult market for horticultural produce, some have been able to handle technically sophisticated infrastructure and complicated market situations. Unfortunately throughout Africa such district level organizations as development committees and local councils have been less successful in part because of the failure of governments to combine programs of political decentralization with fiscal decentralization and in part because governments are apt to bypass them in regard to the planning and implementation of national projects.

As Kimani has noted in connection with Kenya's Mwea Amalgamated Rice

Growers' Cooperative, in many of these organizations participants have shown themselves ready to shoulder additional responsibilities. Such a record should not lead to overconfidence, however, since many of the organizations are still comparatively new and have yet to prove their ability to sustain activities over time. Seemingly essential for success are three factors. The first is that local organizations should be "demand driven;" that is, that local people not only see the need for an organization but are strongly motivated to initiate and maintain it. The second is the presence of strong leaders at the right time. The third is the proper amount of external help in the form of both technical and financial assistance. While external assistance at some point in time appears crucial, too little will prove insufficient to deal with the problems at hand, while too much substitutes outside control for local control, undermines local initiative and runs the risk of creating factionalism, dependency or both. Such is especially the case with expatriate advisory assistance, no matter how well-meaning.

Though directed at government organizations, Okidi's analysis of Kenya's Provincial Irrigation Units is also applicable to local organizations:

. . . the PIUs have evinced a central weakness in the foreign aid aspect. They are dominated by the foreign experts and money, therefore the control at overall policy level is largely foreign. The foreign irrigation experts take advantage of the absence of the local irrigation experts to perpetuate their stay and domination. The notion of training for the local counterparts does not work as the latter are easily diverted to other functions. Thus, a dependency situation is established and perpetuated.

Similar situations involving local organizations were observed by SARSA personnel in the Tana Basin as well as in the Middle Zambezi Valley and the Senegal River Basin. Clearly, there is a major risk involved which need be carefully assessed prior to project

initiation, and, where expatriate experts become subsequently involved, monitored and evaluated. The situation appears so difficult, that technical assistance should be provided to the extent possible by the regular government technical agencies and even then major assistance should be sporadic rather than continual. The ideal situation would appear to be illustrated by the Kangocho case in Kenya where the Irrigation and Drainage Branch, on request from participating farmers, helped with the design and construction of an offtake structure and then withdrew. Just as neighboring Island Farms did not have the skills to survey their fourth furrow, so Kangocho farmers did not have the necessary skills to provide the necessary offtake structure. While institution building for local organizations requires a more sustainable form of assistance, which is best provided by a wider range of institutions, including private voluntary organizations, it too should be carefully tailored to the task at hand and assessed in regard to its impacts on continued local participation.

2. River Basin Organizations

The critical question is not whether or not satisfactory river basin organizations can survive in Africa. The histories of the Volta River Authority, the Central African Power Corporation, and the Tana and Athi River Development Authority show that they can. Rather the critical question is whether or not such organizations can address themselves to a wider range of river basin development options, including those that do not involve the construction of major dams. The record to date is not encouraging, there being no examples yet of either international or national river basin authorities which have played an effective role in planning and coordinating the integrated development of a single river basin. Explanations for this deficiency include national preoccupation with hydropower generation as the major priority of river basin development and donor support for that prioritization. The end result is that river basin authorities become the executing agencies for that coalition of developers that

continues to advocate the construction of dams and medium and large-scale irrigation projects. In the process, such other options as rainfed agriculture, flood water cultivation and livestock management tend to be ignored as is the participation of local organizations in the planning, implementation and evaluation of development projects and programs.

This is a problem that needs further analysis. Is there a fundamental incompatibility between the pursuit of multiobjective development goals and river basin authorities? At the moment, the answer appears to be yes although for reasons that are not very clear. In part the deficiency may be due to the nature of river basin authorities as centralized, hierarchical organizations whose senior staff find it very difficult to decentralize responsibilities to regional and project offices and to hand over managerial and other responsibilities to other organizations, including local organizations. Another problem relates not so much to the nature of river basin authorities as organizations but rather to their establishment by heads of state and other senior officials, with the strong backing (indeed, in some cases the insistence) of donors, with the mandate to build dams. A major result of these characteristics is that river basin authorities are more effective during the construction phase of development than during the subsequent development phase. A solution to this deficiency may be to restrict the functions of authorities to planning, coordination, the raising and disbursement of funds, and monitoring, with the implementation and management of development programs and projects, including dam construction and operation, the responsibility of other organizations.

For political as well as economic reasons, states which participate in international river basin authorities allocate most implementation of development projects to national institutions with the major exception of dam construction. The member states in the the Middle Zambezi and the middle and lower Senegal Basin are examples. CAPCO's interests were largely restricted to dam construction for electricity generation and

transmission. While the OMVS has belatedly recognized the importance of small-scale irrigation and has begun to recognize advantages which might be associated with 'the hydropower plus controlled reservoir drawdown and downriver flood option,' would such options, along with others, have received more serious attention if international river basin development agencies were not given the responsibility from the start for building mainstream dams as opposed to planning how best to develop a given river basin?

National river basin authorities are more apt to engage in a wider range of implementation activities. Examples include the VRA and TARDA. While their efforts show that both organizations had the managerial capacity for carrying out a wider range of responsibilities, there is an increasing risk of conflicts of interest when authorities add implementation responsibilities to planning and coordinating ones. While the VRA has divested most of its non-power responsibilities (exceptions being Kpong Farms and Volta Lake transport), TARDA has been moving toward greater involvement in project implementation -- at the expense of its ability to coordinate and to mediate between different users within the Tana River Basin.

A major recommendation of SARSA is that serious consideration should be given to initially restricting the responsibilities of both national and international river basin authorities to planning and coordination, to raising and disbursing funds, and to monitoring project implementation. The question as to what organizations should construct or otherwise implement, manage and evaluate specific projects (including dams) would be left until after plans have been assessed and specific options selected. While such a recommendation would not preclude river basin authorities from being implementing agencies in regard to pilot projects, dam construction, and other development efforts (such as lake transport), there is an underlying assumption in the SARSA recommendation that implementation and management should be handed over to other agencies and that the intention of such handing over should be stated from the

outset.

Since planning skills within river basin authorities are inadequate, they need be upgraded. The same is true of planning units, especially in such international river basin authorities as the OMVS, OMVG and NBA. On the one hand, such units need the political support of senior officials -- often a delicate matter since those officials are apt to be under political pressure to proceed with dam construction before the necessary feasibility studies have been completed. On the other hand, they need a greatly improved capability to gather, store, access and analyze information and to present the results of analysis to policy makers in the form of a broad range of alternatives. Improved monitoring is also required. While evaluation is best left to other organizations (such as national universities and research institutions), planning units should also have a capability to assess evaluations. In all of these areas there is need for increased donor assistance.

3. Donors

Though deficiencies are emphasized in this section, in all fairness it should be stressed at the start not only that there are individuals within bilateral and multilateral agencies who are well aware of such deficiencies, but also that a corrective trend is underway. For example, AID has pioneered over the years the increasing incorporation of socioeconomic studies within environmental impact assessments. At the multilateral level, the World Bank has begun to look more closely at the environmental impacts of dam construction. The Bank also has been taking increasing responsibility for ensuring that populations displaced in connection with dam construction do not suffer as a result of removal.

In the 1950s and 1960s the Bank ignored population relocation which was considered strictly a host country responsibility in the Kariba and Volta cases. Indeed at Volta, only part of the financing of the resettlement of over 80,000 people was

considered a project cost. By the 1970s, however, the Bank not only insisted at Kpong that relocation be considered a project cost and its implementation a project responsibility, but resettlement expertise was included within Bank appraisal missions. In the 1980s the Bank took the lead among donor agencies in pressing for equitable resettlement policies, being the first to formulate a set of guidelines for resettlement. Still more recent efforts in regard to the resettlement component of a number of projects in Africa, Asia and Latin America illustrate that the Bank is taking its own resettlement guidelines very seriously, even in the face of strong resistance from member countries. This statement applies both to new projects like Nangbeto Hydroelectric Project in Benin/Togo and to old ones, like Kiambere Hydroelectric Power project in Kenya where belated efforts are being made to assess the damage done where the Bank's 1982 guidelines were ignored by Bank personnel during both appraisal and supervisory missions.

It is too early, however, to know whether or not riverine states will actually implement the plans that they have formulated in response to Bank guidelines, and it is too early to know whether or not the Bank will take the necessary steps to require compliance after dam construction begins. The same problem applies to environmental guidelines which also pertain more to plans than implementation of those plans. Furthermore, river basin development in Africa continues to be primarily the responsibility of the Energy Division so that dams are still viewed primarily as single purpose projects for hydropower generation -- as illustrated by the titles of the Nangbeto and Kiambere projects. Rather than to facilitate sustainable development, the purpose of environmental and resettlement guidelines is to mitigate dam-induced adverse impacts. As a result, the Bank continues to be 'part of the problem' and will continue to be so until responsibility for river basin development is taken out of the hands of Bank divisions responsible for energy and irrigation.

Most donor deficiencies are shared by bilateral and multilateral agencies alike.

While donors have biases pro or con different approaches toward river basin development, no policy or strategy papers were found by the SARSA team. This is a serious failing. On the one hand, it perpetuates an out-dated water resource management emphasis as opposed to the integrated development of land, water and human resources. On the other hand, it makes it difficult for donors to follow through systematically on programs for river basin development which require not years but decades of careful policy formulation, conversion of policies into plans, and implementation, evaluation and modification of those plans.

Another major problem, not easily resolved since major political and economic issues are at stake, is inadequate coordination among donors. Notwithstanding the difficulties, improved coordination is crucial if more successful river basin development is to be implemented. In the absence of coordination, each donor is all too apt to go its own way on a project by project basis. Haphazard and financially costly development is the result. Though riparian states may have political concerns about improved coordination, economically they cannot afford the long term results of a haphazard and too narrow approach to the development of their few river systems. The fact that no one donor can go it alone in financing large-scale river basin infrastructure gives donors the opportunity to exercise leverage where necessary. Should multidonor coordination improve, as a last resort donors should be willing to use their financial clout where riparian states are following unwise courses.

Other deficiencies concern a project versus a regional orientation; excessive and inadequate studies and unrealistic planning expectations; delayed decision making and inadequate supervision; inadequate training and lack of continuity of effort in regard to training and institution building; insufficient attention paid to riverine habitats and production systems (a theme that recurs throughout this monograph); and inadvertent suffocation of local initiative and participation. Only UNDP has taken a consistent regional approach to river basin development both in regard to research and institution

building. As for studies, problems are too many studies, the wrong kind of studies, and an inability of host country agencies to utilize available studies.

While riparian states tend to underemphasize the importance of planning studies (the decision to proceed with a particular project often being a political one), it is ironic that donors require of African countries, with relatively weak planning skills, more planning than they require at home. Few riparian states can cope with the demand, being unable to access all the studies and reports let alone use them for planning purposes. Solutions to excessive studies and unrealistic planning expectations need involve better coordination and strategy formulation on the part of donors (with studies reflecting that coordination and those strategies, and with donors disseminating and standing by study results), and better planning capabilities on the part of riparian states. In the latter case there is no substitute for the institutionalization of effective data storage, analysis, planning, monitoring and evaluation units within river basin authorities and planning ministries.

Looking to the future, training deserves much more donor attention not just for staffing institutions with river basin development responsibilities, but also to reduce the heavy financial burden of high expatriate salaries. To date the training component of both bilateral and multilateral programs time and again has been inadequate. The situation is especially deficient when donor funds are used to employ international experts and firms since generally speaking these place relatively low priority on training. Three major problems are involved. The first concerns the poor phasing of training in relationship to the expatriate expert component (trainees are apt to be studying overseas while expatriate staff members are in the field so that on-the-job training is rare). The second problem concerns the time constraints placed on expatriate researchers and advisers. Understandably eager to further their own careers by doing a good job, they tend to accord low priority to training. Finally expatriates, and the organizations that they represent, are seldom eager to train their replacements,

so again training and institution building receive low priority.

In illustrating various donor deficiencies, most SARSA examples have involved AID and the World Bank. Like other donors, neither AID nor the Bank have a strategy or set of guidelines for their involvement in river basin development. In the AID case lack of a strategy has weakened the agency's impact -- an unfortunate situation granted AID's concern with environmentally sustainable downstream development.

Furthermore, because of the lack of an agreed-upon strategy, good projects have been inexcusably delayed in implementation; poor projects have been implemented; conceptually important projects have been poorly designed and mired in controversy; and AID has been unable to defend itself against both informed and uninformed criticisms of its efforts. In the case of the World Bank, river basin development has remained primarily the prerogative of divisions of energy and irrigation. As a result, the Bank continues to contribute to the momentum favoring major dams for hydropower and irrigation as opposed to a genuinely integrated program of river basin development which may or may not involve major dam construction.

4. The Private Sector and Research Institutions

It should be continually kept in mind by both national planners and donors that the main private sector entity in Africa's river basins, in terms of numbers and importance, is the local household. Not only are household members the principal risk-takers in regard to development programs and projects, but it is their rising disposable income, more than any other factor, that spurs development during the early stages of industrialization. More attention should also be paid to the involvement of local firms than has been the case to date; indeed their involvement should be a requirement, with technical assistance and credit provided to improve their capabilities. Heads of state and national policy makers are insufficiently aware of the importance of household production systems; they also do not appear to realize the extent to which the

construction of large-scale infrastructure favors international firms over local firms.

It is necessary to stress the importance of local households and firms because of the tendency for the major bilateral and multilateral donors to define private sector involvement primarily in terms of international firms and to advocate the involvement of those firms, as opposed to local firms and households, as "a privileged solution." This emphasis on local firms and households is not intended to denigrate the importance of involving international firms in river basin development. On the contrary, case studies show that international firms can play a key role in catalyzing regional development. Unfortunately this potential has only seldom been realized, the commoner outcome being the operation of international firms at the expense of local farm households. The logical corrective is to relate policy more closely to research on what works to the benefit of international firms, on the one hand, and national, regional and local development goals, on the other hand. AID-funded research on contract farming is an important start which should be expanded.

As an instrument for river basin development, to date international firms appear to have been most successful in the production and marketing of certain crops. In terms of production these are coffee, tea, rubber, tobacco, and sugar, with the greatest benefits accruing when the private sector (either alone or through a joint venture with government agencies) links a small holders' outgrowers program to a nucleus estate and processing facility. In terms of marketing, high value flowers, vegetables and fruit for European winter consumption dominate.

For ideological reasons there is a tendency for donors to play down the role of government in successful private sector ventures, pushing instead for the removal of government involvement. Yet that same government involvement has played a crucial role in some of the more successful private sector cases including Gezira and the Zambia Sugar Company. Even where the private sector has gone it alone in the sense that no legally constituted joint venture with government is involved, government

involvement is still very much a factor whether in terms of favorable policies for leasing of land, for protection of new enterprises (including subsidized prices and import controls), and for credit as in the Delmonte case, or for provision of feeder roads and electrification which benefit, for example, the Kenya Tea Growers Association.

Where tripartite joint ventures are involved (private sector, government and small holder), the weakest partner is clearly the small holder. Donors should keep this in mind. While it is understandable that international firms, local subsidiaries, and local firms should place priority on their own interests, not infrequently those interests (as in the Delmonte and Gwembe Valley Development Company cases) have been defined in ways that are contrary to the interests of local populations, especially in regard to involvement in agricultural production projects, and quite possibly even in terms of the longer term interests of the firms involved. As in the recent Zambian emphasis on joint ventures, in their rush to implement a new policy national governments may also act in ways that put local producers at a disadvantage. In giving assistance, donors must continue to bear the main responsibility for ensuring that adequate social and environmental impact assessments are completed, and are incorporated within plans for implementation.

Once the relationship between private sector, government and small holder collaboration is better understood, donors should encourage private sector firms to participate more frequently in African agricultural development and in river basin development. There is much room for imaginative experiments involving research relating to the crops grown, joint production ventures, banking (along the line of experiments by Hatton's Bank in Sri Lanka in connection with the Accelerated Mahaweli River Basin Development Program, and other banks elsewhere in South Asia), management of former state farms (as in the case of Somalia's Juba River Basin sugar production project), and facilitation of outgrower production around petroleum

and natural gas, mining, lumbering, and nucleus estates.

As for private voluntary organizations (PVOs), they are an important actor on the development stage, especially in situations where unfavorable rural-urban terms of trade and other constraints are associated with inadequate government services and funds. PVOs can be especially effective in introducing alternate technologies and in building up local community or organizational capability to the point where local people can handle their own affairs and compete for scarce local, regional and national resources. On the negative side, weaknesses are several. First, overzealous personnel can delay or suffocate local initiative, hence delaying the institutionalization of self-help activities. Second, activities are apt to be restricted to a small number of communities. Third, monitoring and evaluation capabilities are weak. Granted the range of PVO activities, and the creativity of many PVO personnel, this is a major inadequacy since it not only leads to perpetuation of mistakes but to inadequate information about successes and the extent to which they are replicable. Fourth, generally speaking there is very little coordination between PVOs, with each working in its own area and relatively uninformed about other activities which may be of relevance.

For PVOs to become more effective in the future, these weaknesses need be addressed by themselves and by donors like AID and the World Bank which are paying more attention to the involvement of PVOs in development activities. As with private sector firms, there is the risk of donors taking a "privileged solution" perspective in regard to PVOs. Clearly they have an important role to play, but as partners with local people, their institutions, governmental agencies and other private organizations.

In advocating greater involvement of PVOs, once again donors must not favor international organizations at the expense of local ones. So that local PVOs can emerge and be effective, donors should also consider carefully the legal and political environment in which they operate. With its multifaceted democracy, India, for

example, is a more favorable environment for PVOs than exists in most African states. Just as donors diplomatically are pressing for structural reforms to facilitate economic development, reforms relating to freedom of expression and to a reasonably independent legal system are needed if the potential of PVOs, and especially local PVOs, is to be released.

African universities and research institutions have played a more important role in river basin development than donors, and international researchers and consultants, realize. This conclusion is an important one, suggesting that an increasing proportion of donor funding for feasibility, monitoring and evaluation studies, and for conferences and workshops, should be used to utilize and build the research capacity of African universities and research institutions.

GLOSSARY

AVV	Volta Valley Development Authority (Burkina Faso)
AHT	Agrar-und Hydrotechnik
AID	United States Agency for International Development
APC	Agricultural Production Corporation
ASRT	Academy of Scientific Research and Technology (Egypt)
CAPCO	Central African Power Cooperation
CIDA	Canadian International Development Agency
CIDR	Compagnie Internationale de Developpement Rurale
CILSS	Permanent Committee for Drought Prevention in the Sahel (Comite Inter-Etats pour la Lutte contre la Secheresse dans le Sahel)
CREA	Center for Applied Economics
DAC	Development Assistance Corporation
EEC	European Economic Community
ENDA	Environnement et Developpement du Tiers-Monde
FAC	Fonds d'Aide et de Cooperation (France)
FAO	Food and Agriculture Organization of the United Nations
GSDP	Gwembe South Development Project
GTZ	German Agency for Technical Cooperation (Federal Republic of Germany)
HCG	Harrisons and Crosfield Group
IDB	Irrigation and Drainage Branch
IDEP	Institute for Economic Development and Planning
IDP	Integrated Development Project
IDRC	International Development Research Council
IIASA	International Institute for Applied Systems Analysis
ILO	International Labour Organization
IUCN	International Union for Conservation of Nature and Natural Resources
KBO	Kagera Basin Organization
KFFHC	Kenya Freedom from Hunger Council
KHE	Kenyan Horticultural Exporters
LCBC	Lake Chad Basin Commission
NAS	National Academy of Sciences (United States)
NBA	Niger Basin Authority
NCKK	National Christian Council of Kenya
NGO	Non-Governmental Organization
NIB	National Irrigation Board
OMVG	Organisation pour la Mise en Valeur de Fleuve Gambie
OMVS	Organisation pour la Mise en Valeur du Fleuve Senegal
ORM	Operation Riz-Mopti
ORSTOM	Office de Recherche Scientifique et Technique Outre-Mer
PEEM	WHO/FAO/UNDP Panel of Experts on Environmental Management of Vector Control
PIU	Provincial Irrigation Unit

PPAR	Project Performance Audit Report
PVO	Private Voluntary Organization
RBDA	River Basin Development Authority
RBDO	River Basin Development Office
SAED	Societe d'Aménagement et d'Exploitation des Terres du Delta
SARSA	AID-funded Cooperative Agreement with Clark University and the Institute for Development Anthropology on Settlements and Resources Systems Analysis
SCOPE	Special Committee on Problems of the Environment of the International Union for the Conservation of Nature
SIDA	Swedish International Development Agency
TARDA	Tana and Athi River Development Authority
UN	United Nations
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
VALCO	Volta Aluminum Company of Ghana
VRA	Volta River Authority
WMSII	Water Management Synthesis II
ZESCO	Zambia Electricity Corporation

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