

1. PROJECT TITLE
 DEVELOPMENTAL APPLICATIONS OF SCIENCE AND TECHNOLOGY

APPENDIX ATTACHED
 YES NO

2. PROJECT NO. (I.D. 19-53)
 641-15-110-069

3. RECIPIENT (specify)
 COUNTRY Ghana
 REGIONAL INTERREGIONAL

4. LIFE OF PROJECT
 BEGINS FY 1975
 ENDS FY 1979

5. SUBMISSION
 ORIGINAL _____ DATE _____
 REV. NO. _____ DATE _____
 CONTR./PASA NO. _____

II. FUNDING (USD) AND MAN MONTHS (MM) BY ELEMENTS

A. FUNDING BY FISCAL YEAR	B. TOTAL \$	C. PERSONNEL		D. PARTICIPANTS		E. COMMODITIES \$	F. OTHER COSTS \$	G. PASA/CONTR.		H. LOCAL EXCHANGE CURRENCY RATES \$ US (AS APPLICABLE)		
		(1) \$	(2) MM	(1) \$	(2) MM			(1) \$	(2) MM	(1) GRANT	(2) LOAN	(3) COUNTRY
1. PRIOR THRU ACTUAL FY												
2. OPN FY 1975	\$590						\$590					\$425
3. BUDGET FY												
4. BUDGET +1 FY												
5. BUDGET +2 FY												
6. BUDGET +3 FY												
7. ALL SUBC. FY												
8. GRAND TOTAL	\$590						\$590					\$425

9. OTHER DONOR CONTRIBUTIONS

(A) NAME OF DONOR	(B) KIND OF GOODS/SERVICES	(C) AMOUNT

III. ORIGINATING OFFICE CLEARANCE

1. DRAFTER Bill Long, OST/TAB Gus Daniels, AFR/CWA	TITLE Environmental Affairs Officer Assistant Desk Officer	DATE 11/15/74
2. CLEARANCE OFFICER W. Haven North (Draft)	TITLE Director, USAID/Ghana	DATE 11/18/74

IV. PROJECT AUTHORIZATION

1. CONDITIONS OF APPROVAL
 Authorization of procurement from Geographic Code 935 (Special Free World Countries) in an amount estimated not to exceed \$50,000, is included in this project Authorization. By his signature of this project Authorization, the Assistant Administrator finds that exclusion of procurement from the sources and for the purposes requested in annex F would constitute a restriction against extending the assistance required by the Government of Ghana.

2. CLEARANCES

DIR. OFF.	SIGNATURE	DATE	DIR. OFF.	SIGNATURE	DATE
AFR/CWA	Dalton A. Griffith	2/21/75	PPC/DPRE	Ronald E. Bobel	2/20
AFR/DS	Princeton N. Lyman	2/20/75	AFR/DP	Robert G. Huesmann	2/21/75
AFR/GC	Edward A. Dragon	2/20/75			

3. APPROVAL AS OF OFFICE DIRECTOR

SIGNATURE Samuel C. Adams DATE 2/25/75

TITLE AA/AFR

4. APPROVAL AS OF ASSISTANT ADMINISTRATOR

SIGNATURE _____ DATE _____

TITLE _____

Annexes

- A. Objectives of the Desertification Study
- B. Management Structure of the Desertification Study
- C. Program Description
- D. Ghanaian Science Institutional Framework
- E. Procurement Source Authorization
- F. Logical Framework

DEVELOPMENT APPLICATIONS OF SCIENCE AND TECHNOLOGY

	<u>PAGE</u>
I. Introduction	1
II. Project Rationale and Strategy	4
III. Grant Project Description	12
A. Program Element #1 - Demonstration Desertification Research Study	12
1. Study Content	16
2. Study Areas	17
3. Management Structure	20
4. Action Plan for Research	21
5. Budget - Table	22
6. Permissible Costs	23
7. Funding Sequence	26
8. Counterpart Contribution	27
9. Project Duration	28
B. Project Element #2 - Extending and Institutionalizing Science Policy Planning and Program Analysis	28
1. CSIR/PAG Policy and Program Analysis	31
2. NAS Advisory Services	33
3. Budget Requirements	33
a. PAG Analytical Studies	33
b. NAS Advisory Services	33
IV. Implementation Plan	34
V. Project Backstopping	36
1. U.S. Consultants	36
a. Desertification Study	36
b. Science Policy Planning and Program Analysis	40
VI. Project Evaluation	40
VII. Relevance of the Fixed Amount Reimbursement Method	42
VIII. Role of Women in the Project	46
IX. Relationship of Project to Those of Other Donors	46

I. INTRODUCTION

A joint Ghanaian-U.S. Workshop on Research Priorities and Problems in the Execution of Research in Ghana, held in Accra in January 1971, focused attention on a number of problems and deficiencies in the Ghana science structure which has to date prevented science and technology from playing its proper and necessary role in the country's development. Although the U.S. (largely through AID support of U.S. National Academy of Sciences activities) has attempted to help the Ghanaian science community to address these problems and to employ science more effectively to achieve national goals, the significant investment in both manpower and dollars has had little noticeable impact. Past efforts have consistently focused on strengthening the ability of the Council for Scientific and Industrial Research (CSIR)--a semi-autonomous scientific and technical arm of the Government--to discharge its broad-based mandate to recommend national science priorities, and to identify, stimulate, and coordinate needed research. The apparent and continuing problem for the CSIR has been two-fold: (1) how to identify and define science priorities and programmatic responses with few staff and little direction; and (2) how to motivate and coordinate Ghana's science institutions (including CSIR's own independently-financed Research Institutes) without program funds of its own to dispense. A possible solution to the first aspect may become available shortly with the creation of a new Planning and Analysis Group (PAG) within the CSIR to carry out policy planning and program analysis.

In FY 1974, the Ghana Mission suggested a technical cooperation project in the Science and Technology (S & T) sector which would build

on several earlier and related centrally-funded initiatives (principally support of joint CSIR-National Academy of Sciences workshops and study groups). The aim of such a project was defined as "strengthening the capability of the Ghanaian science community to more effectively apply its skills and knowledge to national priorities". Emphasis would be placed on meeting the needs of the nation for more efficient and expanded production of food and other essentials. Since world attention was being focused on the impact of the drought on the Sahelian countries just north of Ghana, and since the Ghanaian Government was expressing concern over the potential effects of drought in its Northern Region, it was proposed by the Mission that a basic thrust of the project be the design and implementation of an integrated, multi-disciplinary research study which would address the causes and control of desertification in Northern Ghana. Its central purpose would be to serve as a demonstration of: how major research programs in Ghana can be designed and implemented; how the science community can be mobilized and employed in the effort; and how the procedures could be institutionalized within the CSIR to support its future activities.

As subsequently presented in the FY 1976 Field Budget Submission and Congressional Presentation for FY 75, the Mission proposed channeling AID grant funds for the "Development Applications of Science and Technology" project through a local institution dedicated to the support of scientific research. Specifically, it was suggested that the intended objectives could be accomplished by making a grant to CSIR, which would keep the allocation of funds

close to the seat of policy, and obviate the need to provide the large-scale financial and administrative resources that would be required by creation of an entirely new institution.

In October-November 1974, a joint Ghana-U.S. team, financed in part by AID, met in Accra for two weeks to design and budget the demonstration project on the problem of increasing desertification in Northeast Ghana. The team had at its disposal a new bibliography relevant to the topic prepared by the CSIR with a \$2,000 grant from AID. Two AID/Washington officials participated in the design activity to ensure that the desertification project was consistent with, and could achieve, the broader AID objective of utilizing the project as a vehicle for promoting cooperative research and thereby strengthening the overall science and technology management capability of the Ghanaian Government. As part of its project design task, the team examined alternative management structures for the overall desertification project; specifically, whether the CSIR is capable of carrying out the management function.

The two principal outputs of the joint study team effort were: (1) design of an integrated multidisciplinary research project on desertification and the supporting management structure (which is viewed by the Mission as providing a useful instrument for mobilizing the Ghanaian science community to address an important national need); and (2) convincing evidence that the Committee on Natural Resources of the CSIR offers the best available mechanism for effectively administering the program.

The AID/W participants on the desertification study team effort also discussed with Ghanaian officials the best method for drawing upon the experience and knowledge gained from the demonstration project, and building it into future CSIR policy planning and program analysis. Specifically, an effort was made to examine other areas beyond desertification which could benefit significantly from the application of Ghanaian science and technology. Particular attention was given to the role of the soon-to-be-established Planning and Analysis Group (PAG) of the CSIR in carrying out policy and program design and analysis, and on how the PAG could be assisted to ensure that it gets off to an expeditious start and quickly establishes itself as a useful and productive body within the Ghanaian science community.

II. PROJECT RATIONALE AND STRATEGY

Ghana has a relatively well-developed science and technology infrastructure (one of the best in Africa) which consists of eight research institutes under the CSIR, three universities with some strong basic science training capability, and a number of Government resource agencies. (A description of the CSIR, its research institutes, and other Ghanaian science organizations is provided in Annex D). Furthermore, the Government has demonstrated that it is well aware of the important role that science and technology can play in Ghana's development. In 1968, the Council for Scientific and Industrial Research was formed to promote and facilitate centralized science policy planning and research coordination in areas of major importance to the Nation's development, and to advise

the Government on opportunities to apply science and technology more effectively toward national goals. Since that time, the CSIR and the Ghanaian research institutions have been requested by the Government to take an active part in various campaigns to achieve self-sufficiency in food production, and to foster the development of exportable commodities.

However, recent analyses by the U.S. National Academy of Science of Ghana's application and utilization of its science and technology infrastructure have revealed a number of serious weaknesses which continue to limit its usefulness and thereby reduce the prestige and stature of science and technology in the eyes of the Government and the general public. Among the identified weaknesses are: (1) lack of clear definition of national priorities; (2) absence of an effective coordination mechanism for inter-institutional science programs; (3) difficulties in organizing multi-disciplinary efforts; and (4) absence of strong linkages between CSIR institutes and user institutions.

The design of this grant project is therefore based on three important assumptions: (1) that Ghana's economic and social development can be significantly increased through better management and utilization of its science and technology capabilities; (2) that the role of the CSIR as a research coordinating and policy advisory institution can be greatly strengthened by providing that organization with funds and experience in supporting scientific research by other Ghanaian science institutions, and assisting it develop a better

policy planning and program analysis capacity; and (3) that the experience and knowledge gained by the CSIR and associated institutions through participation in a carefully designed, development-oriented multi-disciplinary research project with respect to science policy planning, program design and management and stimulating inter-institutional collaboration can be institutionalized and applied by the CSIR in other areas.

The goal of this project is to promote economic development in Ghana through increased application of science and technology. This goal is predicated upon the principle that the intensified creation, adaptation and application of science and technology is an essential component of accelerated economic growth and development. The effective introduction of new technologies must emanate from the institutions, professional manpower and development leadership of the country. The process of introducing new technologies can be advanced dramatically by links with technological developments in other countries, but scientific and technological activities in Ghana are likely to gain lasting support of the Government only if these activities make a significant and visible contribution to national development objectives.

The project purpose is to strengthen Ghana's principal institutional mechanism for planning, coordinating, implementing and applying cooperative, multi-disciplinary research in the areas of science and technology to national economic development priorities. The purpose of the project addresses what has been identified as the

major impediment to the maximum utilization of Ghana's rather considerable scientific and technological resources -- the persistent failure to Ghanaian institutions to work on a cooperative basis in areas of applied research and to accept CSIR leadership in defining national science priorities and initiating and coordinating inter-institutional, multi-disciplinary research programs. Attainment of this objective will enable CSIR to carry out its mandate: to advise the Government on the technological advances likely to be of importance to national development and to encourage and coordinate new research intended to assist Ghana achieve its priority development goals (paragraph 4 of the 1968 decree which established the CSIR).

The major thrust of the project - improving the planning, funding, managing and coordinating capacity of Ghana's major science policy planning and research coordinating institution - is directly supportive of and explicitly linked to the goal of promoting economic development through increased application of science and technology. Measurements of goal and purpose achievement, assumptions, and of project conditions, outputs, inputs, means of verification, etc., are found in Annex F (logical framework).

The strategy of the project is one of attempting to improve cooperative scientific research in Ghana and to enhance the role of the CSIR by: (1) making funds and U.S. technical advice available to the Ghanaian scientific community through the CSIR to support an integrated, multi-disciplinary research program on a carefully defined problem of national importance (i.e., desertification in Northern Ghana); (2) analyzing the results of the demonstration study,

particularly the innovative funding and administrative mechanism and the effectiveness of the CSIR in managing the projects and then applying the results to other areas; and (3) assisting the Planning and Analysis Group (PAG) now being established within the CSIR to get off to an expeditious and successful start, and thereby establish itself as the major science policy planning body within Ghana's science community. It is expected that increasing cooperation between scientific research institutes and greater involvement of CSIR in planning, managing and funding integrated, multi-disciplinary research programs will result in more effective use of Ghana's scientific resources.

The desertification study will be carried out as a pilot demonstration of a new centralized approach to the funding, design, and management of major multi-disciplinary science programs in Ghana. The geographic focus will be the extreme northeast of Ghana, a relatively heavily-populated rural areas of small farmers with very low incomes. It is these people who are bearing the brunt of the desertification process which increasingly is reducing the productive capacity of the land--and who therefore have most to gain from a program which addresses both causes and remedies. If the desertification study is successful in uncovering the primary causes of increasing desertification in this zone, CSIR will be in a good position to develop and test alternative approaches for either reversing this process or reducing its disruptive impact on the economic activities of the rural population. Early identification of the underlying causes of desertification should not only give policy planners more time to develop feasible solutions to the problem

(hopefully at reduced overall costs), but would also fortify the position of the scientific community, including CSIR, as a important contributor to the achievement of national economic development. By focusing on a problem to which the Government and AID attaches high priority (by virtue of the impact of recent drought on the economies of the Sahelian countries to the north), by the careful design of the research study to emphasize and stimulate cooperative multi-disciplinary approaches, and by providing the CSIR with funds and the research management support to administer the project, the desertification study can: (1) serve as a vehicle to support the efforts of Ghanaian institutions to work in a collaborative mode; (2) provide these institutions with the experience of conducting integrated multi-disciplinary research; (3) build CSIR prestige and experience for promoting and administering coordinated S & T programs in other areas; and (4) provide a case study of the central funding and management of science programs in Ghana.

The project strategy then envisions utilization of the new Planning and Analysis Group of the CSIR to evaluate the results of the pilot project, particularly the funding and management approach use in relation to other alternatives that Ghana may wish to adopt in the future, and to apply the project analysis approach in two other specialized development areas in an attempt to perpetuate the analytical methodology and establish CSIR's leadership role in program definition. A portion of the funding will facilitate and further encourage a continuing relationship between the CSIR and the U.S. National Academy of Sciences in the general areas of science policy and information exchange, and especially to promote collaborative work

in those areas in which the PAG will be initiating studies.

One of the very crucial factors which will determine whether CSIR will, in fact, be capable of undertaking similar activities in the future will be its experience and record in planning, analyzing, funding and managing scientific and technological research programs. As presently designed, this project incorporates a number of features which contribute directly to the development of CSIR's capability to carry out successful development-oriented research programs. These are:

1. Ghanaian scientists from the CSIR's associated institutes and universities have already participated in planning and designing a multi-disciplinary research program, i.e. desertification. This experience has not only resulted in increased awareness of some of the procedures, requirements and problems involved in developing multi-disciplinary research programs, but it has also led to expanded contacts between Ghanaian scientists and greater appreciation of the development problems of Northeast Ghana.
2. The planning, management and analysis functions to be carried out under this project will provide CSIR with a timely opportunity to test the effectiveness of various research techniques and to demonstrate to the Government and the scientific community the value and benefits of applying scientific and technological research to a real world situation.
3. The PAG will use the desertification project as a case study of the requirements for effective policy analysis, program management and central funding of integrated multi-disciplinary research programs in Ghana. By a continuous

process of analysis, study, and evaluation of the results and achievements of the desertification project, the PAG will devise means for incorporating the best features into other development-oriented research activities, thus contributing to the institutionalization within CSIR of a new capacity to plan, design and coordinate programs in the area of science and technology

4. CSIR, particularly the PAG, will receive continuing assistance from NAS in identifying program and policy needs as these relate to various areas of scientific research.
5. Two major seminars are planned in order to permit the principal Ghanaian researchers to review the progress of the project.

In summary, the experience gained to date plus implementation of the desertification component and completion of the research design for three other development areas (two studies will be initiated at the beginning of the third year) will provide CSIR with three years of practical experience in funding, managing and coordinating multi-disciplinary research programs. It is reasonable to expect that the organization's confidence in its own capacity will increase as it gains in experience and that the lessons learned from both failures and successes will be evident in planning, design and management of activities scheduled to take place during the second and third year of the project.

III. GRANT PROJECT DESCRIPTION

A. Project Element No. 1 - Demonstration Research Study

The desertification study designed by the joint Ghana-U.S. team can be viewed as part of a series of centrally and regionally-funded AID activities under-taken since 1971 to assist the Ghanaian science community to work cooperatively and more effectively on priority development problems. However, it represents a clear departure from earlier activities which focused principally on delineating general science and technology policies and program priorities for Ghana. The desertification study, which will receive the major portion of the grant funds, will be an action-oriented multidisciplinary research effort targeted on a major national development problem.

The study was designed by a joint Ghanaian-U.S. team which met in Accra during a two-week period in October-November 1974. It is described in its entirety (including budgetary requirements) in the report by the design team entitled, "Northeast Ghana Savannah Research Project". The objectives as set forth in the report are:

- "1. To strengthen the capability of the Ghanaian scientific community to conduct interdisciplinary research which contributes directly and significantly to the short-term solution of critical problems of socio-economic development, particularly in the areas of agricultural production and the improved health and economic well-being of the people of the study area.
- "2. To identify more clearly, evaluate and quantify the factors involved in possible desertification in the

Savannah zone of Northern Ghana.

- "3. To investigate and recommend cultural and management practices which will halt and even reverse the trend toward increasing land degradation in the northeastern area of Ghana with a view of improving the living standards of the rural people.
- "4. To design a coherent integrated study which will stimulate and contribute to cooperative international programs in the areas of desertification and resource management in semi-arid regions.

It is noteworthy that the Ghanaian participants on the team, representing Government Ministries, CSIR and the Universities, all agreed that a deliberate and principal objective of the study should be to strengthen their collective capabilities to conduct integrated, multi-disciplinary research. This consensus emerged despite the fact that the principal goal of the study design effort as initially perceived by the Ghanaians was to develop a program of research to address the problem of desertification in the North. AID, however, while recognizing the importance of desertification, viewed Ghanaian interest in this problem as also providing an excellent vehicle to promote a new spirit of national purpose and cooperation within the science community. Successful completion of the study would provide a demonstration of Ghana's capacity to carry out multi-disciplinary, problem-oriented research under CSIR leadership. In addition, the project places particular emphasis on improving the lives of the people in the heretofore relatively neglected rural region of Northeast Ghana by addressing the need to halt the increasing deterioration of agriculturally-productive land. Thus, there

is congruence between the objectives of the study designed for Northeast Ghana and current AID priorities. There was also a clear basis for believing that the principal objective of the study as perceived by AID (i.e., to advance Ghanaian science and technology) could be achieved by utilizing the desertification project as an implementing mechanism.

The desertification research study focuses on a relatively localized area of the Northeastern part of the Upper Region--the Tamne River Basin, including the adjacent Bawku urbanized area to the north. Five specific lines of research will be pursued, each addressing a priority problem which contributes to land degradation (i.e., "desertification") in the region:

- (1) Burning
- (2) Water Availability and Distribution
- (3) Overgrazing and Deforestation
- (4) Agricultural Cultivation Practices
- (5) Socio-Economic Relationships

The study was purposely designed to emphasize the requisite multi-disciplinary, inter-institutional nature of the research and also to cover the spectrum of studies needed to advance from the initial stage of: (a) understanding and assessing the principal causes and extent of the problem; through (b) evaluating the impacts of the problems on land productivity and general well-being; and (c) assessing alternative management strategies to remedy the problems; and finally to (d) selecting and designing specific remedial methods, procedures, technologies and/or policies to achieve the most practical and cost-effective solution to the problem.

The AID funding provided under the grant, coupled with the significant Ghanaian contribution which has been pledged and will be required (both cash and in-kind support), is adequate to carry out all the research delineated in the study design. This is in part the result of selecting a relatively small study area (approximately 250 square miles), and also relates to the fact that implementation of research results is not included in the project. The work carried out under the study will provide the scientific basis for carrying out remedial actions and identify, on a pilot basis, the best of the alternatives; it will not, however, go beyond the analysis and demonstration stage.

As the study evolves, it is highly probable that additional lines of profitable research will be revealed, or that the control of desertification in Ghana would benefit from similar studies undertaken for comparative purposes in other parts of the country. (Note: Several Ghanaian members of the joint design team favored a second concurrent study in the Northwest.) If the study evolves smoothly, these related spin-off and comparative studies should be encouraged along with the application of the model to the solution of other similar types of man-resource management problem.*

*It is anticipated that the CSIR will seek funding from other donors for these purposes. On the basis of having at its disposal a coherent, integrated study design, prospects of attracting such support appear high. Also, it is anticipated that AID will be willing to provide additional financing if the program proves to be well executed and meaningful at that time.

1. Study Content:

The report by the design team describes the desertification study in detail. It recommends research activities in five major theme areas, and also includes an "Integrating Sub-project" as a mechanism to pull together results from the various major theme areas studies into an integrated whole. Further, the design provides an implementing methodology and an implementation plan which are intended to promote inter-disciplinary, inter-institutional cooperative research.

AID financing will support the requisite research investigations in each of the major theme areas. The research has been time-phased to reflect the fact that the level and focus will change over time (i.e., one must first define and interpret the causes of the problems before proceeding to study impacts; and the investigation and testing of remedial actions will come even later).

The study design requires that work be initiated in each of the five areas within the first year. This brings into play a much broader range of cooperative research possibilities than if the approach had been to complete work on all elements of a single area before beginning in others. The research will consequently involve a wide spectrum of resource management problems and cooperating institutions and will therefore compel an integrated multi-disciplinary effort. Since the principal objective of the study is to stimulate Ghanaian science and technology the spirit and experience of cooperative research (rather than to solve a desertification problem), it is felt that the CSIR should implement the study in such a way that a large number of Ministries, CSIR Institutes and university departments can play roles in the very early stages, lest

the momentum of interest built up during the study design phase be dissipated or lost.

2. Study Areas:

Although the terms of reference given by the CSIR to the Ghana-U.S. study design team called for a geographical focus on the "Northern Ghana Savannah Region", the team agreed that a sharper focus must be provided to ensure that the research effort is not spread too thinly and thereby constrain the close collaborative multi-disciplinary activities required to achieve project objectives. Based on criteria established by working groups, the geographical target area was initially delimited to the general Bawku-Bolgatanga region in the northeast corner of the Upper Region.

The principal criteria used to make this selection include: preliminary evidence that desertification is already having an impact on the area; the fact that continued drought in the Sahel to the north would trigger effects in Ghana which could be sensed first in this project area; the relatively high density of population; and the spectrum of land use practices, infrastructure elements, physical and natural resources, and socio-cultural features extent in the Northeast.

Following additional analysis the team agreed that the study area could be even further limited without reducing the possibility of achieving all project objectives. Furthermore, reduction of the size of the area would improve prospects for cooperative research, and also reduce logistics and other support costs. The goal of the design team at this point was to define an area small enough to be manageable--yet large enough to demonstrate a wide range of resource management problems, optimize use of available manpower and financial resources, and enhance

chances for the results to be transferable to other regions of Ghana.

Based on the above considerations, the study design team selected the Tamne River Basin, including Bawku, as the study area. (See maps which follow.)

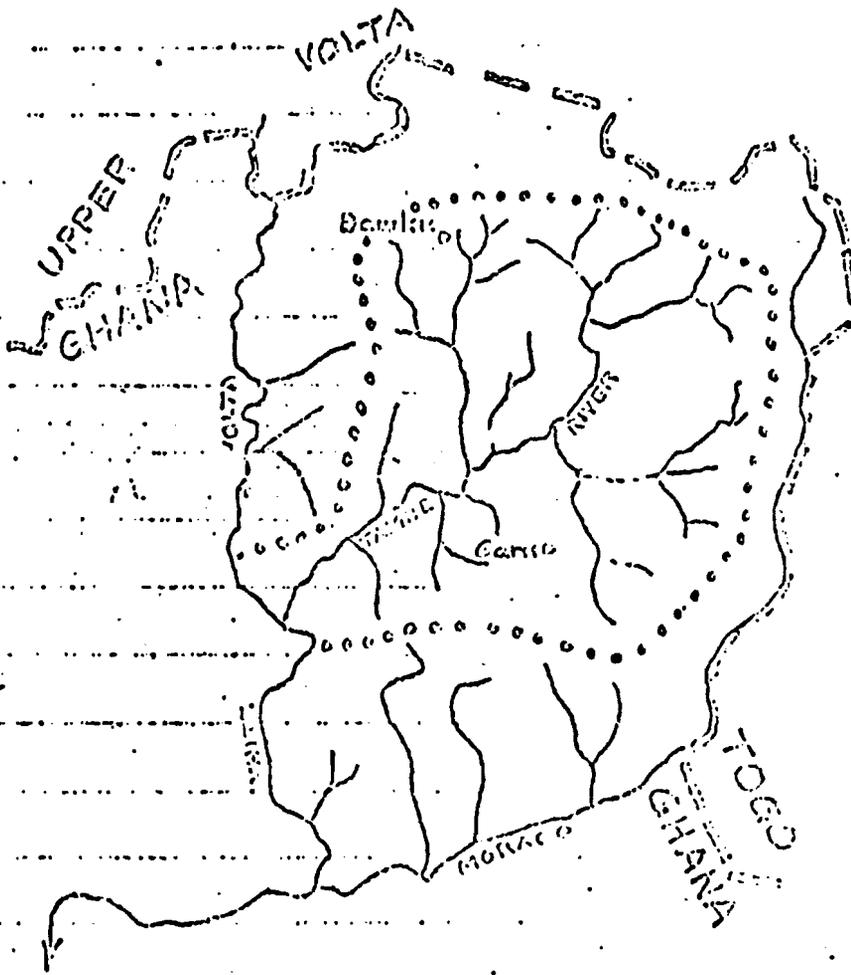
The following are some of the advantages of selecting this area:

- (a) Hydrologically, it contains a well-defined and complete unit.
- (b) It represents all of the major land uses of the region (except forest reserves).
- (c) It includes both forestry and agricultural research stations and two land planning areas.
- (d) The Bawku region is particularly important and representative of compound farming and annual cropping in a permanent agriculture.
- (e) Even though it is in a regionally unique soil area, examples of an adequate cross-section of the soils of the region can be found for the purposes of essential research.
- (f) It includes elevational variation representative of the extremes of the region.
- (g) The road network is adequate for essential transportation in conduct of the research and surveys.
- (h) The Tamne River Basin includes Bawku and contains numerous other villages of varying size for purposes of socio-cultural studies. With a population density of over 200 persons per square mile, it is one of the most densely settled areas in Ghana.
- (i) The study area is included on parts of two frames of imagery obtained in 1972-73 by the Earth Resources Technology Satellite.

- (j) All five major components of the research program (to be described in the remainder of the region) can be effectively investigated in the Tamne River Basin.

Figure 2

Tambo River Basin Study Area



3. Management Structure:

The management aspect of the desertification study is a critical component since a new funding and management concept will be tested and demonstrated. This concept represents a radical departure from traditional science funding and administration in Ghana. Consequently, the desertification design team included expertise in research management and provided very specific recommendations and guidance on project management. These recommendations are acceptable to the CSIR which will establish the necessary management structure immediately after the grant agreement is negotiated.

The overall responsibility for management and administration of the study will be vested in the Executive Chairman, CSIR, acting through the CSIR Committee on Natural Resources. The development and implementation of specific policies and programs for the Northeast Ghana Savannah Research Project; the solicitation of research proposals; their subsequent selection, integration, and budgeting; and the monitoring and review of the overall project will be carried out by the Project Management Group (PMG) to be established within the CSIR's Committee on National Resources. A Project Coordinator will be designated by the Executive Chairman, CSIR, to provide daily management and coordination of the study. Details of the project management structure and operations are presented in Appendix B.

The principal objectives of the management function are:

- (a) Well-conceived, continuous and systematic management of research to assure close cooperation and communication among researchers, conservation of research resources, and careful analysis of the inter-relationships among the individual

research projects.

- (b) Utilization of the best research talent available within Ghanaian agencies, institutes and universities to carry out the research activities.
- (c) Open, direct and rapid communication between the responsible units of CSIR and the individual researchers.
- (d) Review, analyses and synthesis of the organizational and research activities on a timely basis.

Achievement of these objectives is expected to result in better management and improved coordination of Ghana's science resources.

4. Action Plan for Research

The Northeast Ghana Savannah Research Study designed by the Ghana-U.S. team provides a comprehensive work plan covering six sub-projects, and contains general budget estimates. However, it does not identify the study leaders, describe their working relationships, or set forth budget details for the sub-projects. These omissions are deliberate since it was recommended by the design team that this be left to the Project Management Group in the interest of providing experience in the programming and budgeting of multi-disciplinary, cooperative research investigations. The Project Management Group will thus be expected to use the team report as a guide for determining groupings of sub-projects and establishing exact budgetary requirements. After the grant agreement is negotiated and funding assured, Ghanaian science institutions and scientists will be advised of the research required, and invited to submit proposals. The notification in most cases will define a logical grouping of study objectives and call for single study proposals involving more than one

discipline. Healthy competition between institutions and scientists for funds will be encouraged, but this must be handled carefully.

The Project Management Group will then make the decisions on which sub-projects to approve from among those submitted. All those relating to a particular broad program area will be integrated, the package of related sub-projects carefully budgeted, and the package used as a basis for requesting funds from A.I.D.

5. Budget

The nature of this study does not lend itself to tight budgetary analysis at the outset. Apart from the financial resources necessary to support the Program Coordinator and the Program Management Group, the specific funding requirements and budget components will not become clear until research proposals for each of the main research theme areas are solicited by the CSIR management structure, reviewed, selected, synthesized, and budgeted in detail by the Program Management Group, and then submitted to USAID/Ghana for review and approval. Responsibility for developing the precise budgetary details required for release of funds by AID resides with the CSIR Program Management Group. Since the study will be supported through a science concept, the nature of the exact research approach, including levels and types of staffing and equipment will not be known until the scientific community responds to a definition of need with specific proposals.

The allocation of AID grant funds for the various components of the desertification study based on analyses and guidelines established by the study design team, and subsequently modified during CSIR-USAID/Ghana discussions of the team report are presented in Table I below.

TABLE I - BUDGET FOR THE DESERTIFICATION STUDY

	First Year		Second Year		Third Year		Life of Project	
	\$	C*	\$	C*	\$	C*	\$	C*
A. Socio-Economic								
Sal. & Wages	15,000		5,000		5,000		250,000	10,000
Equip. & Supplies	10,000		3,000		2,000		15,000	3,000
Training	2,000		1,000		0		3,000	0
Travel/Other	5,000		7,000		7,500		19,500	2,000
Consultants	1,000		500		500		2,000	0
TOTAL	33,000		16,500		15,000		64,500	15,000
B. Cultivation Practices								
Sal. & Wages	5,000		7,000		8,000		20,000	15,500
Equip. & Supplies	20,000		8,000		2,000		30,000	3,000
Training	2,000		1,000		0		3,000	0
Travel/Other	2,000		3,000		2,000		7,000	3,000
Consultants	1,500		2,500		1,000		5,000	0
TOTAL	30,500		21,500		13,000		65,000	21,500
C. Overgrazing & Defores.								
Sal. & Wages	5,000		7,000		8,000		20,000	38,000
Equip. & Supplies	35,000		3,000		1,500		29,500	45,000
Training	3,000		2,000		0		5,000	0
Travel/Other	5,000		7,000		3,000		15,000	35,000
Consultants	1,500		2,500		1,000		5,000	0
TOTAL	49,500		21,500		13,500		64,500	118,000

* only life-of-project total available. Not possible to pro-rate by years at this time.

BEST AVAILABLE COPY

BEST AVAILABLE COPY

	First Year		Second Year		Third Year		Life of Project	
	\$	¢	\$	¢	\$	¢	\$	¢
D. Water								
Sal. & Wages	5,000		7,000		8,000		20,000	52,000
Equip. & Supplies	35,000		3,000		2,000		40,000	46,000
Training	3,000		2,000		0		5,000	0
Travel/Other	5,000		15,000		10,000		30,000	60,000
Consultants	2,000		2,500		1,000		6,000	0
TOTAL	50,500		29,500		21,000		151,000	158,000
E. Burning								
Sal. & Wages	1,500		7,000		7,500		16,000	0
Equip. & Supplies	6,500		250		250		7,000	0
Training	1,000		1,000		1,000		3,000	0
Travel/Other	2,000		3,000		2,000		7,000	3,000
Consultants	500		1,000		500		2,000	0
TOTAL	11,500		12,250		11,250		35,000	3,000
F. Integrating								
Sal. & Wages	4,500		5,000		5,500		15,000	0
Equip. & Supplies	0		0		0		0	0
Training	3,000		3,000		2,000		8,000	0
Travel/Other	500		500		1,000		2,000	3,000
Consultants	2,000		2,000		1,000		5,000	0
TOTAL	10,000		10,500		9,500		30,000	3,000
G. Project Mngs.								
Sal. & Wages	7,000	18,000	8,000	16,500	9,000	19,000	24,000	55,500
Equip. & Supplies	18,000	25,000	1,000	10,000	1,000	10,000	20,000	45,000
Training	3,000	0	0	0	0	0	3,000	0
Travel/Other	10,000	20,000	10,000	21,000	8,000	22,000	23,000	63,000
Consultants	10,000	2,000	5,000	2,000	5,000	2,000	20,000	6,000
TOTAL	48,000	65,000	24,000	51,500	23,000	53,000	95,000	159,500

BEST AVAILABLE COPY

	First Year		Second Year		Third Year		Life of Project	
	\$	£	\$	£	\$	£	\$	£
H. Total Proj.								
Sal. & Wages	43,000		46,000		51,000		140,000	175,000
Equip. & Supplies	124,000		13,250		8,750		151,500	142,000
Training	16,000		12,000		2,000		30,000	0
Travel/Other	29,500		45,500		33,500		108,500	169,000
Consultancies	19,000		16,000		10,000		45,000	6,000
TOTAL	235,000		135,750		106,250		475,000	492,000

U.S. Dollar 1 - £1.15

BEST AVAILABLE COPY

Adjustments not to exceed 25 per cent should be permitted between the various categories, since the nature of the research as it unfolds may require modification.

The Management Operating Expenses is the only area where fairly precise budgeting is possible prior to initiation of the study, and this has been done. The funding allocations for the other research areas represent estimated maximum levels, although a 25 per cent adjustment within the research categories (but excluding Management Operating Expenses) is allowable.

6. Permissible Costs:

The budget provides funds for research management operations; scientific research studies, including supporting costs; project back-stopping and evaluation through use of U.S. consultants; travel for Ghanaian scientists both domestically and overseas; synthesis and dissemination of results; and specialized training for Ghanaian scientists in Ghana and in the U.S. The following specific costs are deemed permissible under the grant:

- (a) Salaries for new staff essential for the performance of the research and for study management and administration:
salary remuneration for selected senior Ghanaian scientists on short-term (2-3 weeks) assignment, and release time payments to enable universities to cover classroom responsibilities of faculty engaged in the project. A large portion will support university students who will be involved in data gathering.
As standard practice, however, the salaries of Ghanaian scientists are expected to be "contributed", and the Project Management Group is instructed to include this in the criteria

for proposal selection.

- (b) Honoraria for members of the Project Management Group and a few highly qualified senior Ghanaian scientists who will be required for program guidance and evaluation on a limited basis.

- (c) Equipment, other Capital Expenses and Research Support Costs

New equipment and project costs other than personnel support required to carry out the study should be financed under this grant. The design team report identifies, for each category, general types of equipment that will be needed for the research, although precise equipment needs are unknown until the research packets are assembled by the Project Management Group. Some of the needed equipment may be available at different institutions within Ghana and, since this is to be a cooperative study, equipment-short agencies may combine with staff-short institutions to optimize their impact and minimize costs. Individual institutions will not be allowed to use the grant program merely to expand staff and procure equipment. A major objective of the study is to stimulate the institutions to cooperate on work which a single agency cannot do well by itself. Not to seek combinations of talent and equipment therefore, would run counter to these objectives. The Program Management Group must include evidence of this type of cost-sharing and collaboration within its selection criteria. It should be recognized, however, that successful research requires adequate equipment, vehicles and logistical support--and, further, that Ghana is presently quite deficient in this area. There is a natural tendency to seek budget cuts in this area,

but indiscriminate cut-backs in equipment and support have severely damaged the effectiveness of many potentially productive research programs.

One essential guidelines will be built into the grant; the cost of new equipment, vehicles and other capital items should not exceed 33 per cent (%) of the total AID funding (although the per cent may exceed this figure in a particular sub-project area).

- (d) Training. Costs for providing specialized short-term training to Ghanaian scientists, managers and administrations involved in the study will be covered by AID funding. It is estimated that approximately six Ghanaians will undertake training in the U.S. during a portion of the three-year period, and that at least one seminar will be conducted in Ghana by a U.S. institution.
- (e) Travel. Costs for travel by Ghanaians directly engaged in the project to attend regional international meetings devoted to resource management in semi-arid lands will also be covered.

Criteria for selection of meeting and individuals will emphasize the relevance of the meeting to the specific Ghanaian situation, and the degree and nature of the traveler's participation in the program. Priority will be given to scientists who will be presenting papers on the Ghana project. It is envisioned that Ghana will chose to participate in UNESCO's Man and the Biosphere Program (MAB) which requires and promotes information exchange on arid land problems. Attendance

at such: UNESCO Provides training to LDC participants in the MAB program, and it is hoped that this will be a source of additional training for the Ghanaian scientists in this project.

- (f) U.S. Consultants. Costs for U.S. consultants to backstop the research management and scientific components of the study will be financed under a single contract with the University of Arizona. (See section on "Project Backstopping".)

7. Funding Sequence

The sequence for the release of grant funds by AID will be as follows:

- (a) Operating Funds for the Management Group and Coordinator will be released immediately after the grant is signed, and in accordance with a detailed budget which updates the present estimate. This will cover only the first year of operation. Funds for year 2 and year 3 operations will require new budget submissions just prior to the beginning of each year.
- (b) Funding will next be released for the Socio-Economic Data Base Compilation which underlies and supports the other research theme areas. This will be the initial research programming responsibility undertaken by the Project Management Group and will be based on solicitation of research proposals and their selection, integration and budgeting.
- (c) Funding can next be released for any of the other major research theme areas (Burning, Cultivation Practices, Water Availability and Overgrazing - Deforestation) in any sequence, and as recommended and requested by the Project Management Group. It is anticipated that the initial request for funding in any one theme area would not cover the total effort in that area, since

the direction and resource requirements may change as the work progresses from the analysis of problem causes to the development of remedial strategies. Therefore, it is recommended that the total effort in each theme area be disaggregated and presented to AID in discrete, segmented packets.

- (d) The final effort in the study will require financing of the Integrating Sub-Project which is designed to pull together, synthesize and evaluate the discrete research activities. This will also require detailed programming and budgeting by the Project Management Group, and will be submitted to AID at the beginning of the second year of the grant.

8. Counterpart Contribution

The total local contribution (both cash and in-kind) will have to match the AID contribution on a one to one basis if study objectives are to be achieved. Funds have been made available (40,000 cedis) by the Ghana Government for the first year of the study and it is expected that this level will at least be maintained during each of the other two-years- -and that the CSIR will make a major effort to have this increased. The Bulk of this funding will go to support the Management Operations component of the study, an area where the Ghanaians should be expected to make a major commitment of funds. The necessary level of local contribution is shown in the budget tables, and the actual commitment will be included in each research study package subsequently prepared and submitted by the CSIR Project Management Group to AID for approval. At this stage it is not possible to do more than suggest counterpart contribution levels since the specifics of the individual research

elements are unknown yet. However, the success of the study depends upon the Ghana Government and its research institutions making the necessary commitment to release top scientists for the projects, and to absorb their salaries within their existing budgets. The Ghanaian institutes must take on this study as an integral, high priority activity.

9. Project Duration

The desertification demonstration study will run for three years from the date of formal grant agreement. This is considered to be sufficient for performance of the necessary research. It was felt by the design team that a longer time period would merely stretch out the performance, run up costs, and possibly dissipate the enthusiasm and momentum necessary to successfully conduct this type of cooperative venture.

B. Project Element #2 - Extending and Institutionalizing Science Policy Planning Program Analysis

The total grant project consists of two major elements: first, carrying out a science applications demonstration project on "desertification"; and then building upon and extending the experience gained by the Ghanaians in problem analysis, policy planning, and project design and implementation for application in other important areas of science and technology. Particular importance is attached to examining the potential for institutionalizing the most promising analytical, managerial and funding approaches that emerge from the demonstration project.

The May 1973 joint CSIR-NAS "Workshop in the Role of the CSIR in Determining Science Policy and Research Priorities" pointed out that there is a number of critical constraints which, if left uncorrected, will hinder the effective and efficient utilization of Ghana's science and

technology capabilities to achieve national needs. The working report noted that: "Although the CSIR has a legal responsibility for giving advice concerning national priorities in research, the important decisions are now usually made on a narrower basis. The Management Boards of the (CSIR) Institutes are the bodies entrusted with the responsibility of determining research priorities. Thus, a badly constituted or poorly functioning Board may destroy the whole process of establishing effective programs within an institute. Since all other government supported research institutions must follow a similar independent procedure in requesting funds, they too are subject to similar procedures in the process."

To respond to this situation, the 1973 CSIR-NAS panel proposed creation of a new Planning and Analysis Group (PAG) within the CSIR, Specifically to undertake the analytical work needed to enable the Council to carry out the broad advisory functions assigned to it by its 1968 enabling decree. The team envisaged "a group of highly qualified people who would be given the task, with requisite facilities, of evaluating major problems that may be encountered in the formulation and execution of national policy for science and technology."

The functions of the PAG are to include:

- (a) providing analytical studies needed by the CSIR to carry out its broad advisory functions;
- (b) collaborating with the Economic Planning Division of the Ministry of Finance and Economic Planning with a view to identifying priority areas of national development where scientific and technological advice is needed;

- (c) analyzing and recommending assignment of identified projects to research organizations, (institutes, agencies, universities and private organizations) which can best deal with the problems; and
- (d) projecting requirements for manpower and other resources needed for investigating problems.

It is important to observe that the analytical and program design work just carried out by the ad hoc Ghana-U.S. team on desertification in Northeast Ghana is exactly the type of activity that a PAG should undertake. Steps are now being taken to create the PAG. The Ghana Government has approved funds for a three-man group, and the CSIR secretariat is in the process of recruiting candidates. The body should be ready to function in early 1975. Funds needed for staff support for the PAG will be made available in the near future by the Government so that it can give prompt attention to providing a more rational basis for directing the research institutions toward important national needs, and to making better use of limited manpower and financial resources.

The strategy for this component of the grant is to utilize the PAG as the mechanism for evaluating the results of the demonstration projects, extending and perpetuating the best aspects into other areas, and (in the process) institutionalizing within the CSIR a new, innovative capability for science policy analysis and program design and administration funding. It is intended to achieve these objectives by: (1) assisting the PAG to carry out analytical policy and program-oriented studies on three topics of high priority importance to the future development and application of science in Ghana; and (2) supporting the continuation of the relationship between the CSIR and the U.S. National Academy of Sciences under which

the NAS has been assisting with the identification of policy and program needs in both general and specialized areas of science and technology.

1. CSIR/PAG Policy and Program Analysis

Grant support of \$90,000 will be made available to the CSIR to assist the PAG carry out its policy planning and program analysis responsibilities. Three studies will be carried out--one involving an analysis of the future funding of science and technology in Ghana, and the other two on specialized development problems (e.g., local manufacture of agricultural waste products, food technology). Since the two specialized studies are not planned to begin until the third year of the grant, a firm selection of topics was not made at this time. The selection of these studies is part of the process of the PAG developing and learning its role. The PAG will begin evaluating needs and opportunities after it is established, and will then make specific recommendations for the two studies through the CSIR to USAID/Ghana for review and approval.

The studies are to draw on the experience and knowledge gained from the desertification demonstration project, particularly with respect to problem analysis, program design and implementation, and the best mechanisms to achieve institutional cooperation, proper funding and effective management.

The first of the studies to be undertaken by the PAG under this grant is an analysis of "Alternative Approaches to Funding and Managing Cooperative Research in Ghana". This is dictated by continuing problems which beset the funding and management of science and technology in Ghana, and the fact that the desertification study will test a new concept for designing, conducting and funding science programs: namely, reliance on

a central source (i.e. CSIR) to identify priority needs and program requirements and then to disburse funds to selected institutions on the basis of proposals solicited from within the entire science community.

Historically, research funds have moved directly from the Ministry of Finance to the individual CSIR institutes on the basis of individual budgets they submit. Little or no centralization of program review and coordination exists and past studies have indicated that this results in the dissipation of limited manpower and financial resources, some duplication of effort, and failure to achieve a "critical mass" of talent and institutional capacity to successfully mount effective problem-solving efforts.

Under this sub-project activity, the PAG will identify and evaluate patterns and mechanisms of science funding in different countries of the world in relation to the projected future needs of Ghana. The experience gained from the desertification centralized approach will provide a major input. Particular attention will be accorded the management structure needed to program and administer the funds. In addition to analyzing the internal flow of funds for science within various sectors and recommending a future pattern for Ghana, the PAG will review potential sources of external and internal funding to support Ghanaian science and technology. Funding arrangements and opportunities with respect to multi-national and bilateral donors, in both the private and public sectors, will be examined. The result will be a detailed analysis of science funding for the future, and a series of specific recommendations to the CSIR on national policies and approaches for funding and management sciences and technology in Ghana in the next decade.

2. NAS Advisory Services

Technical support for the work of the PAG in the three studies described above, and also in the discharge of their duties in other areas, will be provided by the U.S. National Academy of Sciences which has worked with the CSIR since 1970. The predominant science policy orientation of the NAS, and its long and extensive experience with the funding and management aspects of cooperative science programs, makes it an excellent counterpart for a body such as the PAG is designed to be.

3. Budgetary Requirements

(a) PAG Analytical Studies: AID will provide support for the three analytical studies to be undertaken by the PAG (including consultations and seminars) to analyze the scientific problems, potential science applications and alternative policies and program strategies, and to make recommendations to the CSIR. Funds will be available for background data collection and the publication and dissemination of the results of the analysis. Breakdown estimates for each of the three studies are:

(1) Travel and per diem for four U.S. consultants--two week visits/consultation in Accra	
(\$6,000 x 4)	\$24,000
(2) Pre-conference data collection and analysis, including travel principally to support the science funding analysis)	4,000
(3) Publication of Final Reports	<u>2,000</u>
Total	\$30,000

(b) NAS Advisory Services: \$25,000 in grant funds will be used to cover costs for NAS members involved in CSIR-PAG activities

over the three years.

IV. IMPLEMENTATION PLAN

Immediately after PROP approval, a grant agreement will be signed between the U.S. and the Ghana Government, with executing responsibility vested in the Executive Chairman, CSIR. The grant will provide \$475,000 over a three-year period for the demonstration desertification project; \$90,000 to support the new Planning and Analysis Group of the CSIR to carry out three analytical studies; and \$25,000 for NAS Advisory services.

The implementation plan and schedule is as follows:

1. Year 1

- | | |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| (a) PROP reviewed and approved (February 1975) | AID/W |
| (b) Grant Agreement prepared and signed | USAID/CSIR |
| (c) Initial funds transferred under line of credit to provide <u>operating funds</u> to the Program Management Group (CSIR/PMG) for the desertification study (based on detailed budget provided by CSIR) | USAID/CSIR |
| (d) Preparation of task descriptions by CSIR for desertification research areas based on team report and solicitation of proposals from Ghana science community | CSIR/PMG |
| (e) Review, evaluation and selection of desertification research proposals; integration into single program element; detailed budgeting; and submission to AID/W for approval | CSIR/PMG |

- (f) Transfer of grant funds to support initial component of operational desertification research program
(NOTE: CSIR will probably submit total research requirement in discrete packages at different times) USAID
 - (g) Desertification research initiated by Ghanaian institutions Ghana Institutes
2. Year 2
- (a) Desertification Research continues Ghana Institutes
 - (b) First "Integrating and Evaluation" seminar for desertification study held in mid-year CSIR/AID
 - (c) PAG initiates analysis of funding of science and technology in Ghana, with NAS assistance, following submission of study plan and budget to USAID/Ghana for approval PAG/NAS
 - (d) NAS is used to assist CSIR and PAG on ad hoc basis for other tasks CSIR/NAS
3. Year 3
- (a) Desertification research continues toward completion at end of year Ghana Institutes
 - (b) PAG initiates two specialized policy and program analysis with NAS assistance following submission of study plans and budgets to USAID/Ghana for approval PAG/NAS

(c) Final "Integrating and Evaluation"

seminar for desertification this one

involving independent reviewers

CSIR/AID

As noted above, the PAG will undertake the first of the three studies (i.e., Science Funding and Management during the second year of the grant program, and the remaining two during the third year. This recognizes the fact that the analytical work should take advantage of the demonstration desertification project, and that the latter will not be well enough advanced before the second year of operation. Secondly, the PAG, as a newly established body, must be given the chance of starting slowly so as not to diminish the quality of its work. It was for the latter reasons that the program is limited to three analyses, although the NAS and the CSIR have previously identified upwards of 15 priority study areas.

V. PROJECT BACKSTOPPING

Although the project is designed to emphasize reliance on Ghanaian scientists and institutions, U.S. support will be required at various stages of the effort, particularly during the initial period of the desertification study when the administrative and managerial policies and procedures are elaborated and first put into operation.

1. U.S. Consultants

(a) Desertification Study (Project Element #1)

A minimum of U.S. consultants are included in the project design, but some will be needed to support specific components. To facilitate the acquisition of U.S. experts and the contractual process, it is proposed that a single contract be given to the University of Arizona to handle

all aspects of external project backstopping, both the managerial and technical scientific components.

The University of Arizona is in an excellent position to do this by virtue of a special relationship it has developed with the CSIR Executive Chairman and its Secretariat, as well as with senior officials at various Ghanaian science institutions. Dr. Jack Johnson, Director of the Office of Arid Lands Studies, University of Arizona, prepared the initial consultant report on "Drought in the Ghana Savannah" (May 1974) and, at the virtual insistence of the CSIR, was leader of the U.S. expert group that participated in the October-November 1974 desertification project design meeting in Accra.

Under terms of the grant, the CSIR will contract with the University of Arizona's Office of Arid Lands Studies for 8½ man-months of U.S. expertise (at a cost of \$45,000) over the three year duration of the project. This will provide for a major U.S. input into CSIR proposal evaluation and project programming and budgeting during the first stages of the activity (estimated 2 U.S. experts for a combined total of 6-8 weeks); 1-2 week evaluation and guidance visits by individual consultants at 6 month intervals; and provision of necessary short-term technical experts to assist with the research investigations on an "on-call" (by CSIR) basis over the life of the project (not to exceed an agreed upon funding limitation). It is anticipated

that Ghanaian capabilities will have to be supplemented by U.S. scientists in the following areas: (a) range ecology planning and analysis in support of the Overgrazing-Deforestation area; (b) hydrogeology; (c) systems engineering; and (d) remote sensing. These costs are included in the various research budgets. While contracting arrangements for providing U.S. consultants will be solely limited to the University of Arizona, it is recognized that as the Tamne River Basin desertification subactivities develop, CSIR may require assistance in specialized areas of research which cannot be provided directly by the University. In this event, the University of Arizona will make every effort to obtain the services of specific individuals from other U.S. institutions as designated by CSIR. A provision to this effect will be included in the contract with Arizona in order to ensure that technical advisory services will be available to the Ghanaians from a variety of U.S. sources.

The rationale for utilizing the University of Arizona extends beyond the University's prior involvement in the preliminary phases of the desertification project. There is also the availability on the new five-year 211(d) grant in the area of Integrated Management of Natural Resources (in semi-arid lands) recently awarded to the University of Arizona. The objective of the 211(d) grant is to build University capabilities

in the area of integrated, multidisciplinary research applied to semi-arid lands, a subject matter orientation which parallels the thrust of the Ghana desertification project. The 211(d) program envisions building University capabilities by carrying out a series of activities which include conduct of overseas seminars, development of pilot training programs, operation of a centralized information program for the U.S., and advisory assistance to AID on the sources of U.S. talent. Since Arizona had already planned to work in Ghana (having identified it as one of a series of countries for 211(d) linkages), it is possible to draw upon this linkage to support the desertification project. For example, an Arizona agricultural economist will be in Ghana for 4 weeks in January under the 211(d), and could assist the Desertification Program Coordinator with the initial work on the solicitation of research proposals from the Ghanaian science community.

In addition, the National Academy of Sciences has volunteered to assist the CSIR with the identification and involvement of U.S. scientists; and AID's Office of Science and Technology (TA/OST) is also willing to serve as a technical backstop, source of advice, and switchboard for the CSIR to use to obtain the desired U.S. technical assistance to be financed under the grant. The CSIR will directly contact these offices

if the need arises.

(b) Science Policy Planning and Program Analysis (Project Element #2)

Since the studies to be carried out by the PAG involve the analysis and planning of national science policies and programs, the National Academy of Sciences, through its Board on Science and Technology for International Development, will organize and provide the U.S. scientific input given their past and ongoing international efforts in this area. Funds to support local costs in Ghana for NAS participants have been included in the grant. The CSIR has expressed its interest in continuing its past relationship with the NAS, and its confidence that joint CSIR/PAG-NAS studies will be productive. The AID/W office of Science and Technology is also prepared to fill gaps and to advise and assist the CSIR as required.

VI. Project Evaluation

Periodic evaluation of the project is particularly important because of the dependence of Project Element #2 on the results of the demonstration desertification research study. As a result, several mechanisms will be utilized to evaluate this project. The desertification demonstration study, the major project component, includes provision for visits by University of Arizona scientists at six month intervals for review and advisory purposes. Each will be required to submit an evaluation report which will describe progress to date in comparison with the implementation

schedule, and identifies problems which have emerged or are foreseen. Secondly, two major seminars are planned - one at the halfway point and one towards the end - to bring the Ghanaian principal investigators together with the Project Management Group to review progress and to integrate the individual study elements.

An AID evaluation of the total grant project will be carried out as part of the second major seminar. It will provide a comprehensive overview to both the CSIR and USAID/Ghana of the progress achieved in science research management and increased knowledge of the desert encroachment problem, its causes and possible remedies. The analysis of CSIR's management problems identified in this document (PP 1, 5 and 33) and in various NAS reports, the Northeast Ghana Savannah Research Report and the Socio-Economic Data Base Compilation will form the point of departure/baseline data for the evaluation. AID will fund the integrating and evaluation seminars under the grant (with the exception of the participation of AID/W or outside, independent evaluators whom AID will finance under a separate mechanism).

In addition, the evaluation process will include an annual project evaluation (PAR), as described in Supplement I of AID Manual Order 1026.1, assessing progress towards the outputs, purposes and goals set forth in the logical framework with special emphasis on fulfillment of conditions specified in the "End of Project Status." The first PAR review will be conducted within one year after initiation of the desertification project.

VII. Relevance of the Fixed Amount Reimbursement Method

The fixed amount reimbursement method was considered in the context of alternative financial arrangements for implementation of this activity. Although the structure, timeframe for implementation (three years) and relatively low cost (\$590,000) the project might appear on the surface to make it appropriate for fixed amount reimbursement financing, a lengthy review of the criteria and procedures of the method led to the following conclusions: (1) the project does not fully meet the specific requirements of the method, and (2) application of the method to the project would very likely result in a slow, ineffective system of research management.

The reasons for these conclusions are as follows:

- (a) The Development Applications of Science and Technology project does not have a small self-contained element which would be meaningful in itself regardless of whether other sub-elements are actually undertaken and completed. Each element of the project is supportive of other essential elements by providing specific insights and data on the desertification process in Northeast Ghana and the requirements for effective planning, management, coordination and funding of multidisciplinary research programs. In addition, the implementation plan requires initiation of research activities in each of the five major sub-areas during the first year of operations and continuation for the three-year life of the project, thus making identification, financing and completion

of discrete sub-elements through use of fixed amount reimbursement exceedingly difficult.

- (b) CSIR does not have, as is assumed under fixed amount reimbursement, sufficient funds and an experienced staff to undertake this activity in the absence of AID/GOG financial support. In fact, lack of funds and limited managerial experience have been two major weaknesses of CSIR to date and are just the chief defects which this project is designed to remedy. Given CSIR's lack of funds, early initiation of research activities would require it to either obtain an advance of funds from AID and assume the risk for repayment or devote considerable effort to seeking the Government's approval of a budget which may not be fully reimbursed by AID. It is almost certain that the project would experience several months delay while the budgetary processes of the Government are being completed. It is very likely that a prolonged delay would interrupt the schedule for completion of research activities, sharply reduce current expectations regarding the effective role of CSIR as the principal agency for coordinating and managing development-oriented research programs, and have a negative impact on the CSIR associated institutes with regard to participation in the program.
- (c) Use of the fixed amount reimbursement method would also require USAID/Ghana and/or the University of Arizona to conduct frequent inspections of sub-elements of the project to determine compliance with agreed plans and specifications. USAID/Ghana

plans to review carefully the individual research packages and to closely monitor implementation of the project to ensure conformity with Agency policies and procedures. The University of Arizona (the contractor) will closely follow the rate of progress towards the achievement of stated objectives and will provide short-term technical experts and guidance in the areas of budgeting, programming and management. These inputs plus periodic assistance from NAS and USAID/Ghana backstopping are considered sufficient to ensure maximum effort without disrupting the special emphasis which this activity places on development of a cooperative relationship with and between Ghanaian scientists and institutions. Under the fixed amount reimbursement method, USAID/Ghana would have to carry out several reviews (rather than just one) of the individual research packages as well as undertake frequent field inspections to determine conformity with agreed research plans and schedules. These review and inspection functions cannot be assigned to the contractor because the project involves only $2\frac{1}{2}$ man-months of contractual services over the three year period of implementation, much of which will be concerned with technical and managerial considerations. Expansion of the proposed contract to permit University of Arizona personnel to carry out the monitoring functions required under fixed amount reimbursement would necessarily result in a substantial increase in project costs and duplication of many of the control, administrative and

inspection functions of the Program Management Group and the Project Coordinator.

In short, application of the fixed amount reimbursement method to this activity would delay initiation of project activities and impose additional financial risks on the recipient organization at a time when it is preparing to undertake a new program already matching AID's contribution on a one to one basis. It would also require the field Mission to expend considerable personnel resources in monitoring project implementation. Since the project does not involve physical construction or regular production of tangible outputs, there would be greater scope for disagreement between the field Mission and CSIR as to what should or should not be reimbursed.

VIII. ROLE OF WOMEN IN THE PROJECT

To the maximum extent feasible, CSIR will make a special effort to involve qualified women scientists in every aspect of the project. It is anticipated that such involvement will include employment opportunities as well as active and continuous participation in the analysis, planning, management and research activities of the PAG and the PMG. CSIR and its associated institutes will take whatever steps are required to ensure that qualified women are considered for both profession and clerical position as these relate to project implementation. In addition, CSIR will make a special effort to identify and select women scientists for participation in the training activities to be carried out under this project.

IX. RELATIONSHIP OF GRANT PROJECT TO THOSE OF OTHER DONORS

The U.S. Government has provided assistance to a number of science and technology projects in Ghana since the mid-1950's. Presently, U.S. assistance is being provided through: (1) USAID/Ghana-funded consultancies (e.g. Dr. Jack Johnson on drought problems); (2) AID/W-funded activities (e.g. NAS-CSIR consultations, Arthur D. Little, Inc., annotated bibliography on desertification); and (3) the U.S. Peace Corps.

While other external donors have not provided assistance to multi-disciplinary, development-oriented research programs in Ghana, several donor agencies are assisting the Government to carry out economic development projects in the geographical area selected

for the Northeast Ghana Savannah Research Project. The Government of West Germany is supporting a fertilizer project in the North.

Although this has been mainly concerned with increasing the productivity of large-scale rice farmers, the focus is now shifting to extension, research, processing, storage, seed and technology development in support of small farmers. It is expected that this project will be further extended to activities outside the agricultural sector including feeder road expansion, health, etc. The Germans are also supporting extension work on a regional basis in the North.

The World Bank/WHO is responsible for directing and coordinating the seven country, regional (Volta Basin) 20-year \$120 million onchocerciasis control project. This long term effort to eliminate the black fly from the riverine valleys in the Upper Region and resettlement of cleared areas involves participation by the United States and six other governments. The Government of West Germany is also providing assistance to health services in the Northern Region. The Government of Ghana has a variety of small irrigation projects and other activities at various stages of development and execution adjacent to the designated project area.

Obviously, the degree of success attained by other developmental activities may have some impact on the research activities contemplated in the implementation of the Northeast Ghana Deserification Research Project. For example, the target area for the IBRD/WHO onchocerciasis project includes the Tamne River Basin, and the ecological studies

carried out for that project in Northeast Ghana may contribute to, and supplement, the data collection phase of the AID-financed desertification study. Conversely, the research to be carried out under the desertification project will undoubtedly result in some analyses of interest to other donors. However, with the rather specialized focus and limited geographic concentration of this project, there would appear to be little duplication and overlap.

Annex A - Objectives of the Desertification Study

1. To strengthen the capability of the Ghanaian scientific community to conduct interdisciplinary research which contributes directly and significantly to the short-term solution of critical problems of socio-economic development ... particularly in the areas of agricultural production and the improved health and economic well-being of the peoples of the study areas.
2. To identify more clearly, analyze and enumerate the factors involved in possible desertification in the savannah zone of Northern Ghana.
3. To investigate and implement cultural and management practices which will halt and even reverse the trend toward increasing land degradation in the north-eastern area of Ghana, and with a constant view to improving the living standards of the rural people.
4. To design a coherent integrated programme which will stimulate and contribute to international programmes in this area, and will attract funds from a wide variety of sources.

Annex B - Management Structure of the Desertification Study

A. General

The program of research presented in this report is comprehensive, systematic, interdisciplinary, and offers promise of effective problem-analysis, feedback, and implementation on the many facets of problems in the Savannah Region of northeastern Ghana. Research management must be orderly, well-conceived, and continuous. An individual project, in some instances, may mesh into several other studies. Close coordination and communication must be maintained among researchers, and research resources must be conserved to avoid unnecessary duplication. Furthermore, the best research talent available within Ghanaian agencies, institutes, and universities must be drawn into the projects.

The project will undoubtedly lead to larger research and implementation programs which will require funding from multiple sources. The objective has been to design a comprehensive project, with the expectation that the Project Management Group and research Coordinator can identify, within the whole, groupings of projects that will, in themselves, lead to productive solutions. However, implementation of anything less than the total project will leave unresolved research problem awaiting in the future. While a small area of Ghana has been selected for intensive research, its implications extend into a much broader area of Ghana and the Sahel. Therefore, establishment of comparative research programs in other regions of northern Ghana is a desired objective, and other sources of funding to accomplish it should be sought if sufficient Ghanaian manpower is available.

The overall responsibility for management and administration of the Northeast Ghana Research Project (NCSRP) has been vested in the Executive Chairman, CSIR, acting through the Committee on Natural Resources of the Council for Scientific and Industrial Research. The membership of this Committee is broad, with representation from the Institute for Industrial Research, Ministry of Works and Housing, Ministry of Agriculture, Game and Wildlife Department, Geological Survey, Fisheries Research Unit, Soil Research Institute, Forest Products Research Institute, Institute of Aquatic Biology, Ghana Timber Association, University of Ghana (Legon), University of Science and Technology, and University of Cape Coast, and also a Secretary from CSIR. As the name and membership implies, the responsibilities of this Committee encompass a broad range of natural resources problems.

B. Project Management Group

Key to successful Management will be the establishment of a Project Management Group (PMG). The PMG should be of limited size, possibly five, and should be appointed by the Committee on Natural Resources. Service on the PMG should be for the duration of the project and its members should be appointed on the basis of their management abilities, not their scientific skills.

Further, PMG members should not be put in the uncomfortable position of representing an agency which might have a vested interest in one of its decisions. Scientific knowledge should be a secondary consideration

regarding PMG selection. The PMG will always have access to scientists for advice, and often practical, management-oriented non-scientists, ask harder questions and are tougher on budget decisions than are scientists. This is not to say, however, that scientists should be omitted from the PMG; reasonable balance between project management oriented non-scientists, and scientists should form the PMG.

In the early stages of project management it is suggested that a qualified external consultant participate in the proposal review and evaluation process and assessment of research progress.

The Project Management Group will assist the Coordinator in the many management and policy decisions that are essential in the NGSRP. It is expected that this group will develop the overall policy, major budgetary allocations, and operating procedures for program management.

The following describes the responsibilities of the Project Management Group:

1. Preparation of detailed plans and policies for management of the Northeastern Ghana Savannah Research Project (NGSRP).
2. Solicitation, review, and approval of projects which specifically address the interdisciplinary problem-solving orientation of the overall NGSRP.
3. Synthesis of research projects into integrated programs, including approval of necessary budget details, for submission to funding sources.

4. Approval of funded projects, and development and implementation of procedures for fund disbursement and project accounting.

5. Recommendation and monitoring of management policies, supervision of project coordination, and maintenance of liaison with project leaders of the NGSRP.

6. Review of Project reports, publications and special seminars, and preparation of PMG reports as required by the Committee on Natural Resources.

C. Project Coordinator

Essential to day-to-day project management will be a Project Coordinator, administratively attached to the CSIP Secretariat. The Coordinator must have a service-above-self orientation, since the scientific and project achievements must be credited to the individual scientists. He must be capable of exercising decisive leadership while at the same time be a diplomatic "go-between" as he tries to pull different disciplines and agencies together to function as a cohesive working unit. Further, he should have a good scientific educational background so that problem analysis is clear to him, although such a person could come from a wide variety of disciplines. The Project Coordinator will:

1. Serve as, an ex officio member of the Project Management Group.
2. Be the overall project manager and responsible for carrying out programs and policies developed by the Project Management Group.

3. Manage operational details on a daily basis and be the chief contact person on matters relating to the project.
4. Maintain close working relationships with project leaders and encourage a spirit of cooperation among them.
5. Exercise fiscal control over approved projects.
6. Encourage and assist in project reporting and publication.
7. Maintain appropriate liaison with administrative officers in participating agencies, universities, and institutes.

The Coordinator's office must have funds for the necessary administrative and clerical help, equipment, supplies, and other expenses.

D. Action Plan

The above description assigns responsibilities, but does not suggest how the responsibilities will be put into an action plan. A general operating procedure can be described, recognizing that situations may arise that will dictate alternative management pathways.

The Northeast Ghana Savannah Project described in this report presents a comprehensive work plan involving several sub-project and budget estimates, but lacks details as to who will be sub-project leaders, what their working relationships will be, and what specific budgets will be approved for projects. It is expected that the Project Management Group will use this document as a guide for determining groupings of sub-projects and exact budgetary requirements. After

adequate financial support is assured, appropriate scientists in Ghana will be notified of the opportunity for participation in the Project. The notification in most cases will define a logical grouping of sub-project objectives and call for single sub-project proposals involving more than one discipline. Competition between institutions and scientists for the funds will be encouraged.

The Project Management Group will then, as stated in their responsibilities, make the decisions as to which sub-projects to approve from among those submitted. Those relating to a particular broad program area will be integrated, and the package of related sub-projects carefully budgeted and used as a basis for requesting release of funds from donor agencies.

E. Principal and Co-Sub-Project Leaders

The method of sub-project preparation just described requires that the interdisciplinary team which decides to undertake a sub-project must actually work together from the start, even during the sub-project design stage.

The Principal Sub-Project Leader, in addition to having the same responsibilities as those listed below for the co-Sub-Project leaders will be the scientist responsible for ensuring close interaction by the team of scientists. As the project proceeds, progress reviews should be required by the Principal Sub-Project Leader. He will be the individual responsible for compilation of periodic and final progress reports for the total project and their transmittal to the Coordinator.

He may also be asked by the Coordinator to represent the project team on matters relating to the mesning of the project with other projects within the total NGSRP.

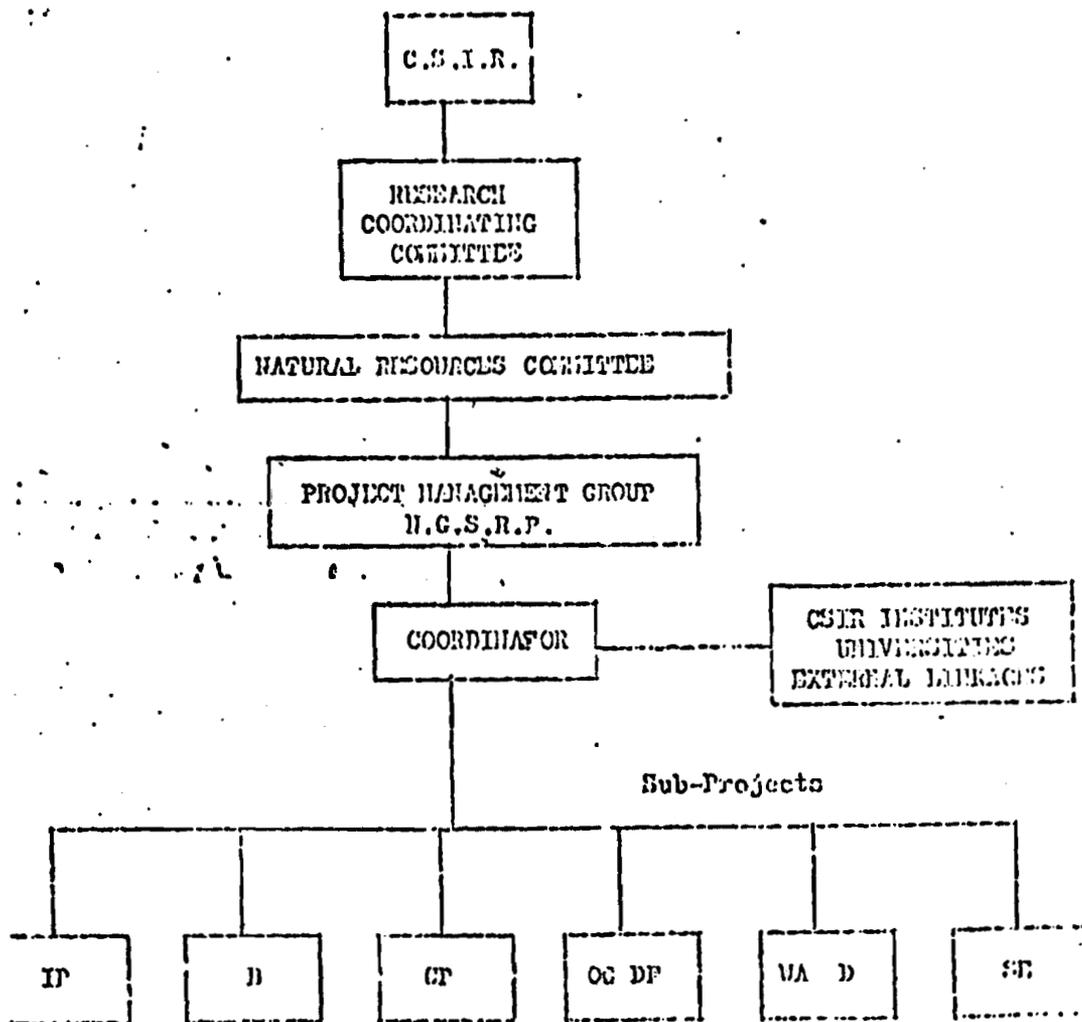
The co-Sub-Project Leaders will be responsible for:

1. Joint participation in preparation of a project statement for . submittal to the Coordinator. This statement will clearly define objectives, procedures, and proposed budget in such a way that contributions of each co-leader to the total sub-project as well as his budget request, are specifically stated.
2. Proceeding with his individual research component as cutlined in the project.
3. Obtaining approval from the Principal sub-Project Leader and Coordinator for essential major deviations from the project statement.
4. Proper use of the share fo funds alloted to his research.
5. Appropriate coordination with other members of the Team.
6. Progress reports and a final report on his share of the project for inclusion in the total project report.
7. Preparation of publications giving scientific information or implementation details that are discovered from the research.

F. Organization Chart

Proper management of the NGSRP, with all participants fulfilling their share of responsibilities in a cooperative effort, will insure the success of the project.

The following chart depicts the recommended working relationships:



- B - Burning Sub-Project
- CP - Cultivation Practices Sub-Project
- CGDF - Overgrazing and Deforestation Sub-Project
- VAD - Water Availability and Distribution Sub-Project
- SE - Socio-Economic Sub-Project
- IP - Integrating Sub-Project

Annex C - Program Description

The Program financed hereunder is designed to strengthen the capability of the CSIR to organize and the Ghanaian scientific community to conduct interdisciplinary research which contributes directly and significantly to the solution of critical problems of socio-economic development. In particular the program will institutionalize science program planning and policy development, strengthen the CSIR's international linkages, and in particular identify more clearly the factors involved in the possible desertification in the savannah zone of Northern Ghana, proposing cultural and management practices to arrest the trend toward increasing land degradation in that region.

AID is prepared to finance Program Activities in the above three sectors up to the following funding levels:

1. Support and promotion of the Planning and Analysis Group (PAG) activities: \$90,000
2. Support of the cooperative relationship between the CSIR and the National Academy of Sciences (NAS): 25,000
3. Support of the study of desertification in Northern Ghana:
 - Socio-economic Relationships \$ 64,500
 - Water Availability 101,000
 - Overgrazing and Reforestration 84,500
 - Burning 35,000

-Cultivation Practices	\$ 65,000
-Integrating Project	30,000
-Management Operating Expenses	<u>95,000</u>
Desertification Total:	<u>475,000</u>
Project Total:	\$590,000

Annex D - Ghanaian Science Institutional Framework

The Ghanaian Council for Scientific and Industrial Research (CSIR) was established by an October 1968 decree (NLCD 293 Article 4) which transferred to CSIR functions, activities and programs which had been carried out by the Ghana Academy of Sciences. The Organization is governed by a 26-member council drawn from organizations and agencies which are involved in scientific and technological research or have an active interest in the programs of the research institutes. CSIR's major responsibility is to advise the Government on scientific and technological advances likely to be of importance to national development, particularly as these affect the utilization and conservation of the natural resources of Ghana. For purposes of administration, it is a unit of the Ministry of Economic Planning.

In order to improve its research coordination and policy advisory functions and to review the utilization of Ghana's land, forest and river resources, CSIR, May 1971 established the Natural Resources Committee. This Committee has been given special responsibilities for conducting and coordinating multi-disciplinary-oriented natural resources studies. It is composed of 12 members drawn from institutions of higher learning, government agencies and departments and the private sector.

Shown below is a list and estimated budget (1974-75) for CSIR research institutes, units and projects:

Total: ₵9,300,000

1. Crops Research Institute	₵2,300,000
2. Animal Research Institute	1,100,000
3. Soils Research Institute	1,100,000
4. Buildings and Roads Research Institute	1,900,000
5. Food Research Institute	700,000
6. Institute of Aquatic Biology	300,000
7. Institute of Standards and Industrial Research	400,000
8. Water Resources Institute	500,000
9. Forestry Products Research Institute	1,000,000
10. National Atlas project	N/A
11. Herbs of Ghana project	N/A

The Universities, the Ghana Atomic Energy Commission, the ministries and government corporations have their own scientific and technological research programs which lie outside the direct control of CSIR and its associated institutes. Most of the research being conducted at the universities is geared to curricula and post graduate training requirements. A number of government departments and ministries, principally the Departments of Geological Survey, Meteorology, Survey and Forestry and various departments of the Ministry of Agriculture have extensive research programs. However, with the exception of the Cocoa Research Institute, the public corporations have not been able to build up the staff and facilities necessary for engaging in scientific investigations and experimental work.

Annex E

Procurement Source Authorization

Summary Information

Cooperating Country: Ghana
Authorizing Document: PRCP (attached)
Project: Developmental Applications of Science and Technology
Nature of Funding: Development Grant (FAA Sections 106 and 639A(b))
Description of Goods: Four wheel-drive vehicles and research supplies
and equipment
Approximate Value: \$50,000
Probable Source: Geographic Code 935 Countries including Ghana

Discussion: Achievement of the objectives of the Developmental Applications of Science and Technology project will require procurement of new equipment and research materials and supplies, including vehicles for logistical support. The Northern Ghana Savannah Research study, the largest component of the project, and the only one requiring equipment and supplies, will be carried out in the extreme northeast section of Ghana, along the border with Upper Volta, and will therefore require extensive vehicular support for the field research teams. In addition, research materials and supplies associated with the collection and analysis of scientific data on soils, water, vegetation and meteorological parameters will be required in sufficient quantity and on a timely basis to enable research activities to be completed in an orderly sequence. Costs of all equipment and supplies which will be required is estimated at approximately 35% (\$142,000) of the total cost of the Northern Ghana Savannah study.

The desertification study is being funded entirely by funds authorized under section 639A(b) of the Foreign Assistance Act of 1961, as amended. That section expressly provides that assistance to the drought-stricken nations of Africa may be provided "notwithstanding any prohibitions or restrictions

contained in this or any other Act....". While much of the required new equipment, instrumentation and supplies can and will be obtained in the U.S., the requirement of U.S. procurement in the case of several anticipated requirements, particularly four-wheel drive vehicles and selected analytical instruments, would constitute a severe restriction against extending the kind of assistance necessary here.

Compliance with FAA Section 636(i) (procurement of U.S. manufactured motor vehicles) would constitute an especially severe restriction. The circumstances and location of the field work for the study require rugged four-wheel drive all-terrain vehicles with locally available spare parts and maintenance. There are no U.S. manufactured vehicles which meet these requirements.

This same situation is expected to hold true for certain other equipment and instrumentation needed for the study. That is, spare parts and servicing may be needed in-country. Also, delivery lead-time for U.S. equipment may be prohibitive and create an untenable burden on the project. Selection and procurement of such non-U.S. equipment shall be on an item-by-item basis and shall be as jointly agreed by the Government of Ghana and USAID/Accra.

Authorization is thus requested for procurement of vehicles and selected equipment from countries included in AID Geographic Code 935 (including Ghana) in a total amount estimated not to exceed \$50,000.

Annex F

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK MATRIX

1. Life of Project
From FY 75 to FY 79
2. Total U.S. Funding:
\$590,000
3. Date Prepared:
November 15, 1974

Project Title & Number: Development Applications of Science and Technology -
641-15-110-069

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	IMPORTANT ASSUMPTIONS	MEANS OF VERIFICATION
<p>A.1. <u>Goal Statement</u> - To promote economic development in Ghana through increased application of science and technology.</p>	<p>A.2. <u>Measures of Goal Achievement</u></p> <ol style="list-style-type: none"> a. Evidence of increasing collaboration and communication between research institutes and the end-user community. b. Number of high priority development areas which are beneficiaries of successful adaptation and application of science and technology. c. Number of new coordinated, inter-institutional development projects of a multidisciplinary nature designed and implemented through the CSIR mechanism. d. Expansion of information exchange activities with non-Ghanaian institutions regarding techniques for adapting and applying science and technology to national development problems. 	<p>A.3. <u>Assumptions of Goal Achievement:</u></p> <ol style="list-style-type: none"> a. The Government of Ghana will continue to recognize the vital role of science and technology in economic development and will encourage policy planners and project managers to place greater reliance on a central science policy planning body. b. The initial efforts at organizing and implementing the cooperative scientific program envisioned in this project will be successful and will receive full support from the Ghanaian scientific community. 	<p>A.4. a. Records of CS associated institutes.</p> <p>b. GOG records p annual and sp reports of CS associated institutes.</p> <p>c. CSIR records new research projects.</p> <p>d. USAID records evaluation rep</p> <p>e. Assessment of increased utilization of both traditional and modern technol</p> <p>f. Records on Ghanaian participation in international scientific programs.</p>

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	IMPORTANT ASSUMPTIONS	MEANS OF VERIFICATION
	<p>A.2. (Cont.)</p> <p>e. Expanded application by Government agencies of scientific and technological methods appropriate to Ghana in the areas of food production, nutrition and health.</p> <p>f. Increased reliance by the Government on the Council for Scientific and Industrial Research (CSIR) for appropriate inputs into national development policy and for guidance on the research requirements for implementation of economic development programs.</p> <p>g. Expanded participation by Ghanaian science institutions in international, regional and bilateral science programs.</p> <p>h. Increased utilization of Ghanaian scientific manpower and resources for identifying, defining and testing the application of technological research to development problems.</p>	<p>A.3. (cont.)</p> <p>c. CSIR's central administration of a research program will be based on sound management considerations, and will result in increasing reliance of the science community on CSIR.</p> <p>d. Sufficient support from donors and collaborators can be mobilized at a sufficient level to permit development oriented science programs to be organized and implemented on a timely basis.</p> <p>e. Ghanaian research institutes will choose to combine resources to address national priorities, and will operate multidisciplinary research programs on a fully cooperative basis.</p> <p>f. Lack of funding and insufficient coordination of research programs on important multidisciplinary development problems have been critical constraints on CSIR's capacity.</p>	<p>A.4. (cont.)</p> <p>g. Publications and analysis of research results</p>

A.3. (cont.)

to develop and apply appropriate technologies to Ghana's major development problems.

B.1. Statement of Project Purpose: To strengthen Ghana's central institutional mechanism for planning, coordinating, implementing and applying cooperative, multi-disciplinary programs of science and technology to national economic development priorities.

B.2. Conditions Expected at the End of the Project:

- 1a. Integrated series of inter-institutional, multidisciplinary science and technology sub-projects related to desertification have been successfully carried out under CSIR auspices and administration. (Success as measured by accomplishment of the objectives outlined in Annex A - Objectives of the Desertification Study).
- b. Individual feasibility studies have been carried out by the CSIR in other areas to define needs and possible expanded roles for science and technology.
- c. Appropriate follow-up projects have been designed in these other priority areas by the CSIR drawing on experiences gained from the desertification project.
- d. CSIR is prepared to advise the Government on the feasibility of centrally funded.

B.3. Basic Assumptions for Achievement of Purpose:

- a. By carrying out a successful desertification project CSIR will acquire the experience, managerial capacity and internal support necessary for design and management of multidisciplinary research programs in other priority development areas.
- b. The desertification project will be assigned sufficiently high priority by the Government and its science community to displace other priorities and thereby permit top-level Ghanaian personnel to participate.
- c. Combined Ghana-AID funding is sufficient to solicit the interest and participation of a spectrum of Ghanaian science and research institutions.

- B.4. a.** Review of investment by Ghana Government in implementing program in the north to address land degradation.
- b.** CSIR reports or research progress joint U.S.-Ghana seminar to intend and evaluate project results
- c.** Review of related program activities implemented with other donor support since initiation of this project.
- d.** CSIR progress reports, plus U.S. and AID participation in sub-project design studies; overall science technology evaluation.
- e.** AID evaluation of CSIR performance and progress reports.

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	IMPORTANT ASSUMPTIONS	MEANS OF VERIFICATION
	<p>B.2. (cont.)</p> <p>projects in the areas of agricultural machinery and the use of agricultural wastes or other topics as a result of analytical work undertaken by the PAG.</p> <p>e. Ghanaian scientists equipped with expanded skills in the application of new technologies and methodologies for resource inventory, evaluation and problem solving.</p> <p>2. Increased focus by Ghana Government on the causes and potential future impact of desertification phenomenon in the Northeast and the Sahel to the north, and its influence on the long-term viability of that region.</p> <p>3. Participation by Ghana in the semi-arid lands component of UNESCO's Man and Biosphere Program, and in regional and international activities related to Sahelian drought rehabilitation.</p>	<p>B.3. (cont.)</p> <p>d. The PAG will be established in early 1975 and will receive support from the Ghana Government and its science institutions.</p>	<p>B.4. (cont.)</p> <p>f. Reports on research and technology applications prepared by participating agencies and individuals and AID monitoring of CSIR-U.S. seminar convened to synthesize and evaluate results of individual studies.</p> <p>g. AID assessment use of new technologies in conduct of project.</p> <p>h. Review of Ghana participation in the Man and the Biosphere program and the exchange of information with non-Ghanaian institutions in the field of arid land management</p>
<p>C.1. <u>Statement of Project Outputs:</u> <u>Output and Output Indicators:</u> a. Development of adequate capacity within CSIR to plan, design, and manage development-oriented scientific research progress.</p>	<p>C.2. <u>Magnitude of Outputs:</u> a. Magnitude unquantifiable/demonstration project completed after third year.</p>	<p>C.3. <u>Assumptions for Achieving Outputs:</u> a. CSIR is committed to initiate and administer a research grant program in accordance with guidelines.</p>	<p>C.4. <u>Verification Outputs:</u> a. AID monitoring and evaluation of CSIR performance in consultation with</p>

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	IMPORTANT ASSUMPTIONS	MEANS OF VERIFICATION
<p>C.1. (cont.)</p> <p>b. Completion of one science applications demonstration project (desertification).</p> <p>c. Increase in Ghanaian scientific manpower experienced in, and capable of, employing new approaches to natural resource planning and management.</p> <p>d. Expanded Ghanaian participation in international and regional programs on semi-arid lands.</p> <p>e. Documentation of the causes, present impacts, and future trends in desertification problems of northeast Ghana.</p> <p>f. Analysis of opportunities for increased use of science and technology in two other development sectors.</p> <p>g. Completion of a study to restructure research</p>	<p>C.2. (cont.)</p> <p>b. One dozen Ghanaians trained through specialized courses by end of third year; others receiving on-the-job training and experience in multidisciplinary research management and coordination through their participation in the desertification study.</p> <p>c. Approximately 12 Ghana science managers and scientists involved in UNESCO's MAB Program, and in regional workshops on Sahel drought problems.</p> <p>d. Research reports from each of the desertification sub-projects, beginning at end of first year; and a comprehensive, integrated analytical report available by end of year 3, in part the results of a final wrap-up seminar.</p> <p>e. Documented analytical reports by the PAG to the CSIR in two other areas selected for policy and program analysis (e.g., agricultural machinery and use of agricultural wastes).</p> <p>f. PAG report on science funding in Ghana.</p>	<p>C.3. (cont.)</p> <p>provided by the U.S. Ghana project design team.</p> <p>b. The government and the Universities will give the desertification project high priority in the allocation of resources and the assignment of personnel to carry out research activities.</p> <p>c. The PAG will be staffed and operating during the next year.</p> <p>d. The request for research proposals will bring forth the quality and level of response necessary to carry out the spectrum of desertification project elements.</p> <p>e. Ghanaian science institutions and scientists are interested in participating in international and regional programs.</p> <p>f. High quality backstopping will be provided by the University of Arizona for the desertification project by the NAS for the three analytical studies undertaken by the PAG.</p>	<p>C.4. (cont.)</p> <p>the NAS and other U.S. institutions involved in monitoring and evaluating the project.</p> <p>b. AID review of list of Ghana scientists involved in overseas training and those directly involved in the multidisciplinary desertification study.</p> <p>c. AID consultation with UNESCO staff and review of attendance lists meetings and seminars.</p> <p>d. Quality of research study reports as reviewed by the NAS and University of Arizona Office of Arid Lands Studies</p> <p>e. Review of project funding by UNESCO, UNDP, FAO, etc.</p>