

PRELIMINARY EXAMINATION
OF THE
DO-ANAMBRA RIVERS AREA, EAST CENTRAL STATE, NIGERIA

Prepared for:

Agency for International Development
United States Department of State

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SUMMARY

In June 1972 USAID/Nigeria received a request from the Commissioner of Agriculture and Natural Resources of the East Central State for assistance in the preparation of guidelines for a pre-feasibility study of a proposed irrigation project, primarily for the growing of rice. This request was transmitted to TAB/AGR who selected a three-man team of consultants from member universities of CUSUSWASHI. The team visited the Do-Anambra Rivers Area, the site of the proposed development, in August 1972.

The Do-Anambra Rivers Area, a forest-savannah mosaic, consists of approximately 250,000 acres located in the northwestern section of the East Central State. Approximately 30 percent of this area appears to be suited to irrigated agriculture, if provided with adequate water during dry periods, if protected from floods, and if provided with adequate surface and sub-surface drainage. Detailed surveys may indicate additional suitable acreage which would depend in large part on costs of land clearing, pumping and adapted farm irrigation systems. The team noted that while some basic information on soils, vegetation, topography, hydrology, geology, etc. was available, the hydrologic and the available topographic information was not in sufficient detail for a pre-feasibility or reconnaissance type of study of the area's natural resources.

Of major importance within the project area is the 10,500-acre Uzo-Uwani farm settlement scheme initiated in 1962 with substantial financial support by USAID. Prior to the outbreak of hostilities in 1967, approximately one-fourth of the project area was cleared and about ten percent developed for irrigation. The conflict seriously disrupted activities destroying all farm and construction equipment and damaging the irrigation system. The team noted, however, that many settlers have returned to the area and have set up rainfed agricultural operations.

It is recommended that a high priority be given to completing the development of the Uzo-Uwani project. Emphasis should be given to developing the project as a pilot scheme for the entire Do-Anambra Rivers Area to test the practicality of the proposed farm layouts, the administrative and operating procedures and the willingness and ability of the local farmers to adapt to the plan. An experimental farm should also be initiated to assist the farmers with crop selection, water and fertilizer requirements, crop rotations and a host of related problems.

The team has concluded that the Do-Anambra Rivers Area has sufficient potential to warrant initiating a pre-feasibility study of the area. This study should include a basic survey of the area's resources, both natural and human, and the formulation of an overall plan for the development of these resources. The plan should not be limited to a particular crop such as rice, but should take a broad look at other agricultural crops that may be adapted to the area and to

the forest and fish potential as well. Modernized rainfed agriculture should also be considered where irrigation is not suitable.

It is recommended that as the first step in the pre-feasibility study, aerial photographs be made of the entire area that are of sufficient control for making topographic maps with a 2-foot contour interval. The team further suggests that the use of the latest remote sensing techniques for making aerial surveys be explored. Costs may be reduced over conventional methods in that cloud cover is no problem and added information pertaining to soils, vegetation and even mineral exploration may be obtained with these newer techniques. (Upon returning from their visit to Nigeria, the team has learned that a company engaged in making aerial surveys is currently located in Lagos.)

Concurrent with the aerial surveys, streamflow gaging stations should be established on the major rivers and tributaries of the area.

Following the basic surveys, a 4-man team (engineer, soils scientist, economist and agronomist) could then evaluate the area's resources, formulate plans to develop these resources and present methods and costs for obtaining the detailed, pre-construction feasibility studies.

Incorporated in the basic survey of the pre-feasibility study should be plans to identify and assess the socio-economic factors within the project area. Consideration should be given to establishing a water policy and administrative system as well as a land title recording system.

In addition to the above physical, economic, social and legal studies, an environmental impact study should be included to assess the long-term effects of the proposed plan for developing the area.

INTRODUCTION

Team Involvement

In June of 1972, the Commissioner of Agriculture and Natural Resources for the East Central State of Nigeria requested the assistance of the United States Agency for International Development (USAID) Mission in Nigeria in the preparation of guidelines for a pre-feasibility study of a major land development project. This request was transmitted through the Food and Agriculture Office of the USAID Mission in Lagos to the Technical Assistance Bureau (TAB) in Washington, D.C. TAB responded favorably by selecting a team of consultants from member universities of CUSUSWASII, a consortium of universities involved in agricultural development and improvement through proper soil and water management. The field study was conducted in August 1972 by the following specialists:

Howard B. Peterson, Agronomist/Chief of Party
Martin M. Fogel, Hydrologist/Agricultural Engineer
George E. Radosovich, Legal Specialist/Economist

Scope of Study

The terminology associated with the development of agricultural projects is as varied as the projects are themselves. To avoid possible confusion, a brief discussion on this matter follows.

Pre-investment studies, pre-feasibility studies, preliminary surveys and reconnaissance surveys are various names given to investigations which may have similar objectives. Reports resulting from such studies generally pertain to developing a comprehensive master plan for the orderly and economic development of an area. Specifically, pre-feasibility or reconnaissance type surveys review existing and proposed developments and determine the practicability of making a detailed study of the area. If a detailed study is recommended then the reconnaissance survey usually prepares an estimate of the type and number of personnel required, the equipment needed, the time required and cost.

In studying the land and water resources of an area, it is necessary to make various related surveys and studies. These include basic engineering surveys, geologic examinations, ground-water surveys, hydrologic surveys and studies, economic analyses and forecasts, estimates of probable costs and benefit studies. Much of this has not been done for the Do-Anambra Rivers Area, at least in sufficient detail for even a reconnaissance-type study. This particular effort, therefore, should precede or be a part of a reconnaissance or pre-feasibility study. The basic objective of such studies is to make a preliminary survey of the area

to determine whether a comprehensive basin-wide study will be justified in view of existing developments, previous studies and the probable future needs for land and water development.

Feasibility investigations are considered pre-construction studies in that it is possible to directly follow them with construction surveys, once the decision is made to build the project and financing is obtained.

Previous Investigations

The Do-Anambra Rivers Area has been under investigation for over 10 years as a potential area for sugar cane production. A study made in 1971 by a team from the Netherlands (Department for International Technical Assistance, Ministry of Foreign Affairs) was the latest investigation. They concluded that most of the survey area was not suitable for large scale sugar cane production because the lands can only be irrigated at relatively high costs. A moderately high pumping lift (approximately 80 feet) and scattered occurrence of suitable soils or that the soils are imperfectly drained to allow proper aeration and adequate root penetration were the reasons presented. A part of the imperfectly to poorly drained soils in the center of the survey area, however, was concluded to be suitable for large scale rice production. Approximately 64,000 acres in continuous stretches could be double-cropped to rice. Furthermore, the Dutch team stated that only a small portion of this area is used for agriculture.

Previous investigations have stated that some 75,000 acres in the southern part of the plain within the 240,000-acre survey area has possibilities for sugar cane production. One of the earlier investigations was done by Tahal Ltd. of Israel who reportedly studied the water resources and sugar cane potential in the East Central State during the early 1960's. These reports were not located by the U. S. team.

While none of the basic surveys (engineering, geologic, soils, hydrologic, etc.) are in sufficient detail for a feasibility study, an available soils survey was deemed adequate for this preliminary examination. The semi-detailed soil and vegetation-land use survey was conducted in 1960 (Obihara et.al., 1964). The mapping was based primarily on fixed interval auger-hole observations along accessible paths through the area and stereoscopic interpretation of aerial photographs (scale 1:25,000) flown in 1959. The soil and vegetation maps were published on a scale of 1:50,000. The team was not able to find the maps prepared on the scale of 1:25,000.

According to the Dutch team topographic maps, scale 1:10,000 with a contour interval of 10 feet and 1:50,000 and a 50-foot interval, are available (Federal Surveys, Nigeria 1964). In either case, topographic detail is not adequate for evaluating the requirements of irrigated agriculture.

Hydrologic and meteorologic data for the area are meager with the former practically non-existent. About three years of water level measurements were taken prior to the outbreak of hostilities. A relationship between water depth

and streamflow has not been firmly established. Precipitation data can be extrapolated from Enugu and Nsukka with a fair degree of reliability.

Local Interest

The Ministry of Agriculture and Natural Resources of the East Central State in Nigeria considers development of the Do-Anambra Rivers Area of utmost importance. A request for technical assistance for a pre-feasibility study of the area has been sent to the Federal Ministry of Economic Development and Reconstruction and the Federal Ministry of Agriculture and Natural Resources. In addition, the ECS Agricultural Commissioner has included in his current budget request funds for rehabilitating the irrigation system of the Uzo-Uwani project, a farm settlement scheme financed in large part by USAID. Portions of the irrigation system were damaged during the recent conflict.

The interest within the political structure of the East Central State is based upon the objectives of the government in developing this project which are directly in line with the national objectives as set forth in the Second National Development Plan, 1970-74, Federal Republic of Nigeria. The primary objective in developing the Do-Anambra Rivers Area is to produce food for an expanding population in a country and state having the highest population density in Africa. A second objective is to increase the standard of living and productive capacity of the people within the region. The third objective concerns the redistribution of population in the East Central State that will come about as a result of developing the project area and providing agriculture and infrastructure labor requirements.

DESCRIPTION OF AREA

Physical Features

The Do-Anambra Rivers Area of approximately 250,000 acres is located in the northwestern corner of the East Central State of the Federal Republic in Nigeria (see Fig. 1). Enugu, the State Capitol, is about 35 miles southeast from the heart of the survey area, while Nsukka, location of the University of Nigeria, is a similar distance to the northeast. Bordering the west is the Anambra River, a major tributary of the Niger River, while the Ezu, Do and Adada Rivers form the southern and eastern boundaries. The area's northern boundary extends nearly to the State line.

Climate

A tropical wet and dry climate with a mean annual rainfall of 66 inches prevails in the area. The wet season extends from April to October with a minor

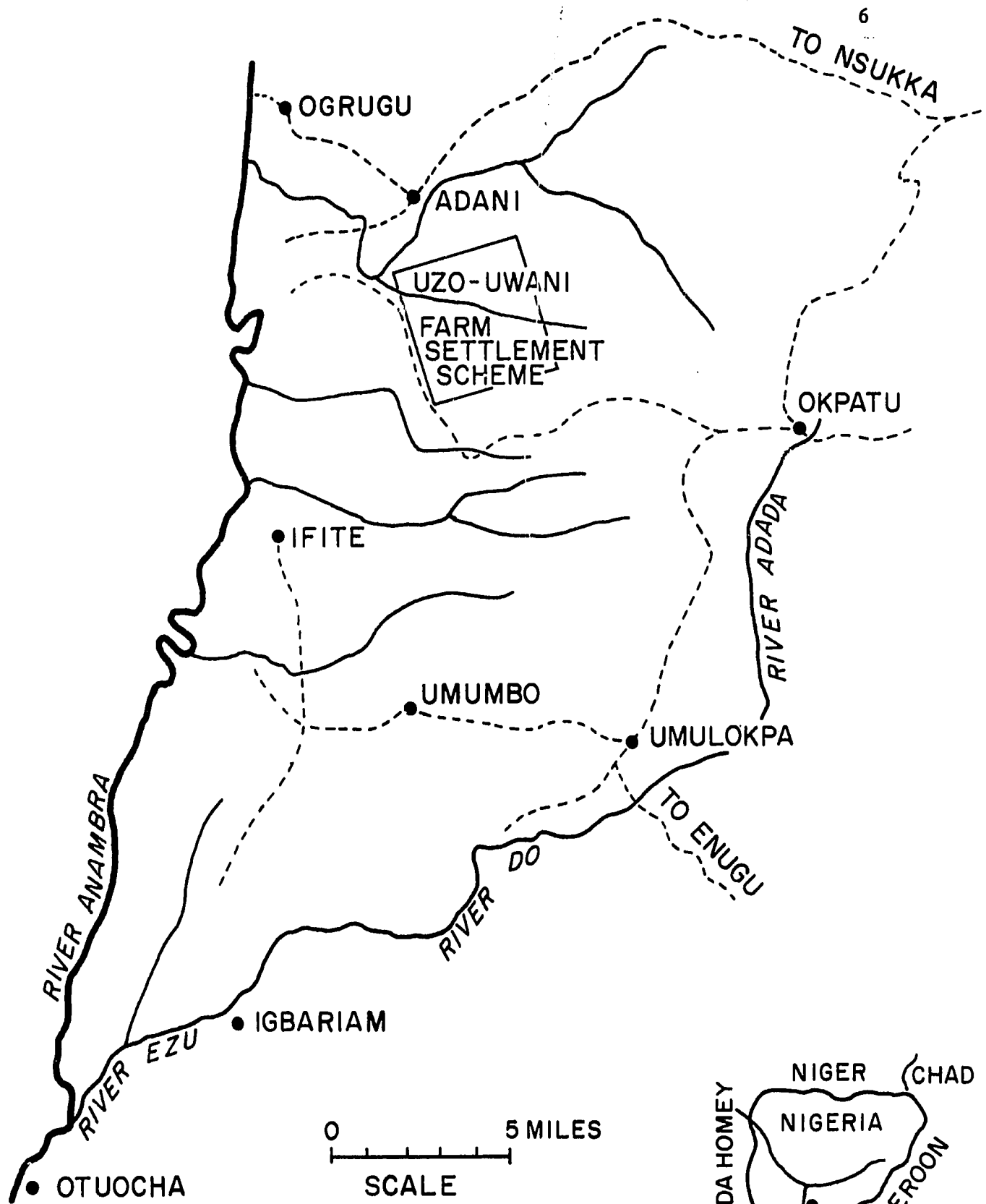


FIG. 1 THE DO-ANAMBRA RIVERS AREA, EAST CENTRAL STATE, NIGERIA

dry period during the August break. There appears to be sufficient variability in the distribution of rainfall during this period to indicate that supplemental irrigation may be of economic benefit. Irrigation would definitely be required for crops grown in the dry season, November to March, as the rainfall total averages out to less than 7 inches for the 5-month period (see Table 1).

The mean monthly temperatures varies between 74°F in August and 82°F in February with the diurnal variations seldom exceeding 20°F. Humidities are generally high (above 50 percent at 1500 hours) except during the northeasterly "Harmattan" which blows intermittently between December and March.

TABLE 1.

Mean Monthly Rainfall and Temperature for Nsukka

	Rainfall, inches	Temperature, °F	
		Max.	Min.
Jan.	0.6	87	71
Feb.	0.9	91	72
Mar.	3.4	90	73
Apr.	5.2	86	71
May	7.9	84	70
June	7.3	82	68
July	9.8	83	68
Aug.	6.9	79	68
Sept.	13.3	80	68
Oct.	8.6	83	68
Nov.	1.7	85	71
Dec.	0.3	87	71
Total	65.9	--	--

Soils, Topography and Drainage

Based on the previously mentioned soils survey of 1960 and the Dutch report of 1971, the area can be classified into the following main subdivisions:

- Uplands: lands with a relatively high elevation (over about 80 feet) above the nearest river water level and/or a rolling to undulating topography. The soils are coarse-textured and are generally well drained. Located along the eastern and western boundaries of the area, these lands comprise a little more than one-fourth of the area.
- Plains: lands with low to moderately high elevation (less than 80 feet) above the nearest river water level and with level to gently undulating topography. The soils are imperfectly to poorly drained being fairly deep, compact and silty. Represents approximately one-half of the area and according to the Dutch report contains most of the land that is suitable for rice irrigation.
- Flood plains: lands along rivers that are level and at an elevation below the seasonal high water level of the river. Soils are deep, clayey and poorly drained; they are basically suitable for rice irrigation if flooding is prevented.

Water Resources

With the area bounded on three sides by relatively major rivers and dissected internally by tributaries, it would appear at first glance that there would be sufficient water to develop the entire area. Since much of the land that may eventually prove to be suitable for irrigation will be at some elevation above the river, pumping rather than direct diversion appears to be the means for diverting the water for irrigation.

If one-fourth of the survey area (about 60,000 acres) is deemed suitable for irrigation, a continuous flow of about 1000 cubic feet per second would be needed during the dry season. The August 1972 flow in the Do and Anambra Rivers was crudely estimated to be 2,000 and 3,000 cfs, respectively. The Dutch team estimated the minimum discharge at 850 and 1450 cfs, respectively. Thus, it appears that there is sufficient water to irrigate most if not all of the suitable lands within the project area.

Vegetation and Land Use

Table 2 shows the percentage of the total area (approximately 400 square miles) that is in various land use and vegetation categories as determined by the 1960 soil survey (Obihara et. al., 1964).

TABLE 2.

Land Use and Vegetation in the Do Anambra Rivers Area

Land Use on Vegetation Category	Percent of Total Area
Dense cultivation	15
Cultivation and fallow	14
Cultivation and fallow, ex-forest	9
Cultivation in Anambra flood plain	6
Borassus palm on flood plain	19
Forest	13
Tree grassland	18
Tree and scrub grassland	6

Community Facilities

In Nigeria, facilities for the transportation and marketing of products can be broken down into three basic conveyance systems: 5,000 miles of navigable rivers; 55,000 miles of roads; and 2,200 miles of railroads. Within the project area, there are no railroads and the roads that lead into the major towns and villages are fair. The principle all-weather road extends from Nsukka to Adani. With the bordering rivers (Anambra, Ezu, Do and Adada) being tributaries of the Niger River and to a large extent navigable, economical transportation to major cities is available.

The extent of utilities and of community services such as hospitals, schools, etc. within the project area were not determined. Enugu, some 35 miles from the center of the project, would have many of such facilities available.

The People

Within the East Central State and the project area, the dominant ethnic group is the Ibo. The Ibo and other groups in southwestern Nigeria generally subscribe to the concepts of competition, personal aggressiveness, and freedom from a rigid class structure. They apparently are willing to accept any type of work that offers the individual an opportunity for personal achievement and advancement towards a better way of life.

Land Tenure

In the general land tenure system of the Ibo people, the land is held by the group of kin, family or clan with a very definite trust responsibility in the living with respect to the proper use of the land. Under the Ibo system of land tenure, three cardinal principles emerge. One, the land ultimately belongs to the community and cannot be alienated from it without the consent of the community. Two, within the community, the individual shall have the security of tenure for the land he requires for his compound, garden and farms. Three, no member of the community shall be without land. A favorable aspect of the project area with respect to land tenure is the low population density which facilitates the role of the government in controlling land use.

Problems of Area

The major technological problems in the development of the area revolve around the suitability of the lands for a sustained type of irrigated agriculture. The soils themselves, more specifically their drainability, appear to be the number one problem that must be resolved. Internal drainage is poor in much of the area and may become worse under unrestricted land leveling that is required for efficient irrigation. Surface drainage relief from heavy rains and flooding would also have to be provided.

The relatively high costs of clearing the land and lifting the water to portions of the area are additional problems that should be considered.

Insofar as institutional problems are concerned, an obstacle to overcome is the constraint imposed by the traditional land tenure system and the lack of legislation and uniform customary law on the allocation and control of water. The constant division and subdivision of land holdings and the scattering of the plots tends to increase the water delivery problems. A corollary problem concerns obtaining new land by farmers although willing and able, financially and physically, to develop the land. With a lack of any formal land registration or deed recording system, land holders must rely on verbal recognition of boundary lines. The land holders are also prevented from using their land as collateral under modern banking practices.

FUTURE INVESTIGATION PROGRAM

Multiple Use Development

The Do Anambra Rivers Area rich in natural resources has the potential for producing a wide range of products useful to man. Management of this area should

be directed not only towards agricultural production but also to forests and fish. To realize the full potential of this area, consideration should be given as early as possible in the development for the possibility of implementing the multiple-use concept in natural resource management.

In competition for the land/or financial resources of the survey area are irrigated agriculture, rainfed agriculture, forestry, fisheries, domestic water supply systems and flood control. The plan that is eventually formulated should present possible solutions to the entire spectrum of problems, if possible, and not just to one segment of the overall development program. Water resources development involves preparing a plan that considers all the alternatives for all the area's potentialities.

Rehabilitation of Uzo-Uwani Farm Settlement Scheme

The Uzo-Uwani farm settlement scheme located in the northern part of the survey area several miles south of the village of Adani was initiated in 1962. USAID designed and financed the scheme and an irrigation system capable of delivering water to 5,000 acres out of a total 10,500 acres in the project. Water for irrigation was supplied from a small river, the Obing. By the fall of 1967, a rockfill diversion dam and canal headgate were constructed, 70 percent of the necessary 7 miles of main canal were completed, 2,500 acres were cleared and about 1,000 acres were developed for irrigation.

Following cessation of hostilities, examination of the area revealed that the roads and buildings in the residential area were generally intact with most of the settlers having returned to the area. While all the farm equipment was damaged, the irrigation system was more fortunate. To deliver water to those units that previously received water, approximately 1/2 to 1 mile of the unlined main canal would have to be repaired, the entire canal cleaned and a gate in the control structure repaired. All of this could be done locally.

The U. S. team strongly recommends that the initial step in the more detailed investigation of the survey area be the restoration of the irrigation system of the Uzo-Uwani farm area to an operational basis to function as a pilot or small-scale example for the entire Do-Anambra Area. Settlement by the people in this demonstration area need not conform to the original intent but should be left to the discretion of local authorities. Within the pilot area, it is suggested that an experimental farm be established to study the cultural practices of growing rice, maize and other food crops suitable to the Do-Anambra Area. As a model for the larger project, the pilot scheme would be in a position to encounter some of the major problems that may arise in the Do-Anambra Area such as the problems of land tenure, acquisition of land, and economic farm size. In addition to studying these sociological problems of developing the Do-Anambra Rivers Area, the pilot scheme should also perform studies to obtain answers to hydrologic, agronomic and management problems.

Area Survey

As mentioned earlier, a reconnaissance or pre-feasibility study of the entire Do-Anambra Rivers Area should be made before more detailed studies are initiated on any particular phase or stage of development. The reconnaissance study should (1) inventory all the resources and (2) develop a framework plan for optimum use of these resources. This study should be more comprehensive than the 1971 Dutch report or any other previous investigation made in the area. It should be in sufficient detail to be reasonably sure that an overall plan close to the optimum has been developed.

In making pre-feasibility studies of an area, it is essential that accurate aerial surveys be available. For reconnaissance studies of this type, a scale of 1:25,000 with a 10-foot contour interval should be adequate. If sufficient control is obtained, the photographs may be blown up to 1:5,000 and utilized for the detailed investigations. It is recommended that the use of the latest remote sensing techniques be investigated, as cloud cover presents no problem. Also, these techniques often obtain additional information on soils, vegetation and minerals at little extra cost.

The proposed plan may be of a general nature such as the overall water resources development that includes an irrigation system, flood control, domestic water supply and a fishery project, for example. The overall plan may be accomplished in stages with the first being the development of an irrigation system for rice production on a portion of the area, say 20,000 acres. This alternative for the southern part of the area is seen as a possibility in Figure 2. Subsequent stages would then be plans to develop additional areas to the north. Figure 3 illustrates possible pump diversion locations for irrigating all of the suitable lands within the Do-Anambra Rivers Area.

Feasibility Study Requirements

Feasibility studies should be prepared in sufficient detail to determine the economic and financial feasibility of the project and to be the basis for a firm project plan. It should be possible to proceed directly to construction surveys as soon as the decision has been made to build the project and financing is available.

The following is a suggested checklist of work, comprehensive but not necessarily complete, that should be performed during the feasibility investigations:

1. Field Engineering
 - a. Topography of the project service area on a scale of 1:4,800, with a contour interval of 2 feet. This work could probably be done best by aerial photogrammetric methods.
 - b. Topography of sites of project features, at scales and contour intervals appropriate for each site.
 - c. Alinement surveys of canal lines, drains, levees, and channel improvements.

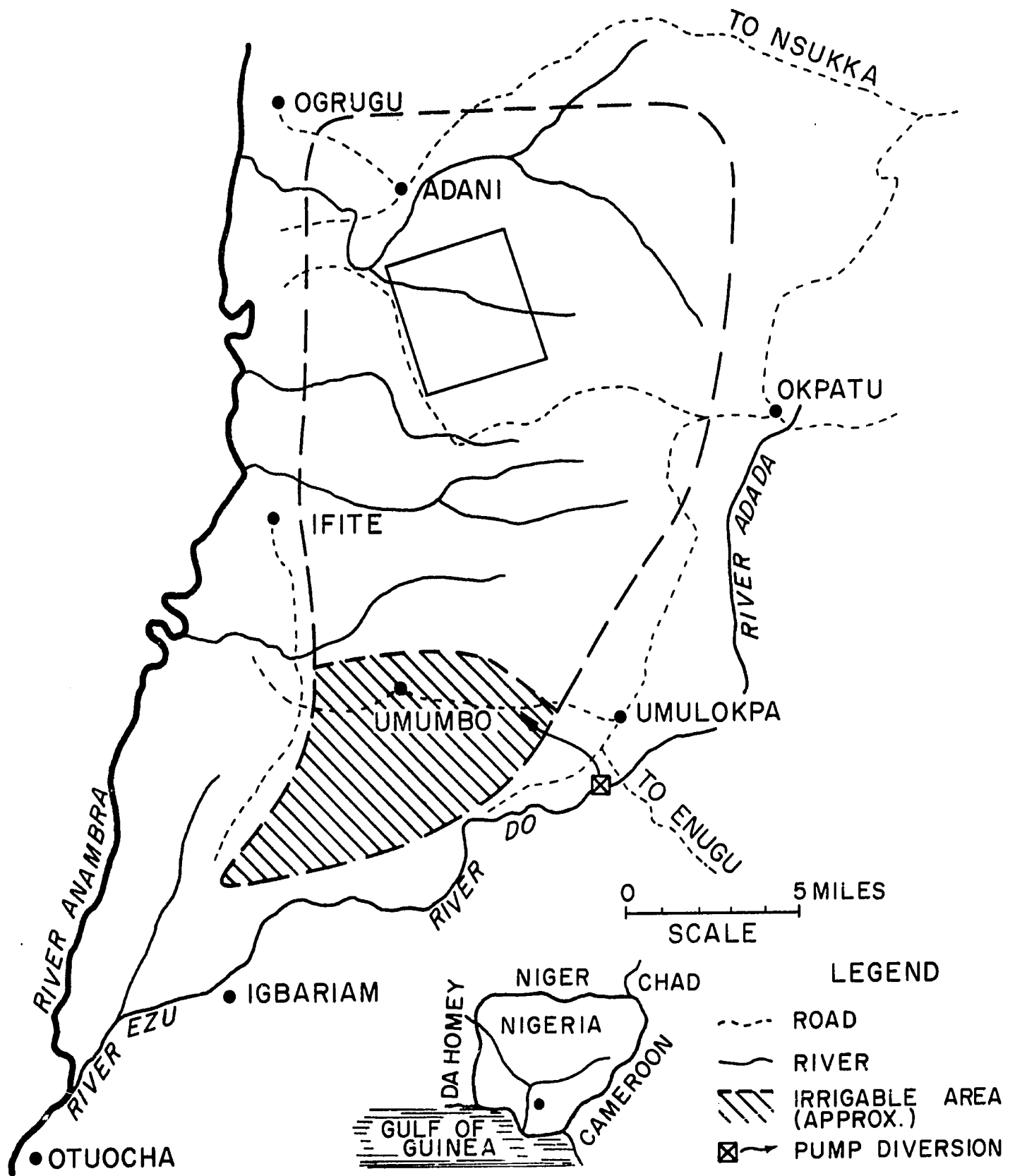


FIG. 2 ALTERNATIVE FOR PUMP DIVERSION TO IRRIGATE APPROX. 20,000 ACRES

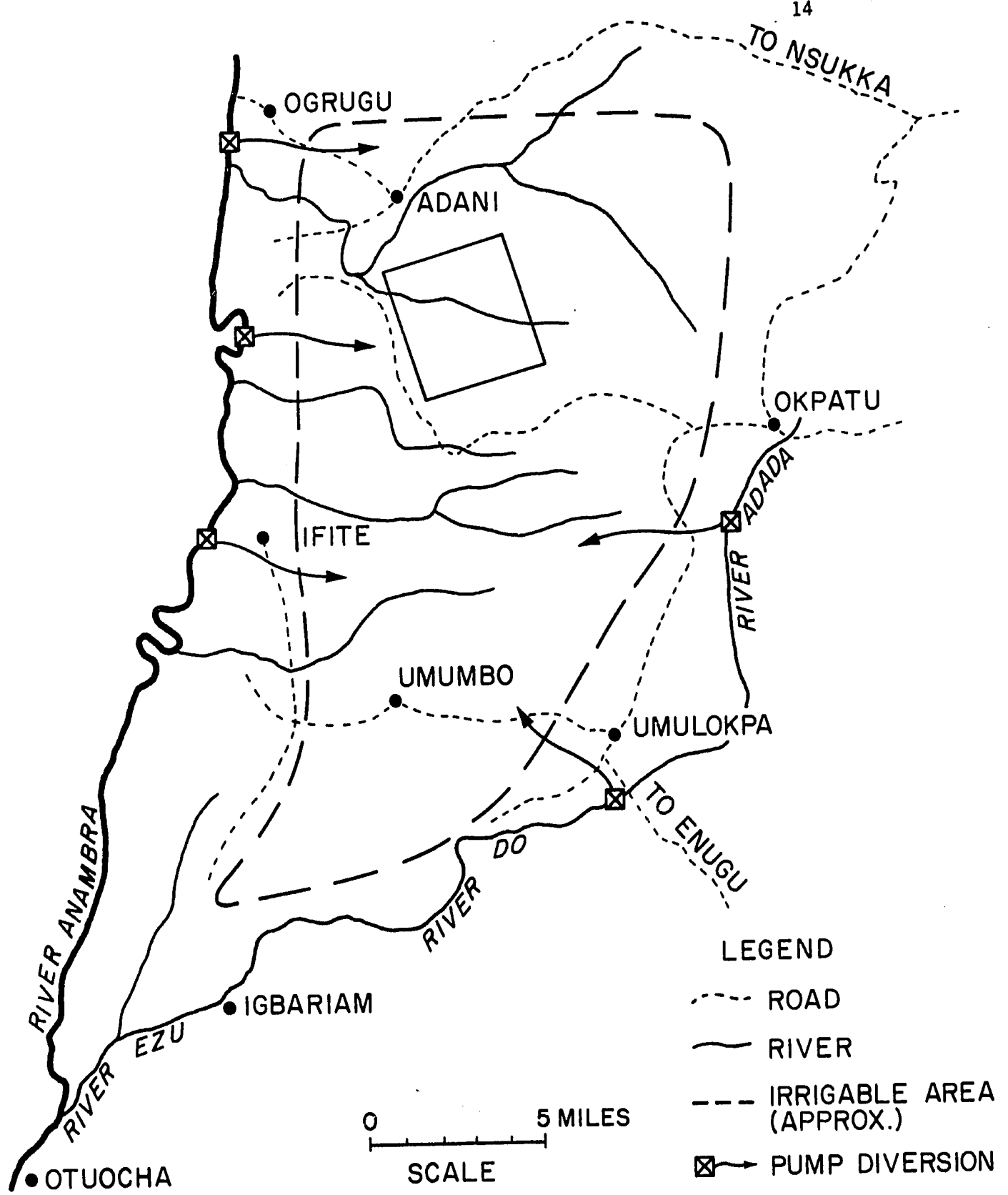


FIG. 3 POSSIBLE PUMP DIVERSIONS TO IRRIGATE DO-ANAMBRA RIVERS AREA

2. Geology
 - a. Regional geologic studies
 - b. Geologic studies of project works including, as appropriate: mapping of surface geology; foundation exploration, including drilling; exploration for and testing of construction materials.
3. Hydrology
 - a. Determine available surface water supply in area. Since streamflow records are essentially non-existent, the Nigerian Government should immediately establish (or in a few cases re-establish) streamgaging stations on the major rivers and its tributaries. This would include but not be limited to gaging
 - (1) the Anambra at Ogrugu and Otuocho
 - (2) the Do at Umulokpa
 - (3) the Ezu at Igbariam
 - (4) and the tributaries, the Obing, the Okpu and the Iyiakwa.
 - b. Make flood control studies that would
 - (1) estimate flood control magnitudes
 - (2) estimate flood damages
 - (3) select flood control plan
 - (4) estimate flood control benefits
 - c. Studies of water requirements of crops expected to be grown in the area.
 - d. Ground water studies, coordinated with subsurface drainage investigations.
 - e. Analyses of quality of water supplies.
4. Land Classification
 - a. Detailed classification of project lands, based on standards that correlate economic and physical factors relating costs and returns of production under irrigation farming.
5. Drainage
 - a. Necessary studies to determine the need for subsurface drainage. These should include deep borings to determine characteristics of subsoils, observations of ground water and field permeability tests.
6. Agricultural Economic Studies
 - a. Basic irrigation and agronomic data would be obtained from studies on the pilot scheme.
 - b. Studies of marketing, transporting, and processing various crops and livestock expected to be produced on the project.
 - c. Economics of controlled livestock production.
 - d. Family farm income requirements.
 - e. Labor requirements--both family and hired--per farm unit and for various crops.
 - f. Farm budget studies.
 - g. Estimates of project benefits.
 - h. Estimates of payment capacity of irrigators.
7. Office Engineering
 - a. Designs of project features.
 - b. Estimates of construction cost, including land preparation, on-farm works, and permanent operating facilities.
 - c. Estimates of project operation, maintenance, and replacement costs, including all administrative costs.

8. Multiple-use Studies
 - a. Domestic water supply.
 - b. Forestry potential.
 - c. Fisheries.

9. Financial and Economic Analysis
 - a. Determination of benefit-cost ratios for project justification.
 - b. Allocation of project costs to appropriate purposes.
 - c. Determination of requirements for project repayment.

10. Sociological Studies
 - a. Present land tenure.
 - b. Land acquisition problems.
 - c. Removal of homes and unharvested crops.
 - d. Resettlement studies--homes, villages, schools, and other community buildings, etc.
 3. Infrastructure required to accommodate changes brought about or necessitated by project--transportation, processing, financing, education, government, structure, etc.

Schedule of Investigations

A preliminary estimate is that about 5 years should be allowed for the feasibility investigations of the Do-Anambra Rivers Area. This would include about 2 years for the inventory of resources and plan formulations (reconnaissance or pre-feasibility study) and 3 years for the detailed studies themselves.

It would be desirable that the pilot scheme be in operation for a few years before the agricultural economic studies are completed. A possible time table for accomplishing the various phases leading up to the construction of the proposed project is shown in the following approximate schedule:

	Year				
	1	2	3	4	5
Rehabilitate Uzo-Uwani irrigation system	x				
Complete Uzo-Uwani pilot scheme	x	x			
Pilot scheme in operation		x	x	x	x
Inventory resources	x	x			
Formulation of plans		x			
Feasibility study			x	x	x

Personnel Requirements

A 4 man team for a period not to exceed 90 days should be adequate for making the reconnaissance appraisal of the Do-Anambra River Area. An engineer, an agricultural economist, a soils scientist and an agronomist would probably make up the team. A forester and a fishery specialist may be needed for a brief period. The reconnaissance team should be scheduled following completion of the aerial photographic survey. A rough estimate of the cost of the reconnaissance team and the aerial surveys including the processing and plotting of the topographic maps is in the general area of \$125,000. This estimate will depend in large part on the techniques and the detail of the aerial survey, on the availability of information and on the team requirements. It does not include making any other extensive basic surveys pertaining to the soils, geology, hydrology, etc. It is assumed that other than streamflow measurements, sufficient information exists for the pre-feasibility or reconnaissance study. The reconnaissance team should obtain information on methods and costs for the necessary detailed investigations.

For the detailed investigations, a much larger team would be necessary. This would in all probability include one or two project engineers, a geologist, several field and design engineers, a draftsman, two or three hydrologists, two field soil scientists, a drainage engineer, an agricultural economist, a sociologist, one or two administrative officers, a report writer, stenographers and clerks and a local survey crew and laborers. The exact number of the above personnel would be ascertained by the reconnaissance appraisal.

CONCLUSIONS AND RECOMMENDATIONS

The conclusions and recommendations given in this report are the result of a limited field examination of the Do-Anambra Rivers Area, a review of available information and discussions with key personnel in the Ministry of Agriculture and Natural Resources of the East Central State.

Although the team encountered difficulty in traversing much of the survey area because of damaged bridges, there was sufficient evidence to indicate that the area has a definite potential for being developed into a major food producing region. The development, however, would probably be on the costly side. A major portion of the area will require extensive clearing of existing vegetation prior to any land forming for irrigation. Flood protection may be required for some of the more productive sections such as for rice. A pumping lift of approximately 100 feet would be required to divert water on to parts of the area. Nevertheless, the team concludes that

- (1) a basic survey of the resources, both natural and human, of the Do-Anambra Rivers Area, is definitely warranted.

- (2) the formulation of an overall plan for the development of these resources be initiated.

Studies that are conducted along these two lines are essentially of the reconnaissance or pre-feasibility type.

In inventorying the area, the first step should be obtaining a set of aerial photographs on a scale of at least 1:25,000 with a contour interval of 10 feet for the entire Do-Anambra Rivers Area. Since the detailed feasibility investigations will require topographic maps with a 2-foot contour interval, it may be possible to obtain the 1:25,000 photos with sufficient control so that they may be blown up to a 1:5,000 scale and utilized to obtain an adequate contour interval for topographic mapping.

The reconnaissance would be better scheduled after the maps have been obtained to be of value to them during their pre-feasibility study. Also, logical boundaries within the total area should be selected for programming the basic surveys in the event limited financial support is available.

Prior to or at least concurrent with the resources survey and plan formulation studies, the team recommends that the Uzo-Uwani irrigation system be restored to operational status. The team also suggests that this project function primarily as a pilot scheme for the development of the entire area rather than as a farm settlement scheme as was formerly the case.

The establishment of a water resources use policy and necessary institutions for administration and enforcement is suggested. The state water policy should be designed toward a resources orientation as opposed to the traditional sectorial or use-orientation in order to optimize through integration or combination the available resources. The substantive water law provisions of the code should refer to the allocation, distribution and utilization of surface and sub-surface waters, the rights of the water users, provisions with respect to both quantity and quality aspects of the resource.

In the water laws, other aspects to concentrate on are: (1) who owns the water and who determines the rights, duties and liabilities of individual water users; (2) who administers the diversions, awards the rights to diverts, and assures continuation of these rights; (3) the basis of the right to use water whether upon capital investment and beneficial use or some other criteria; (4) who shall enforce the water laws, whether it is an administrative body or the courts.

It is recommended, that in addition to establishing a water policy and an administrative system, that water organizations at various levels also be designed and implemented.

The design and implementation of an integrated approach to natural resources and human resources utilization is suggested. The preparation of an East Central State resources development plan should be undertaken with the purpose to provide

a broad, conceptual framework for the orderly, efficient development and management of the state's natural resources in conjunction with meeting the national objectives of food production, redistribution of people, and improving the general well-being of all the State's inhabitants.

A major recommendation is that a land title recording system be designed specifically for the conditions existing in the East Central State. The proposed project should serve as a catalyst for land reformation. Such a land title recording system should encourage the consolidation of holdings into economic units but would not preclude individual or communal ownership. It should also encourage the concept of "undivided interest" in land held by the youngest sons to permit or entice them to find employment elsewhere while allowing the eldest son or one who desires to remain on the farm the right to purchase over time the interest of the non-residing owners.

In addition to the economic, legal, social and physical-technical studies to be conducted in the inventory and assessment of resources, it is highly recommended that a study of the effect of the proposed project on the surrounding environment be conducted. Certain international funding agencies require an environmental impact study. To include it within the initial request would demonstrate a concern for long-range effects and planning as well as provide the basis for an opportunity cost evaluation.

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