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AGENCY FOR INTERNATIONAL DEVELOPMENT

PROJECT PAPER FACESHEET

1. TRANSACTION CODE: A (A = ADD, C = CHANGE, D = DELETE) 60p

PP

2. DOCUMENT CODE: 3

3. COUNTRY/ENTITY: MALI

4. DOCUMENT REVISION NUMBER:

5. PROJECT NUMBER (7 digits): 688-0205

6. BUREAU/OFFICE: A. SYMBOL: AFR; B. CODE: 1

7. PROJECT TITLE (Maximum 40 characters): MALI LAND USE INVENTORY

8. ESTIMATED FY OF PROJECT COMPLETION: FY 78

9. ESTIMATED DATE OF OBLIGATION: A. INITIAL FY 77; B. QUARTER 4 (Enter 1, 2, 3, or 4); C. FINAL FY 78

10. ESTIMATED COSTS ($000 OR EQUIVALENT $1 –)

A. FUNDING SOURCE	FIRST FY B. FX	FIRST FY C. L/C	FIRST FY D. TOTAL	LIFE OF PROJECT E. FX	LIFE OF PROJECT F. L/C	LIFE OF PROJECT G. TOTAL
AID APPROPRIATED TOTAL	1,082	120	1,202	1,893	170	2,063
(GRANT)	(1,082)	(120)	(1,202)	(1,893)	(170)	(2,063)
(LOAN)	( )	( )	( )	( )	( )	( )
OTHER U.S. 1.						
OTHER U.S. 2.						
HOST COUNTRY		48	48		93	93
OTHER DONOR(S)	586		586	1,090		1,090
TOTALS	1,668	168	1,836	2,983	263	3,246

11. PROPOSED BUDGET APPROPRIATED FUNDS ($000)

A. APPROPRIATION	B. PRIMARY PURPOSE CODE	PRIMARY TECH. CODE C. GRANT	PRIMARY TECH. CODE D. LOAN	E. 1ST FY ___ F. GRANT	E. 1ST FY ___ G. LOAN	H. 2ND FY ___ I. GRANT	H. 2ND FY ___ J. LOAN	K. 3RD FY ___ L. GRANT	K. 3RD FY ___ M. LOAN
(1) FN	189	092		1,202		861			
(2)									
(3)									
(4)									
TOTALS									

A. APPROPRIATION	N. 4TH FY ___ O. GRANT	N. 4TH FY ___ P. LOAN	Q. 5TH FY ___ R. GRANT	Q. 5TH FY ___ S. LOAN	LIFE OF PROJECT T. GRANT	LIFE OF PROJECT U. LOAN
(1) FN					2,063	
(2)						
(3)						
(4)						
TOTALS						

12. IN-DEPTH EVALUATION SCHEDULED: MM 10 YY 78

13. DATA CHANGE INDICATOR. WERE CHANGES MADE IN THE PID FACESHEET DATA, BLOCKS 12, 13, 14, OR 15 OR IN PRP FACESHEET DATA, BLOCK 12? IF YES, ATTACH CHANGED PID FACESHEET.

1 (1 = NO, 2 = YES)

14. ORIGINATING OFFICE CLEARANCE

SIGNATURE: Ronald D. Levin

TITLE: Country Development Officer

DATE SIGNED: MM 11 DD 1 YY 76

15. DATE DOCUMENT RECEIVED IN AID/W, OR FOR AID/W DOCUMENTS, DATE OF DISTRIBUTION: MM 10 DD 1 YY 75

AID 1330-4 (3-76)

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ACRONYMS:

AID	Agency for International Development
ASECNA	Association pour le Securite de Navigation Aerien
BDPA	Bureau pour le Developpement de Production Agricole (France) (Assistance to Malian Peanut Production).
BRGM	Bureau pour le Recherche Geologique et Minerale
CIDA	Canadian International Development Agency
FAC	Fonds d'Aide et de Cooperation
FAO	Food and Agriculture Organization (UN)
FED	Fonds Europeen de Developpement
GOM	Government of Mali
IDA	International Development Association
IEMVT	Institut d'Elevage et de Medecine Veterinaire des Tropicaux
IRAT	Institut de Recherches Agronomiques Tropicales et des Cultures Vivrieres
ORSTOM	Office de Recherche Scientifique de Territories d'Outre-Mer
PID	Project Implementation Document
PP	Project Paper
PRP	Project Review Paper
WMO	World Meteorological Organization

B. RECOMMENDATION:

That the Government of the United States through AID grant the Government of Mali (GOM) $2,063,000 in services, commodities and training to implement a national land use potentials survey in Fiscal Years 1976 and 1977.

C. DESCRIPTION OF PROJECT:

This project is a multi-donor effort (Mali, the United States, and France) aimed at providing for the Malian Government a reconnaissance level (1:200,000) resource inventory and evaluation incorporating information about soils, vegetation, water resources and present land use. Information and data collected will be analyzed and evaluated, and expressed in terms of production potentials under present physical and human conditons, and at various levels of investments in development. The project also contains a training program which will develop Malian capability to undertake resource inventory and evaluation on an institutional basis. The Ministry of Production's Institute of Rural Economy is the implementing agency for the project. The work will be carried out by a multinational team composed of foreign technical advisers in the fields of soil science, range ecology, tropical agronomy, agricultural economics, rural sociology, and hydrology, with Malian counterparts for the foreign advisers. The counterparts will be both participants in the project and trainees. Four Malian counterparts will be chosen for graduate work in the United States and France under this project. The completion of the reconnaissance level resource inventory and evaluation with training to provide a Malian capability for larger scale work will provide the Government of Mali with a much needed and very valuable development planning tool.

D. SUMMARY FINDINGS:

It was determined that the technology involved is applicable and the best available, that the project is technically and financially sound, and that the GOM is fully receptive to the design of the project and desires that it be accomplished as soon as possible. It is anticipated that the project canbegin by January 1, 1977 and the resource inventory and evaluation completed within two years. The last participant receiving training abroad will have returned by July, 1980. Discussions with the French have led to the conclusion that assistance as previewed in this project proposal will be forthcoming. (Its accomplishment rests on the submission of a request by the GOM to FAC.) Therefore there are required actions prior to

signing the Project Agreement, which provide for (1) minimal acceptable levels of French technical assistance, and (2) an evaluation and monitoring plan developed jointly by the combined expertise from the donor countries and Mali. It is possible that some minor changes in the implementation plan may be required following development of the evaluation and monitoring plan. There are no issues other than the level of French technical assistance. The project meets all applicable statutory criteria.

E. PROJECT ISSUES:

1. Intent and capability of the GOM to manage and make use of the project's outputs on an institutional basis. The intent of the GOM to institutionalize the land use potentials inventory as an active step in development planning was explored in some detail. The place of the inventory in the national planning process as described below (page 21) was confirmed by the GOM. Subsequently, the GOM formally established a Planning Division in its Institute of Rural Economy, and established in that Division, a Natural Resources Planning Section which will be the seat of this project. (Annex D.)

2. Participation by the French: It is considered to be essential that FAC participate in the project because: (1) they have the expertise in tropical agronomy that is scarce in the United States, (2) they are already involved in related activities in Mali, (3) they have the capability to render the output information in the French language and, (4) they want to be involved. Their participation depends on a formal, priority request by the GOM. Such a request was made, although the response was favorable, the foremat of the participation remains to be worked out.

3. Extent of coverage north of the Niger River: Theoretically, as the average annual rainfall diminishes north of the Sahel, the differentiation in the soil is reduced and its alternative uses are limited; hence, as a rule little effort to classify such areas, i.e., north of the Niger River could normally be justified. However, the GOM believes that there are certain areas --- oases or near oases --- that will support livestock production. The degree of detail that can be justified for this area is an issue.

II. PROJECT BACKGROUND AND DETAILED DESCRIPTION:

A. BACKGROUND:

Mali, which lacks other known resources which can be exploited in the short-term, must continue to depend upon the agricultural sector for most of foreign exchange earnings and employment opportunities.

The GOM is making a serious effort to develop its agricultural and range resources as means of increasing food production, improving socio-economic status of the Malian people, and maintaining an acceptable trade balance. Ninety percent of Malian employment is land-based. The agricultural sector accounted for 50 percent of the GNP in 1969 and 43 percent in 1972. However, rural per capita income was estimated to be $38 in 1969 and $32 in 1973, with the drought accounting for the decrease. Food, fiber and animal products account for over 94 percent of the value of exports with dried fish accounting for most of the remaining 5 percent.

There is believed to be considerable potential to expand crop and livestock production.

There are 110 million hectares of land south of the 19th parallel receiving over 250 mm (10 inches) average annual rainfall, suited for agricultural or grazing purposes. Large portions of the country's higher rainfall areas are held in a sort of escrow by the tse-tse fly, which is the vector for trypanosomiasis, and cannot be fully exploited until cleared of the fly.

The Sudanian Zone of Mali has historically been a food surplus area exporting grain to deficit regions within Mali and in neighboring countries. For a combination of reasons, Mali became deficit in food production because output did not keep pace with the growth of demand. The reasons include the rapid growth of urban centers, a shift from food crops to export crops because of more advantageous prices and guaranteed markets, a probable (but poorly documented) decline in soil fertility and yields as the result of a shortened shifting cultivation cycle due to population growth and export crop expansion and the prolonged period of below average rainfall.

Because of deficits, 33 percent of earned foreign exchange was required for food importations in 1972. Because of favorable rainfall, most areas had abundant food crop harvests during the 1974/75 season.

For the livestock sub-sector, most of the rangelands were overstocked prior to the drought, contributing to the 25-30 percent decline in cattle numbers between 1968 and 1974. It will be extremely difficult to expand numbers or output beyond the 1968 levels in established grazing areas. As land under cultivation expands, if the Sudanian Zone and seasonally flooded lands are used for irrigated crops rather than dry season grazing, the national herd must either decline or new areas must be opened for grazing to Zebu cattle in the southern portions of Mali. These include zones where trypanosomiasis and onchocerciasis limit land use.

The priority problem faced by the GOM is the identification, evaluation and quantification of its developable resources in order to judge to what extent it can effectively respond to rural employment, national consumption and export requirements. The GOM's Five-Year Development Plan includes a ten-year projection of the livestock required for animal traction, domestic consumption and export. It is assumed that projections of required food production for consumer requirements also exist or will be prepared. Based on these projections and the quantitative, narrative and graphic description of the country's natural resources provided by the survey and considering the human resources and developed infrastructure the GOM will be in a better position to rationally allocate its scarce resources and make valid requests to donors to help fill resource gaps. The data provided by the survey will also permit the GOM to estimate the impact of specific activities and programs on the volume of agricultural outputs and be able to assign priorities among industries' sub-sectors, and projects and among project sites.

The proposed land use capability inventory will contribute to Malian and donor understanding of core development problems and alternatives of a short and long-term nature. It will provide information on units of land which are sufficiently homogeneous that it will be possible to estimate and then establish more nearly optimum cropping/grazing patterns. Alternative hypotheses are that: (a) farmers are currently

exploiting most of the best lands suited to dryland crop production and any expansion of land under cultivation implies use of more marginal lands or, (b) "large" areas of "good" land are currently underutilized which, if placed under cultivation, would increase total agricultural output for domestic consumption and export. It is known that there is a good correlation between land use capability without irrigation and population density but not a perfect one. Population is concentrated on soils which are naturally most productive or where the risk of crop failure is less. Expanding output at a rate faster than population growth will require both the intensification of production in relatively more populated zones and a shift in the production and people toward less-populated areas particularly those in the southern part of Mali. We need to know both the possibilities for intensification and the size and nature of any possible zones of migration and the production possibilities within them.

The related questions in the Sudano-Sahelian Zone are the extent and nature of underutilized rangelands. Alternative hypotheses are that: (a) "large" areas of unused (or underutilized) range exist because of a shortage of water for livestock or, (b) all land is periodically grazed by taking advantage of rainy season surface water supplies. Most persons are in agreement that some (large) areas are overstocked and overgrazed to the point that a dangerous level of soil erosion and "desertification" are occurring. We need to know the location and the extent of both underutilized and overstocked lands. Again, most persons are in agreement that livestock numbers (grazing units) exceed desirable levels even if the grazing pressure was more optimumally distributed in the Sudano-Sahelian Zones. The Sahelian Zone is currently overpopulated with both people and livestock given current systems of land use.

The concept of the land capability survey also includes the presumption that some lands can or should be used only for limited purposes such as watershed protection, forestry, game/tourism or grazing. The data provided by the survey will provide a reliable base for national decisions as to which lands should be reserved either temporarily or permanently for those purposes.

The fact that the human population of Mali will in all probability double within 25 years cannot be ignored. It is generally agreed that levels of donor support must increase if Mali and the other countries of the region are to have a chance to achieve something more than bare subsistence levels of existence for the majority of their citizens.

The land capability survey will assist the GOM to make the best use of its land resource and provide a guide for the selection of development projects and for the development of extension recommendations for both established production zones and those which are under-utilized. The land use land capability survey should be considered as the cornerstone for future AID and other donor support for agricultural sector development in Mali.

The survey will provide the sort of productivity coefficients required to plan the scopes of development projects and to provide baseline data for evaluating projects.

It is also planned (and funded in a livestock sector project) to assist the GOM to develop the capability of monitoring the livestock industry through development of an analytical model of the sector. The data provided by the present survey will provide essential inputs to this model.

An inventory of basic land resources provides a timeless base upon which to plan all land-related activities. It provides a useful framework for summarizing a wide range of physical, economic and social data which is already available in published or unpublished form. It provides planners and decision-makers with information showing the kinds of land, how much of each kind, and where each kind is located. An evaluation of the basic resource inventory provides estimates of present and potential production under various input or management alternatives. Planners must have this kind of information about each kind of land. In addition, they must have a perspective or vantage point from which they can see how these different kinds of land relate to one another. It is essential that thought be given to the impact of management decisions or any given piece of land on other adjacent or related lands.

The method proposed, that is, the cartographic division of land into existing or optimal land use categories, is an approach in which the United States has preeminent capability. The approach has been pioneered by the U.S. Soil Conservation Service, which is suggested as a possible implementing agent. It is an approach which can be replicated with little or no modification in other regions or countries of West Africa. It is not a pilot trial but a proven technique.

III. GRANTEE AGENCY:

Ministry of Rural Development, Institute of Rural Economics.

IV. PROJECT DESCRIPTION:

ORGANIZATION:

The project is envisaged as a two-year task of the GOM's Rural Economics Institute (which is the research/area and planning of the Ministry of Production), the task force being provided by the GOM, AID, and FAC, working toward the task order to describe the significant soil-vegetation groups as to their qualities and their potentials, including restrictions, for development for specified uses.

DETAILED DESCRIPTION:

A. GOAL:

1. Goal Statement:

The project goal is the rational allocations of Malian natural resources by the GOM.

2 Verifiable Indicators:

(a) The extent to which the GOM uses project outputs in the allocation of development resources and the selection of projects.

(b) The extent to which the procedure is institutionalized and integrated in land use planning processes by the GOM.

3. Assumptions:

a. Qualified Malian counterparts will be assigned to work at the side of each expatriate scientist.

b. This cadre of technicians, when trained, will be utilized by GOM in future land use planning activities.

B. PURPOSE:

1. Statement of Purpose:

a. To provide a technological basis for the allocation of resources to agricultural and range development.

b. To develop the capability among Malians in natural resource inventorying and planning.

c. To compile complete information about the resources of Mali in Bamako at a place that is accessible to all potential users. This compilation will require the cooperation of government officials and scientists in Mali, France, and other countries. Access to these documents should reduce duplication of projects and improve research techniques. Much of the information in this file will be suitable for storage in a computer data bank when a national data storage system is developed.

The project embraces a concept of integrated resource inventory, evaluation and interpretation. In summary, it will provide the GOM with the information base necessary to understand the natural resources of Mali and to plan for their logical development and use. It will also enhance Malian capability in utilization of the information and the processes for planning and decision-making. Thus, the integrated resource inventory, coupled with the capability to use it fully, should provide the mechanism for an amalgamation of Malian resources and people based upon an understanding of the resource potentials and limitations.

2. Verifiable Indicators:

a. Development and publication of resource inventory maps, tables, and narratives.

b. Development of production estimates for the different kinds of Malian land units.

c. Establishment of a repository in Bamako for all pertinent information concerned with Malian soil-vegetation resources.

d. Evidence that Malian technicians have been trained in development and use of resource inventories.

3. Assumptions:

Full cooperation and support of GOM, French agencies and organizations.

D. LOCATION AND EXTENT OF COVERAGE:

The area to be covered includes the whole of Mali with varying emphasis. Regions 1 through 5 encompass approximately 432,000 km^2 and the sixth region 809,000 km^2. The agricultural zone (both livestock and crop production) for Mali extends through Regions one through five and is to the northern course of the Niger River. It is estimated that if this segment of Region 6 is included with the area covered by the first five regions, the total agricultural zone would encompass approximately 520,000 km^2. Under this project, these 520,000 km^2 would be mapped at a scale of 1:200,000 with full classification, identification and evaluation. The remainder of Mali lying north of the course of the Niger River is principally desert. The GOM, however, is convinced that there exist some areas where livestock raising may be supported. They are therefore interested in having the entire country covered.

E. PROCEDURE:

1. Assembly of Existing Data: As a preliminary activity the pertinent published and unpublished data will be collected from the libraries and files of the concerned agencies and individuals in France, Belgium, the Netherlands, Rome (FAO), Senegal and Mali. To manage this material will require the employment and on-the-job training of a Malian librarian at the outset.

2. Field Procedures: The proposed survey areas were photographed for aerial navigation charts in the 1950s; negatives are available to the project. Air navigation charts covering the area at 1:250,000 scale published in 1965, based on information dated from 1925 to 1964, are available from the U.S. Department of Defense.

Reconstituted color infrared imagery will be obtained for north-south and east-west strips over the project, crossing at Bamako. The information provided from this sample will be compared to existing black and white imagery and if the added information justifies the extra cost, color infrared imagery will be utilized for the entire project coverage.

Before starting field work, an uncontrolled mosaic, scale 1:1,000,000 will be prepared from Landsat II, bands five and seven providing, respectively, vegetation and soil reflections. Also, Landsat images, enlarged to the scale of 1:200,000, will be obtained in sheets for field analysis. These images will be taken from the dry season, when vegetative cover is minimal, and near the end of the wet season when vegetative growth is at its peak. Thus, four sets of images will be required for field analysis. Field data developed in the 1:200,000 images will be transcribed to the mosaic to accommodate presentation and publication.

Mapping units will be identified both by field procedures and by photo-interpretative techniques. Areas that appear on the maps to be similar to other areas will be checked on the ground to verify the interpretation. After the photo-interpretation has been verified in a sufficient number of areas, photo-interpretation, with field checking, will be used for identifiying those mapping units that can be consistently identified from ERTS imagery. Otherwise, direct field observation will be necessary in each delineation.

Due to the nature of the terrain and the inaccessibility of much of the land, both four-wheel drive, all-terrain vehicles and helicopters will be used in field work.

Transects will be made through representative mapping units to observe the kinds of soil present and to determine the

ecological mix and amounts of vegetation associated with each different kind of soil. Soil characteristics that influence plant species and vigor will be major factors in establishing mapping unit boundaries. It is recognized that mapping units of the survey will contain several kinds of soils from the standpoint of genesis, and the precentage of the different soils and their positions in the landscape will be estimated and described. (Description continues under Ouputs, page 14 .)

The work will be planned to address the Government's presently established priorities - that is, to ensure that information is gathered as the survey progresses to make the significant interpretations (field estimates) of mapping units of greatest interest to the GOM. Thesewill need to be verified as experience is gained.

3. Training: There will be nine Malian counterparts on the project working with the vegetation-soil mapping teams who by the end of December, 1976, will have received some on-the-job training. From these Malian counterparts and upon the advice and recommendation of the Institute for Rural Economy and the foreign advisers, one soil scientist (or person with this potential), one range ecologist (or person with this potential), and one tropical agronomist (or person with this potential) will be selected for university training abroad at the Masters level beginning in January, 1977. It is expected that the soil scientist and range ecologist will receive training in the US while the tropical agronomist will be sent to a French university.

By January, 1977, the 13 Malian land resource planning counterparts will have received on-the-job training for six months. Four Malians will be selected by the foreign advisers together with the Institute of Rural Economy for a two to three-year training programs in the United States beginning September, 1977. Training will be in the fields of land use planning, resource economics, and development planning. In addition theywill receive three months on-the-job training with the Oregon Coastal Zone Management group or similar group engaged in land use planning.

In addition to the on-the-job training received by all Malian counterparts, the foreign advisers will conduct seminars covering the principles of their specialities. Finally, after the inventory is published, a seminar on its content and use will be held in Mali.

4. Printing: Printing of the maps and narrative reports will be in French (1,000 copies) and English (1,000 copies) utilizing resources available in the United States and France. All materials collected and produced during the course of this project will be deposited with the Documents Center of the Institute or Rural Economy. It is anticipated that at some point during the course of the project, the foreign advisers will confer with personnel from the Institute of Rural Economy to assure an adequate informational retrieval system exists.

5. Research and Development: Based on experience with digital recognition of earthen and vegetative objects in Yellowstone National Park from ERTS satellite imagery, the Environmental Research Institute of Michigan has proposed that this procedure could be of material assistance in carrying out the scope of work of the project. While their hypotheses are still being refined, the basic proposition is that soil groupings and vegetative groupings may be identified through digital recognition of ERTS imagery and that this process, incorporated with the more traditional vegetation-soil inventory procedure, can reduce the man-hours survey time per given area and thus materially reduce the cost of the survey. One possible hypothesis would be that relatively large, homogenious areas may be recognized, and that "bad" and "good" areas have their own signatures, hence the mappers could save time by eliminating the "bad" and concentrating on the "good".

The first half of a one-year experiment would be devoted to making ground associations with digital indications and becoming familar with the mapping procedures being utilized in the resource inventory. In the second half of the year, the Institute would make a projection for an unknown area, from the standpoint of visual inspection, and with the team, verify it.

The research project would be guided by a committee of scientists headed by a Malian scientist. Any efficiency gaining technology developed would be integrated in the survey immediately and picked up by the other AFR land use potentials surveys that may be under way.

The Institute would include in its report the complete procedure and program, and would offer the report for publication in at least one of the pertinent professional

journals. This would in effect state the limitations of the procedure in land use potentials inventorying as well as share any new technology developed with the rest of the world.

E. OUTPUTS:

1. Resource Inventory:

a. Maps - Draft maps displaying vegetation-soil mapping units will be constructed at a scale of 1:20,000. Mapping units will be delineated to portray the classification system which reflects differences and similarities in vegetation and soils. These mapping (vegetation-soil) units will provide the information base for interpretation and land use planning. They will reflect only resource characteristics and not interpretations of resource characteristics. Each mapping unit will be identified by a numerical legend that will be described in the narrative (descriptive legend, paragraph "b" below). Thus, each mapping unit displayed on the base map will represent a distinct combination of plants and soils that is identified by a numerical legend and described in the descriptive legend.

Following interpretation and evaluation of resource data, additional map overlays will be constructed, displaying major potential land uses and productivity under various levels of inputs.

The map will be reduced and printed at the scale of 1:500,000.

b. Narrative - A detailed description of vegetation and soil characteristics of each mapping unit will be presented in the descriptive legend. This will include complete profile descriptions of primary soils in each mapping unit, topographic positions, and erosion status. It will include observations on surface and shallow groundwater hydrology, which will be reflected in a thematic overlay map.

c. Tabular Data - Data reflecting kinds, amounts and location of present and potential crop and/or range

yield at two to four technically feasible levels of inputs will be tabulated for each mapping unit. As a rule, the crops addressed will be the staples of the region. For the project these will include millet, sorghum, peanuts, cotton, rice, sugarcane, and special crops where applicable. Yield coefficient estimates will be made for thse crops at the following input levels where they may become technically feasible on a significant, commercial scale:

Input Level	Description of Inputs & Practices
1	a. common seed stock b. mixed culture c. without weed control
2	a. durrent, genetically improved seedstock b. single crop, row culture c. clean culture
3	a. all elements of Level 2 b. complete fertilizer c. plant protection
4	a. all elements of Levels 2 and 3 b. irrigation

These coefficients will be extrapolated for the most part from IRAT studies in Mali and Senegal and from the experience and judgment of the agronomist.

Range yield coefficient estimates will be made for each mapping unit in terms of kilograms of usable forage per hectare. (The option to extend this to animal unit months will be left to the discretion of the range ecologist.)

Input Level	Description of Inputs & Practices
1	- unrestricted grazing
2	- effective grass fire suppression
3	- prescribed grazing system

These coefficients will be extrapolated from the known or estimated performance of the same or similar species on similar soils and under similar rainfall conditions, coupled with the inspector's judgment of present range condition and the percentage lost through burning.

The following table is illustrative:

ESTIMATED LAND YIELD POTENTIALS OF MAPPING UNITS WITH GIVEN LEVELS OF INPUTS

Mapping Unit a/		Input Level			
		1. c/ kg/ha	2. d/ kg/ha	3. e/ kg/ha	4. f/ kg/ha
Soil Type X	Millet Sorghum Peanuts Cotton Rice Sugarcane Range forage Special crops b/				
Soil Type Y	Millet Sorghum Peanuts Cotton - etc.				

a/ Keyed to map.

b/ Treated in special situations.

c/)
d/) Definition of respective input level.
e/)
f/)

This table is the key element of the project, inasmuch as it will portray a comparative evaluation of the mapping units for similar and competitive uses at graduated levels of inputs.

The authors will state the appropriate qualifications and limitations to the tabular coefficients. Whether this will be done in footnotes or treated narratively will be stated in the project work plan.

d. Economic Model Input - The tabular rangeland data will be used as inputs to an economic model of the Mali Livestock Sector financed through the Mali Livestock Sector Grant.

e. Printed Output - The map at the scale of 1:500,000, without overlays, the narrative description and the land yield coefficient table will be printed in the french language in the quantity of 2,500. The Republic of Mali, Ministry of Rural Development, Institute of Rural Economy, will be credited as the publisher, with due acknowledgements to the participating donors and their implementing agencies. Authorship of contributions will be recognized in a group credit line.

f. Resource Inventory Management Capability - The project will be designed to train on-the-job a Malian cadre to keep the inventory current after the present project is completed.

g. Trained Malians to the the staff of a Resource Inventory and Evaluation Office within the Institute of Rural Economy:

(1) One Malian provided university training in the US leading to a MS degree in soils science.

(2) One Malian provided university training in the US leading to MS degree in range ecology.

(3) One Malian provided French university training leading to a MS equivalent in tropical agronomy.

(4) One Malian provided three years' training in the US in the fields of land use planning, resource economics, development economics/planning at a university and on-the-job training in land use planning with the Oregon Coastal Zone Management group.

(5) Five Malians with science backgrounds provided two years on-the-job training in resource inventory and evaluation work, soils science specialization.

(6) Three Malians with science backgrounds provided two years on-the-job training in resource inventory and evaluation work, range ecology specialization.

(7) One Malian with science background provided two years on-the-job training in resource inventory and evaluation work, tropical agronomy specialization.

(8) Two Malians with science background provided two years on-the-job training in resource inventory and evaluation work, geo-hydrology specialization.

(9) Two Malians with science/social science background provided two years on-the-job in land use planning.

(10) Malian team experienced in resource inventory and evaluation work.

2. Verifiable Indicators:

a. Interim reports by the implementing agencies.

b. Draft maps, tables and field notes.

c. Final outputs.

3. Assumptions:

a. That Malian technicians with basic science backgrounds will be assigned to the project. This should be a condition precedent (D, below).

b. That the French will provide the technical assistance described and on the basis of discussion held in France, the probability is that at least four technicians will be provided in the areas most critical (soil science, tropical agronomy and geo-hydrology).

c. That the combination of on-the-job training and participant training will be sufficient to create a Malian capacity to undertake more detailed resource inventory and evaluation work. With the project outputs, the Malians will have increased their capabilities and knowledge base for research and planning.

F. INPUTS:

1. AID

a. Personnel:	3 soil scientists	24 months
	3 range ecologists	24 months
	1 resource planner	24 months
b. Participants:	3 MS degree level	24 months
	1 MS degree level	36 months
b. Commodities:	field equipment including vehicles, office equipment	
c. Other:	helicopter lease cartographic printing	

2. France: (Personnel)

2 soil scientists
1 tropical agronomist
2 geo-hydrologists
work in Paris by BRGM
rural sociologist
rural economist

3. Mali: (Personnel)

5 soil scientists or with science background
1 tropical agronomist or with science background
3 range ecologists or with science background - socio/economics inventory/evaluation team
2 geo-hydrologists
2 resource planners or suitable background

(Other): office space to the extent available

4. **Assumptions:**

a. That the GOM will be able to provide counterparts in the numbers indicated with appropriate background for the training to be undetaken. All conversations with the Ministry of Production lead to the conclusion that they have trainable personnel and will make them available.

b. That the GOM will have sufficient funds to support their personnel in the project and provide most of the required office space.

G. ORGANIZATION:

The Malian development program is guided by the National Development Plan, which is presided over by the President of the Republic. The management of the Plan includes a National Planning Commission and a Director General of the National Development Plan. Each service ministry contains line services along with certain planning facilities. The Plan covers five years. The exercise begins with the line services passing drafts through the ministries' planning facilities, to the Directorate General of the Plan, where they are reconciled with national targets and apparently available resources.

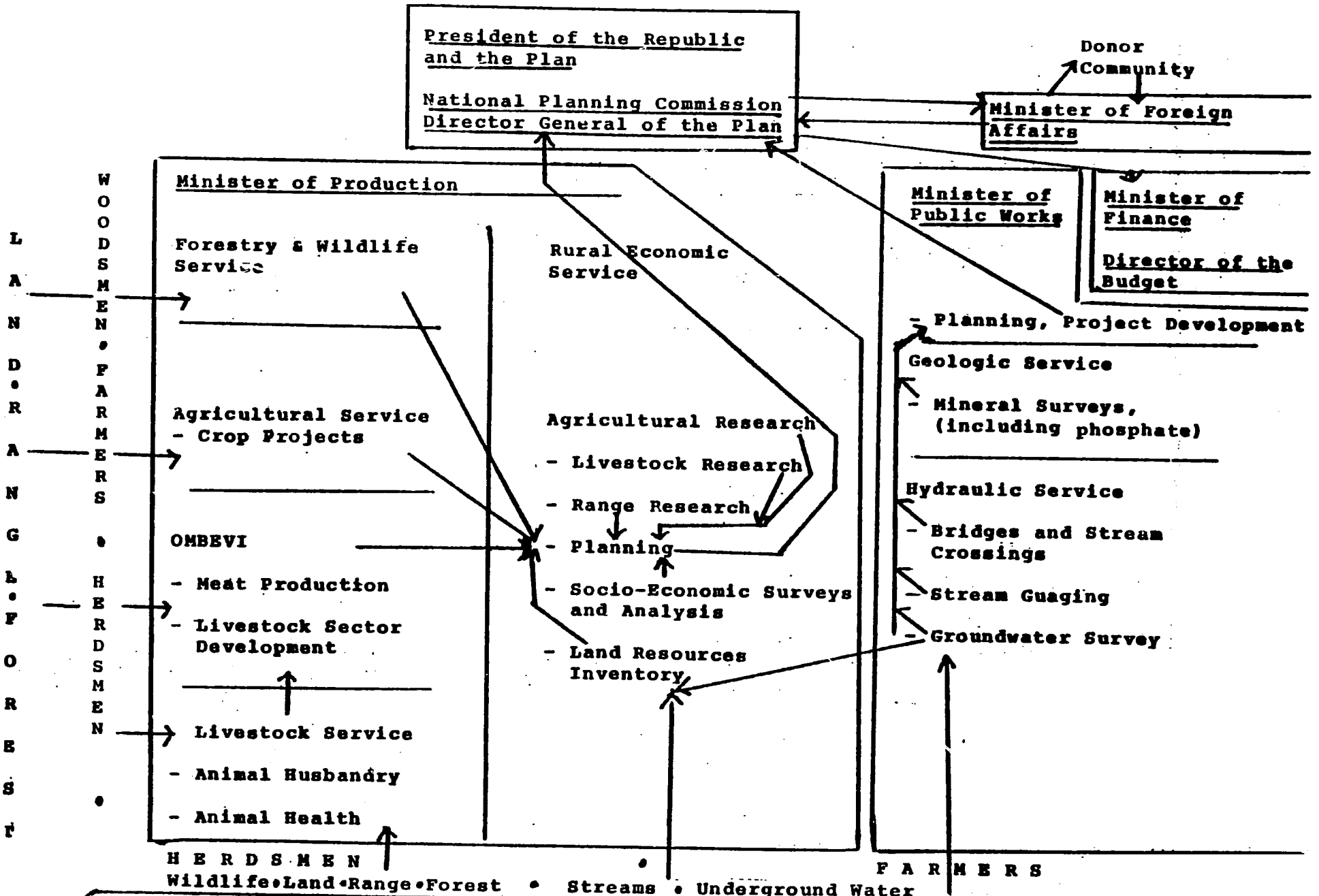
Development projects follow the same route with, at each stage in the channel, the criteria of analysis being conformity to the Plan, the ratio of benefits to cost and social equity. Projects are likely to be referred to donors for external funding before they are sent to the Ministry of Finance, Director General of the Budget. (Chart.)

The Ministry of Production has three line services: Agriculture, Livestock, and Forest and Wildlife --- directly concerned with the development of land resources. It also includes a special production stimulation office, the Malian Office of Cattle and Meat Production (OMBEVI). Finally, the Ministry has a "service" service, the Rural Economic Service, which is responsible for research, socio-economic surveys and analysis, and planning. Recently, an agricultural resources division was added, and this will be the seat of the project (Annex D).

The Ministry of Public Works Hydrology Service is responsible for stream guaging and underground water surveys and is assisted by ORSTOM in doing this

With AID and other donor assistance, the agricultural resources division will collect and organize the existing information that is pertinent to the economic potentials of Malian soils. Then they will make a land use potentials survey of the country, and publish the survey. The division will field the planning team, assisting in the setting of production targets and advising on alternative land allocations for development.

Information flow in the Malian Rural Development Planning and Project Approval Process



Source: Malian Embassy, Washington, 7/9/75

V. PROJECT ANALYSIS:

A. TECHNICAL ANALYSIS:

1. Appropriateness of the Project and its Technological Implications:

The project is designed to provide a reconnaissance level resource inventory and evaluation for Mali and create a capacity on the part of the Malians to perform more detailed resource inventory and evaluation work at a larger scale. In essence, the project provides a valuable development planning tool, i.e., the reconnaissance resource inventory and evaluation, and the capacity to utilize the methodology to obtain larger scale data suitable for project design activities.

Mali ranks among the poorest and among the least developed countries of the world. Even so, the dynamic force pushing for development is present. At this stage of development, it would not be unrealistic to question whether optimization of land use for agriculture development is appropriate. Optimization of land resource allocations is vital to Mali in the long-run. The strategy of optimization demonstrates a realistic appraisal of the future of the country and an acknowledgment of the priorities that ought to exist.

A land resource inventory and evaluation activity is critical to the optimization of land resources for agriculture development. It is a decision-making tool for selecting among alternative land uses when choices are forced but as well constitutes an invaluable development planning tool. The presence of relatively undeveloped land presents an opportunity for wise land use planning.

The Malian logic suggesting that a land resource inventory and evaluation is not merely a useful thing to have but is necessary is based upon the following arguments. First, there currently exists no tool to use as a guide in project development. When the GOM's planning apparatus considers project development alone or together with donor countries, project site selection is virtually based upon a presumption of potential and suitability. If the Malians are to have

limited assistance and internal resources with which to work, then they must make the most of the development resources available to them. They cannot afford the luxury of errors in judgments among project sites. Hence, they must have some rational means by which to select sites with a reasonable, empirically based projection of the potential of the site for input of development resources and some means by which to judge the appropriateness of the invested production-increasing resources, for example. Secondly, they must have some tool by which to integrate micro-agricultural development into long-term national strategy and design. That the Malian Government recognizes the value of land resource inventory and evaluation is much to their credit and displays their forward-thinking in development planning. Their logic is sound.

A land resource inventory and evaluation activity involves the collection and integration of information principally in the categories of ecological data, including soil texture, mineral content, slope, water-holding capacity, degree of erosion, vegetation, water availabilities, past use and present use. Once the information has been collected and integrated, the potential use and productivity of the land under current physical and human conditions can be determined. In addition, production estimates can be made assuming various levels of inputs.

The data collection effort can be undertaken at various scales depending upon the use to be made of the evaluation. The larger the scale, the greater detail in the data collected and because more information is collected about smaller areas of land, the greater the reliability of the effort in terms of the sampling representing the entire area investigated. Generally speaking, the project design work, information is needed at a scale of 1:50,000 (about 15 ha. is useful in making broad judgments about land potential and as a format for assessing and broadly planning development on a national level. Subsequent to decisions on a general level utilizing information at a scale of 1:200,000, more detailed work (at a larger scale) would be undertaken to acquire the more specific information required for project design work. Thus, scarce resources are utilized for areas judged to have more potential on the basis of the reconnaissance level (1:200,000) land resource inventory and evaluation.

For the Malian land resource inventory and evaluation, it has been deemed appropriate to utilize a scale of 1:200,000 because the information level desired on a national scale is appropriate to this scale. The information and evaluation effort will involve obtaining information about ecological units (soils-vegetation), water resources and present land use information. The data collected will be displayed on maps of the scale 1:200,000 utilizing the technique of a base map and overlays representing specific categories of data. Detailed explanatory material will be in narrative form for each map. The project is predicated upon an integrated team approach to evaluation with independent data collection efforts.

As noted in the opening paragraph of this section, it is the intent of this project to undertake mapping and train Malians to establish their capacity to undertake more detailed mapping at larger scales. It would, of course, be possible to train Malians to undertake resourve inventory and evaluation work and let them perform the 1:200,000 survey. Given the upswing in development efforts and thus the need for a development tool to use as a guide in planning for agriculture sector development, it is apparent that their need for this type of effort is immediate. Secondly, there exists a requirement for on-the-job training in land resource inventory and evaluation work to acquire capability to perform the work. By undertaking the resource inventory and evaluation with experienced personnel, this training can be provided as well as providing the knowledge about land resources required for planning and to integrate micro-agriculture development efforts. It therefore appears appropriate to undertake the land resource and evaluation effort for Mali with trained advisers and in the process train Malians to undertake larger scale work subsequently.

Ecological units as utilized in this project refer to a set of environmental conditions that produce a given kind of soil and vegetation. Environmental characteristics influencing development of a given ecological unit include: climate, topography, elevation, aspect, slope, and geology. These factors are interrelated but their relative importance in a given ecological unit varies and may be influenced by the relative impact of other environmental factors. Ecological

units appear on the landscape as distinct and homogeneous combinations of vegetation and soils which may be repeated in other geographic locations where similar environmental conditions exist.

Data will be obtained in this project which will be used to identify, classify, describe, and evaluate ecological units. The method to be utilized will involve a process of field verification of preliminary judgments made from ERTs imagery. ERTs imagery enlarged to a scale of 1:200,000 will be obtained for Mali. Preliminary judgments about the ecological units will be obtained for Mali. Preliminary judgments about the ecological units will be made through analysis of the imagery. Mapping units will be delineated to portray the classification system which reflects differences and similarities in ecological units. Aerial observation with ground vegetation/soils sampling for analysis will be used to verify the preliminary judgments made through interpretation and analysis of the satellite imagery. Soils analysis will be performed utilizing French or U.S. labs. The results of these efforts will be ecological units displayed on maps with detailed descriptive material for each mapping unit presented in narrative form. The narrative material will include complete profile descriptions of primary soils in each mapping unit, vegetation species composition and density, topographic position, and erosion status.

A land resource inventory and evaluation must include information about the presence of water and its characteristics in terms of available quality and crop yield when water is applied at given rates. There are three categories of water resources normally used: surface water (rivers, lakes, ponds), shallow acquifers and deep aquifers (latter two are exploited by use of wells). A total inventory and evaluation of water resources would utilize information about existing or known water resources (lakes, existing wells) but as well would attempt to locate and define both shallow and deep aquifers which could be utilized through the construction of wells. Necessarily, a tremendous capital investment is involved in exploratory drilling to identify underground water. It appears appropriate for this project to draw upon existing information and leave the exploratory drilling as a separate activity which may

or may not be undertaken by the Malian Government at a later point. The approach therefore will be one of integrating existing knowledge and developing knowledge about existing water resources (surface and operating wells). For surface water, ERTS imagery will be utilized for identification with classification efforts (quality, yield, quantity) undertaken with aerial observation and ground truth to the level of generalization appropriate to a scale of 1:200,000. Surface water information thus obtained would be mapped.

To the extent that information on shallow groundwater exists it will be incorporated in the survey report. The project will rely on BRGM for information on deep groundwater.

The potential of land is in essence limited by the physical characteristics and water availability. In addition there is a limitation presented by the pattern of present land use. Therefore it is essential to a land resource and evaluation effort to obtain knowledge about how the land is currently being used. The kinds of data of significance include: nature of wildlife present; human use, crops, livestock; yields of lands cultivated or used for grazing; market structure; transportation; customs governing land use and land tenure systems; and information about special purpose reserves.

It is the intent of this project to integrate, collate and evaluate information about present land use displayed on maps at a scale of 1:200,000. More knowledge exists for this category of data than for physical resources but the existing information lacks a degree of validity necessary for this project. Also, the geographic dispersion of knowledge about present land use is insufficient. It is believed that an approach of first collecting and analyzing the data already available, then using a sampling survey technique will provide sufficient information for the purposes of this project.

Data collection and analysis is essential to the project but integration and evaluation of the data for purposes of assessing present land use potential and possible potential is of equal importance. Land resource evaluation is the critical analysis of the information provided by the resource inventory. Without it, land use data have considerably less value. Land use planning is the logical extension of land resource evaluation.

The present potential of the land given the physical and human characteristics will be assessed using the combined expertise of those involved in data collection efforts. Preliminary identification of land best suited to crop and livestock production will be provided by the resource inventory and evaluation team based upon the data collected. Estimates of production potentials under various levels of inputs will be developed by the entire team (Malian, US, French) from data provided by the resource inventory effort, from published data collected in the process of the project, research reports and personal experience.

Following analysis and evaluation of all resource inventory data including vegetation-soil, water, hydrology, socio-economic, overlay maps will be constructed displaying major present and potential land uses and levels of productivity under various levels of inputs.

2. Project Design and Cost:

To accomplish the two objectives of the project, completion of a land resource inventory and evaluation, and training Malians to undertake more detailed (larger scale) resource inventory and evaluation activities, the resources required include personnel, commodities, and contracted services as discussed below. Table III provides summary cost component information.

To accomplish the task of collecting, analyzing and evaluation of data about ecological units, the personnel required are three US soil scientists, three US range ecologists, two French soil scientists, and one French tropical agronomist. A qualified Malian with degree level academic training in the same or related field as his counterpart will work side-by-side with each foreign scientist. Thus, there will be three teams working simultaneously, each composed of one soil scientist and one range ecologist from the US with 6 Malian counterparts, who are both participants of the team and trainees. The French participants and Malian counterparts will work independently or in rotation with the three base teams as appropriate, utilizing their background experience and knowledge of Malian soils and vegetation. It is estimated that each team can cover approximately seventy thousand hectares per field day. It is expected that each team will spend approximately 250 days in the field and 190 days in the office during the two-year period.

It is expected that the data collection effort and evaluation of water resources will be accomplished by the following program of work. One geo-hydrologist from France will work both independently and in association with the vegetation-soil mapping teams as necessary to inventory and classify surface water. This will be undertaken with a Malian geo-hydrologist counterpart and is estimated to involve about one year of work. BRGM financed by FAC will undertake six months of work in Paris with perhaps a field trip of short duration to Mali to (a) upgrade their existing map for the Sahel areas for wells of 200-700 meters depth, which includes yield, quality, and some resource base information and (b) integrate a synthesis map currently being financed by FAC for all of Mali. One French geo-hydrologist working with a Malian counterpart will undertake an inventory of shallow wells (less than 200 meters deep) and be responsible for the integration of all water resource information collected and analyzed during the project. It is estimated that this effort, shallow wells plus integration, will take two years.

For the present land use effort, it is anticipated that the Institute of Rural Economy will provide personnel to (1) consolidate, evaluate and transfer to base maps or overlap information already available and (2) in association with French scientists undertake field work to the extent necessary to complete the mapping effort at a scale of 1:200,000. It is expected that the minimum French inputs will be one technician and the maximum will be provision of a team from ORSTOM to complete a survey of the type recently performed in Madagascar.

Over two-thirds of the cost is personnel, computed at civil service grade scales which is firm. It appears that the personnel to be provided are sufficient to complete the task within the timeframe planned. Thus, it is believed, the financing is adequate to the task (see B, Financial Analysis, for detailed budget).

3. Relationship to Other Projects:

There are two US projects currently funded which will be underway when this project begins which involve land resource and evaluation activities. Each of the three projects is limited in scope but designed to contribute to related objectives.

First, the AID Mali Livestock Sector Grant has three related components which involve resource inventory mapping and evaluation. For the Dilly area where major inputs directed towards increasing livestock production will be made, there will be resource inventory mapping and evaluation at a scale of 1:50,000. There will be Malian counterparts who receive on-the-job training under this project. Secondly, in the "new lands" three possible sites for the tse-tse fly eradication program with subsequent development will be inventoried and evaluated at a scale of 1:200,000. Both efforts will be launched in a one-year project beginning January, 1976 and completed by December, 1976. They are being undertaken in advance to meet early information requirements of the Mali Livestock Sector Grant. The total area involved is relatively small, 42,000 Km^2. This area will not be duplicated by the Mali Land Resource Inventory and Evaluation Project but rather information developed in these projects will be used as inputs and integrated with overall mapping efforts. In addition to the mapping activity, the Mali Livestock Sector Grant provides for "added capacity in economics and sociology for OMBEVI". The work involves graduate level training in the United States for two Malians with two US graduate students working part of the time in Mali. The timing of this effort is yet to be determined. It is, however, viewed as a useful, complementary activity to the Mali Land Resource Inventory and Evaluation Project and if coordinated will provide significant technical assistance inputs on an intermittent basis.

Financed by FED, BDPA (France) is currently involved in a land survey for an area of approximately 1,500,000 hectares in the southeastern portion of Region 3, studying the bas-fonds through the use of ERTS imagery and aerial photographs supplemented by ground truth. In the process they will map soils-vegetation and shallow groundwater at a scale of 1:100,000. FED is aware of the nature and intent of this project and believes their information will be of use to the project. The BDPA will not evaluate their data for purposes of determining land potential. The Government of Mali is aware of and has indicated that the two projects will be coordinated to the maximum extent possible. The course of action chosen will be either to

incorporate their data for this project and perform the additional work to determine potential and present land use characteristics, or the Malians will request this work be performed by BDPA in the course of their project. There will be Malian counterparts to the BDPA project but their precise number and qualifications are not known. Their training will be useful if the same individuals are involved in the Land Resource Inventory and Evaluation Project although French and American methods are only compatible rather than identical.

The Canadian Government is currently evaluating a Malian request and expects to fund a project under which computer technology will be utilized to analyze and evaluate ERTS imagery. A mapping effort covering some of the resources in the project area will be involved in the project. The project itself is in the design stage and actual components are now known at this time. It appears that the effort will be focused in the area where BDPA will be working. This is viewed as an experiment leading perhaps to location of a regional ERTS center in Mali and designed to contribute towards the goal of utilization of ERTS imagery in French West Africa.

There are three other projects which may well provide useful information about water resources, specifically the central Niger River delta. The BDPA just completed a reconnaissance study of the area and has yet to determine whether further work will be undertaken. Should they undertake any work, there is the possibility that they will undertake some land resource inventory and evaluation work for the Niger River basin. This purpose in doing so would be to acquire information in order to develop projects concerned with management of the delta area. Secondly, FAC has funded and is undertaking a project to upgrade an existing mathematical model of the behaviour of the Niger River in the Sahelian Zone. There will be some work undertaken in Mali in this project, the results of which will be incorporated into the Mali Land Resource Inventory and Evaluation Project. Finally, there is a proposed multi-donor Sahel Water Data Network and Water Resources Management Project under consideration. This project could as well produce significant information concerning water resrouces for part of Mali. The emphasis of this project

will be on improving meteorological and hydrological facilities. Hydrographic stations to measure lake levels and stream flows are totally inadequate for planning purposes.

Generally, of course, the Mali Land Resource Inventory and Evaluation Project interacts with every development effort undertaken in the rural areas. It will provide invaluable information for evaluation of the effectiveness of projects already in process and provide a mechanism for selecting high potential areas for future development projects.

Past, on-going, and proposed development activities are shown in Annex C.

4. Environmental Impact:

This project will give Mali a considerable headstart in environmental control. By obtaining adequate information for land use planning, events such as population growth and project development in rural areas, will not overtake areas needed for special purpose reserves, national parks, etc. Therefore, it is concluded that this project will have no negative impacts on the environment. Rather, the project can only help to assure that future development projects will have positive environmental impacts.

Since this is a research and education activity with the objective of gaining a better understanding of the environment and its limitations to human pressure and development, no further environmental analysis is required.

5. Conclusions:

Upon completion of the project, Mali will have a tremendous advantage over other developing countries in Africa due to the availability of the 1:200,000 scale resource inventory and evaluation. The resource inventory and evaluation procedures are highly suitable for replication in other countries. The Malian program may well become a model to

be followed by other developing countries. Unlike many other developing countries, the Malians have for some time recognized the need for, and moved towards obtaining adequate research and other information necessary for planning agriculture development. Their capacity to sustain this program is built-in. The Institute of Rural Economy exists and has been functioning for many years. The personnel who will be involved in the project are employees of the Institute who are going to continue in such capacity. Their formation into a resource inventory and evaluation unit is merely internal reorganization rather than the creation of an entirely new function with corresponding, added budget burdens. The primary question concerning the ability of the Malians to operate and maintain the program is adequacy of training activities under the project. Their motivation is what led to this project and their commitment to research and planning is long-standing.

During the process of designing this project, substantial discussions with the Malians and with the French took place. It is believed that because of the interaction of the three participating countries on both the technical and development planning levels, the project is technically sound and is utilizing the most suitable technology available. The costs of the project are firmer than most development projects, due to the fact that two-thirds of the budget is for personnel. It is further believed that the project can be completed with the personnel designed and therefore that the technical cost is reasonable. Because this project does not involve technical planning in the sense implied by Section 611 (a) of the Foreign Assistance Act, FAA, nor is any legislative action on the part of the hose country necessary, the project meets the requirements of Section 611 (a) and Section 611 (b) of the Act.

Concerning the relationship of this project to the new directives governing US foreign assistance programs, it is apparent that at face value this project does not appear to benefit the poorest strata of Mali. In fact, however, Mali is and for the foreseeable future will continue to be essentially an agrarian-based country (both crop and livestock production). The majority of the people including the poorest segment of the society are located in the rural areas.

This project will directly benefit the poorest segment because it provides reliable intelligence for making investments in the rural economy which presently is not available. In addition the project will assure a Malian capability to undertake larger scale resource inventory and evaluation work which will directly benefit these people. Without this project, scarce resources specifically devoted to projects directly benefiting this group, might be illspent or not achieve their potential.

B. FINANCIAL ANALYSIS AND PLAN:

1. Financial Rate of Return/Viability:

Insomuch as this is a pre-development service activity to support development projects, the benefit:cost equation does not directly apply. The potential value of the project lies in the probability of increasing the outputs of subsequent development activities by using the information outputs of the present project in selecting among alternative sites. The potential returns are limited only by the imagination of the analyst. For one example, it seems quite realistic to foresee an investment in rural development in Mali of at least $50 million over the next decade. It seems reasonable, further, to predict an increase in the potential for agricultural project output by 25 percent through the election of project sites on the basis of their use capabilities and production potentials. Assuming that the use of resource information increases the average internal rate of return for the aggregate investment from 12 percent to 15 percent, the crude return to the project would be approximately 100 percent. For the present project to show a crude rate of return of 15 percent it would need to improve the rate of return to the $50 million investment by only one percentage point.

While covered in proposition of improving the return to the aggregate investment, the information provided by the present project should steer planners away from poor project sites from the standpoint of resource capabilities. Or the information should be useful in apprising decision makers of the cost of less than optimal resource allocations.

It costs somewhere between $75,000 and $300,000 to make a survey for a project design, varying with the area and complexity of the project. If we assume the average cost to be $100,000 and if the GOM had a team that could make three surveys a year, this activity could result in a 10 percent rate of return in terms of foreign exchange savings.

2. Analysis of the Recurrent Budget of the Implementing Agency:

The GOM's Institute of Rural Economy is providing personnel for the project and office space to include utilities. It is anticipated that they will be able to fund the office space for a period of two years, and that this will be a one-time expense. Malian personnel assigned to the project are employees taken from the Institute who are intended to form the nucleus of the projected Office of Land Resource Inventory and Evaluation. The Institute is not hiring personnel for this project and it is not envisioned that the Institute will expand its total number of employees as a result of this project. Furthermore, it is believed that Mali is taking the appropriate course of action to utilize existing personnel, reorganize them to facilitate this project, then form a small group devoted to land resource inventory and evaluation for the more detailed (larger scale) work. This group may expand to meet future demands. However, expansion will not be necessary to enable the Malians to undertake larger scale resource inventory and evaluation work.

C. SOCIAL ANALYSIS:

Because this project does not introduce anything new into the socio-cultural environment but rather enlarges the scale and capabilities of an existing planning and research institution no detailed social analysis is presented. As noted in the (p. 35) concluding paragraph of the section on Technical Analysis / the distribution of benefits of the project can be traced from the project inputs through a government institution which, because of the project, is capable of making more rational, empirically based investment decisions about development projects in the rural areas which directly benefit the people of Mali.

D. ECONOMIC ANALYSIS:

It is not possible because of the nature of this project either to quantify the economic benefit achievable by performing cost/benefit analysis nor to determine or presume the effects of this project on income and employment. Cost-effectiveness for this project, however, can be judged by comparing the costs of the project as herein designed with alternative ways of achieving the same results.

There appears to be two available alternatives to the design of the project presented in this paper. First, the option is available to not use US technical assistance nor French technical assistance to perform the reconnaissance survey for Mali but rather train Malians to the point where they could undertake the survey. If this approach was utilized, the US costs would include participant university training and on-the-job training plus commodity support (vehicles, helicopter rental). While this approach would result in significantly lower US costs, the effectiveness comes nowhere near an acceptable level (degree of certainty that the work is properly performed) within an acceptable timeframe. The first alternative is thus not superior to the present project design. The second alternative is to undertake micro-level land resource inventory and evaluation for only those areas where AID is or will possibly sponsor projects as they occur. The costs involved for this approach of detailed (larger scale) resource inventory and evaluation work would exceed the costs of this project. Furthermore, the Malians would not have available to them the reconnaissance inventory and evaluation which is to deny them an invaluable development

planning tool. Thus, the second alternative is both more costly and less effective. It is concluded that the project as designed in this paper is cost-effective compared to alternatives available.

VI. IMPLEMENTATION ARRANGEMENTS:

A. ADMINISTRATION ARRANGEMENTS:

The project is undertaken under the auspices of the Ministry of Production, Institute of Rural Economy (described page 21, above). The project manager will be a US AID direct-hire person and his counterpart will be Mamadou Fotogoma Traore, Chef de la Division de la Recherche Agronomique de l'Institut Economique Rural. Responsibility for overall AID supervision rests with the AID country development officer and his counterpart, the Director of the Institute of Rural Economy.

B. IMPLEMENTATION PLAN:

The implementation plan is based on the estimate that the field work can be completed in the better part of two field seasons which occur annually from October to July. On this assumption it is estimated that the project can be executed in two years' team time with six months' additional time required for printing. The final activity, the production of a field seminar on the findings and use of the resource inventory, will take place in Bamako immediately after the material is published. The following schedule is illustrative:

IMPLEMENTATION PLAN

1 August 1976	Review of and approval of Project Paper
15 September 1976	ProAg signed AID PIO/P Waiver signed
15 September 1976	PIO/T signed
1 October 1976	BRGM begins work, collection of completed research begins
15 November 1976	Participating agency named or contractor selected
15 January 1977	All technicians in Bamako All Malian counterparts on board
1 March 1977	Arrangements for participants completed
1 April 1977	BRGM work completed
1 May 1977	Soil scientist, tropical agronomist, range ecology participants depart for US/France
1 May 1977	Arrangements for participant in land use planning completed
1 August 1977	Resource planning participant departs for US
1 January 1978	Shallow well inventory completed
1 July 1978	All field work completed
15 December 1978	Reports, maps completed and sent for printing
31 December 1978	Technicians returned to US
1 April 1979	Reports (maps, etc.) published and delivered to AID
1 June 1979	Seminar on Applications and Use of Resource Inventory

The six technicians in soil science and range ecology will be contracted for by AID for this project.

It is believed that sufficient time has been programmed for the PIO/Ts and PIO/Cs to be signed with the ProAg. The commodity list should be cleared by the contractor or contractors. Because of the structure of the training program, a waiver to sign PIO/Ps in advance of the ProAg will be processed. It may be necessary to process a waiver for local purchases.

C. EVALUATION PLAN:

It is recommended that immediately after the implementing agent is selected, a contract or PASA be made with a second institution to provide external consultative evaluation on the implementation of the project. The institution should provide the services of three persons for approximately nine weeks over 2½ years. One person should be expert in soil classification, one in agronomy (soil management and fertilizer), and one in range ecology. They would go through an orientation exercise with the implementation team. Then in October 1977, they would spend two weeks in the field with the team, during which they would make an interim consultative evaluation of the work. At the same time they would make final plans for a final evaluation, including validity and reliability tests, that they will make beginning about October, 1978 and extending for up to six weeks. The findings of the evaluation will be consulted in the day-to-day liaison between AID and the implementing agent as well as in the final settlement between the two.

Due to the fact that the mode of French participation has not yet been determined, it is recommended that the drafting of the Performance Tracking Network and the ProAg be delayed.

ANNEX B

1. **Detailed Budget and Commodity List** (440 MF = $1.00):

		Year I	Year II	Total
Personnel:				
US:	3 soil scientists, 12 mm each year	216,000	216,000	432,000
	3 range ecologists, 12 mm each year	216,000	216,000	432,000
	1 resource planner, 12 mm eacy year	72,000	72,000	144,000
	Total US Personnel	504,000	504,000	1,008,000
FAC:	2 soil scientists, 12 mm each year	144,000	144,000	288,000
	1 tropical agronomist, 12mm each year	72,000	72,000	144,000
	2 geo-hydrologists, one for 12 mm and the other for 12mm each year	144,000	72,000	216,000
	6mm work by BRGM	10,000	-	10,000
	3 man team from ORSTOM economics/sociology/ geographic-demography 18mm	216,000	216,000	432,000
	Per diem in-country 1500 days			
	Total FAC Personnel	586,000	504,000	1,090,000
MALI:	5 soil scientists, 12mm each year	15,000	15,000	30,000
	2 geo-hydrologists, one for 12mm and the other for 12mm each year	6,000	3,000	9,000
	3 range ecologists, 12mm each year	9,000	9,000	18,000
	1 tropical agronomist, 12mm each year	3,000	3,000	6,000
	3 man team in sociology/ geographic-demography/ economics 12mm each year	9,000	9,000	18,000
	2 resource planners, 12mm each year	6,000	6,000	12,000
	Total Mali Personnel	48,000	45,000	93,000

Annex B, continued -

	Year I	Year II	Total
Participant Training:			
96mm of US training	83,200	-	83,200
24mm of French university training	17,500	-	17,500
Total participant cost	100,700		100,700
Other Costs:			
Supporting Services:			
2 French/English typists, 12mm each year	6,820	6,820	13,640
3 tribal/French interpreters/English, 12mm each year	10,230	10,230	20,460
7 drivers, 12mm each year	7,952	7,952	15,904
Office rental	3,600	3,600	7,200
Total- Other Costs	28,602	28,602	57,204
Local Purchases:			
3' x 6' wooden work tables			
light table 4' x 5' with lights			
drafting table 3' x 5'			
mapping boards			
high stolls			
Estimate total construction costs	600	-	600
Vehicles, gas, oil, maintenance	91,000	21,000	112,000
Total - Local Purchases	91,600	21,000	112,600
Contract Services:			
Helicopter rental Oct/May, Year I and October/January, Year II at $35,000 per month	280,000	280,000	560,000
Cartographic/printing services in US			25,000
Soil sample analysis (France)	3,500	1,500	5,000
Total Contract Services	283,500	306,500	590,000
Research	107,000	-	107,000
TOTAL - OTHER COSTS	510,702	356,102	866,804

Annex B, continued -

	Year I	Year II	Total
Commodities:			
Landsat Imagery: Black and white, 100 images to cover Mali, taken from bands 5 and 7 before and after rainy season, each scene quartered (18" x 18")		-	
400 scenes total at 1:200,000	10,500	-	10,500
Color strips 10 scenes at $80	800		800
6 all-terrain vehicles at $6,000	42,000	-	42,000
2,000 feet drafting paper	200	-	200
2,000 feet plastic overlay	2,500	-	2,500
8 portable electronic calculators plus spare batteries	640	-	640
24 dozen felt tip pens	24		24
10 sets coloring pencils	30	-	30
12 dozen ball point pens	50	-	50
6 dozen mechanical pencils with lead	60	-	60
6 dozen each drafting pencils; 1h, 2h, 3h, 4h, 5h, 6h	100	-	100
36 rolls masking tape, 1" wide	45	-	45
50 rolls nylon filiment tape, 1" wide	100	-	100
50 rolls celluloid tape, 3/4" wide	20	-	20
16 clamp type extendable florescent lamps, compatible, local current	800	-	800
2 typewriters, manual, one English, one French	600	-	600
1 photocopy machine and paper	800	-	800
2 secretarial desks	500	-	500
2 secretarial chairs	150	-	150
2 regular office desks	500	-	500
2 regular office chairs	150	-	150
12 straight chairs	300	-	300
1 drinking water dispenser	50	-	50
1 storage cabinet	150	-	150
Miscellaneous office/professional supplies	2,000	-	2,000

Annex B, continued -

	Year I	Year II	Total
12 acreage grid counters	20	-	20
14 16" drain spades	140	-	140
14 round mouth spades	140	-	140
6 5-foot augers, one piece	168	-	168
3 five-foot bucket augers (3 piece with five foot extension for each)	75	-	75
12 brick hammers	67	-	67
14 Abney levels	800	-	800
7 hand compasses (foresters)	138	-	138
4 pH kits with extra supplies	100	-	100
3 field soil testing kits	990	-	990
6 measuring hoops for range 2.4 sq. ft. area	60	-	60
6 tubular scales (hanging, 1 - 2 lbs.)	120	-	120
18 files to shapen spades	36	-	36
12 grass clippers	72	-	72
6 pruning shears	36	-	36
2 reflecting stereoscopes	150	-	150
12 pocket stereoscopes	60	-	60
8 hand axes	82	-	82
8 pick axes	160	-	160
4 35mm cameras plus film	1,000	-	1,000
Misc. soil sampling supplies	300	-	300
Misc. range sampling supplies	300	-	300
Misc. professional field supplies	2,000	-	2,000
8 footlockers, waterproof	400	-	400
4 4-burner French-made gas stoves with ovens	400	-	400
10 fire extinguishers	100	-	100
10 first aid kits	100	-	100
12 5-gallon gasoline containers	144	-	144
6 water filtration sets	120	-	120
12 50-gallon water containers	120	-	120
7 tents, approx. 10x15 ft, mosquito proof doors & windows, floors and outside suspension	1,750	-	1,750
5 sets of camp cooking equipment	250	-	250
16 sets eating utensils, etc.	320	-	320

Annex B, continued -

	Year I	Year II	Total
16 sleeping bags	840	-	840
24 canteens	150	-	150
14 folding camp cots	400	-	400
7 plastic ground sheets, 10 x 12 feet	35	-	35
4 folding tables, 3 x 6 ft. (dining)	100	-	100
16 folding chairs	240	-	240
7 folding tables, 3 x 3 ft. (work)	175	-	175
4 refrigerators, 6 cubic feet	800	-	800
5 generators, 1100 watts (3 hp.), gasoline operated	1,000	-	1,000
extension cords, lights, etc.	1,200	-	1,200
8 mantle type kerosine lanterns with extra globes	210	-	210
1 headquarters set and three field units, 600 mile range radio equipment	8,000	-	8,000
TOTAL US PURCHASE	86,937	-	86,937
GRAND TOTAL	1,836,339	1,409,102	3,245,441

ANNEX C

PAST, ONGOING AND PENDING DEVELOPMENT ACTIVITIES IN MALI

Crop Production:

4th Region Riz Segou	
3rd Region Cotton	FED
1st Region Peanuts	CFDT
5th Region Millet Mopti	BDPT
4th Region Office du Niger	US
2nd Region Agri. Production Farm	Colonial French
1st Region Cotton Groundnut	FED
2nd Region Bagurden Op.	IBRD
4th Region Sama Seed Farm	Mali
	?

Livestock:

3rd Region Yanfolila Breeding N'Dama	FED
2nd Region Mali Livestock	US
2nd Region Livestock Sector	US

Support:

IRAT - Soil Fertility work sorghum soils lab. Sotuba
UNDP - Sociological study Dogon area of Mopti
UNDP - Tech. asst/trng OMBEVI - Project 523
US - CVL
US - Training under Mali Sector
US - Land Use Dev., new lands - Mali Sector
FED - Finance shortfalls budget - drought
GOM - Commission to study institutional problem of carrying out rural development program
US - Research on increasing milk production (Mali Sector), protein availability, quality local cattle breeding
US - Marketing - Mali Sector
US - Econ. model livestock - Mali Livestock

Water:

2nd Region US - Livestock Sector 14 wells and 20 waterholes
FAC - Regime du Niger
6th Region Germany - 6th region groundwater
IDA - Selingue Dam
ORSTOM - Groundwater Investigation
BRGM - Sahel Groundwater Survey

Soils:

ORSTOM Published Soil Surveys:

a. Carte Pedologique, Mali, Segali, 1:10,000 parts 1 and 2, 1961
b. Carte Pedologique, Mali, Soubasu, 1:50,000, 1961
c. Dobin, B., 1951, Region de Sokolo (Mali) 1:20,000. Agron. Trop. (Paris), 6/606/637

Annex C, continued

Climate:	Int. Monetary Fund, 1965, Mali: Agricultural Zones, Climate and Rainfall (map, scale 1:4,000,000) (Washington) ASECNA, Resume Mensuel des Observations aux Sol (onfil GOM Ministry of Transport)
Crop Production:	6th Region US - Rice/Sorghum Gao 2nd Region US - Rice, sorghum, vegetable, forage 6th Region US - Integrated wheat Northern Niger BDPA - Niger River delta
Livestock:	2nd Region IDA - Relieve overgrazing Upper Valley 1st Region Canada - Feeding program/forage production Kaarta 1st Region FED - Niono ranch and feedlot FED - Mixed farming/intensive feeding - Mali southwest (south of Segou) 5th Region IDA - Range management and livestock marketing
Water:	1st Region - Germany - Bafonde 3rd Region - FAC - Bafonde (BDPA) all of Mali - FAC - Synthesis map Niger River - FAC - Mathematical model All Sahel Water Data Network and Water Resources Management - Multi-donor
Support:	US - Sahelian Tract - Improve roads US - 6th Region land use ILCA - Livestock research sub-station Niono BDPA - Soil survey Niger River delta (counterparts) US - Assistance to agriculture schools

3. Summary Cost Estimate and Financial Plan

Source	AID		GOM		FAC		Total
	FX	LC	FX	LC	FX	LC	
Use							
Personnel	1008			93	1090		2191
Participants	101						101
Other Costs:							
Supporting Services		58					58
Local Purchases		112					112
Contract Services	590						590
Research	107						107
Commodities	87						87
	1893	171					
TOTAL	2063			93	1090		3246

See Annex B, Detailed Budget and Commodity List.

There are no allowances for inflationary costs because of the short-term nature of the project and because the major portion of the funds are for US personnel costs. It is not anticipated that there will be costs anticipated in the future for which funding would be sought. There are past projects in this area.

4. Summary Opinion:

It is believed that the financial plan is sound, that the costing is firm and that a burden is not placed on the host country's budget by this project.

MINISTERE DU DEVELOPPEMENT RURAL

INSTITUT D'ECONOMIE RURALE

République du Mali
Un Peuple - Un But - Une Foi

ANNEX D

N O T E

A) L'Attention de Monsieur le Directeur de l'IER AID au Mali Bamako

1°/ Organigramme indiquant la place qu'occuperait l'unité de Planification des ressources terrestres au sein de l'I.E.R.

La réorganisation de l'IER est en cours et les textes devraient être approuvés par le Gouvernement dans les 5 à 8 semaines à venir. L'organigramme proposé (dont photocopie jointe) prévoit la création d'une Division de la Planification chargée:

de la préparation et de l'évaluation des plans, des programmes et projets de développement rural. Elle comprendra une section de planification, une section d'évaluation et une section Statistiques rurales. Le projet inventaire des ressources naturelles relève de la section de planification qui sera renforcée. La coordination avec les autres services de l'Institut concernés par le projet d'une part, avec les autres services techniques du département d'autre part sera assurée par la direction générale de l'IER.

La Division de la Planification qui travaillera sur la base des orientations dégagées par le Ministère du Plan et de la Commission Nationale de Planification de l'Economie Rurale dont le Ministère du Développement Rural est président effectuera ses travaux en étroite coopération avec les services techniques de la Direction Générale du Plan et de la Statistique. L'Organigramme détaillé de la Division de la Planification faisant ressortir les activités spécifiques de chaque section interviendra à l'approbation des textes de base de l'I.E.R.

2°/ Fonctionnement de l'unité de Planification des ressources terrestres

L'unité de planification sera directement intégrée à la section de Planification. Elle sera un responsable de l'exécution des tâches assignées à l'unité, qui coordonnera les travaux des différents spécialistes travaillant au sein de l'équipe.

Les tâches administratives seront assurées par le Chef de la Division de Planification qui veillera à la mise à la disposition de ses différentes sections des moyens nécessaires à la réalisation des programmes.

A la fin du projet les moyens de fonctionnement de l'Unité de Planification seront dégagés par le Gouvernement dans les mêmes conditions que ceux des autres services de l'Institut.

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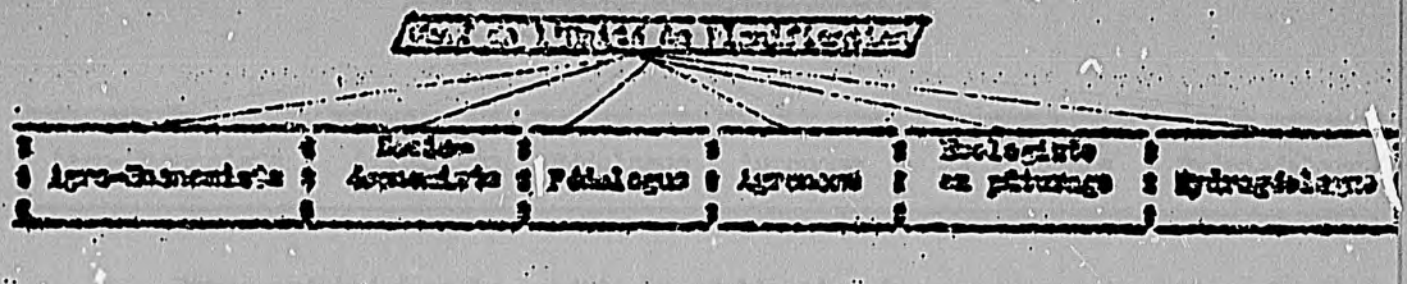
3/ Dénombrement du personnel pour l'unité



Comme prévu dans le projet, la réalisation du programme nécessitera la mise en oeuvre simultanée de trois équipes composées travaillant séparément et formées des techniciens cités ci-dessus.

Dans une phase ultérieure, cette structure sera allégée et la poursuite des actions sera assurée par une cellule légère qui, en coopération avec les autres services de l'ORD, assurera l'exécution des tâches qui incombent à l'unité de planification des ressources terrestres.

4°/ Date à laquelle l'unité sera opérationnelle

Il est fort probable que dans 5 à 6 semaines le Gouvernement adoptera les nouveaux statuts de l'ORD. L'activité de planification des ressources terrestres étant liée au démarrage du projet Inventaires des ressources, elle ne sera opérationnelle pédologiquement que lors la mise en oeuvre du projet.

5°/ Vous trouverez ci-annexe une copie de la requête adressée aux autorités françaises.

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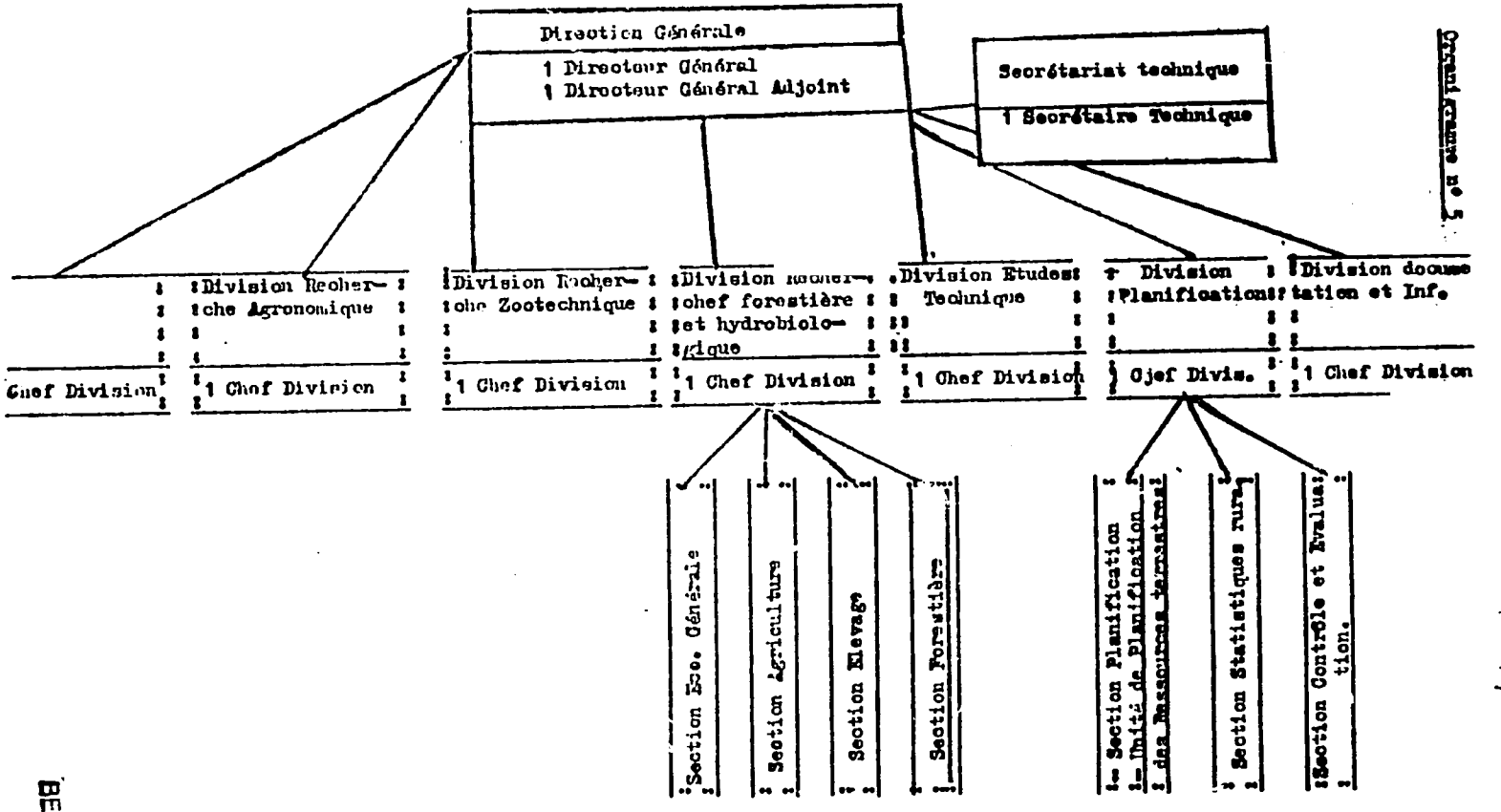
ORGANIGRAMME DE L'I.A.R.



Organigramme n° 5

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Monsieur le Ministre des Affaires Etrangères et
la Coopération Internationale

- BAMAKO -

En réponse à la lettre du 9 Avril 1976 de Mr. le Directeur de l'US AID au Mali, j'ai l'honneur de vous demander de bien vouloir lui communiquer les informations suivantes :

Dans des discussions préliminaires, la partie malienne avait admis le principe que les fournitures de bureaux et locaux de travail, les frais de déplacement des cadres maliens seraient imputés à la contre-partie malienne.

Compte tenu d'une part de l'importance du projet et d'autre part de l'urgence de son démarrage, il nous est paru difficile que le Mali puisse dégager l'infrastructure nécessaire dans un délai raisonnable. Il fallait donc recourir à la contribution de l'US AID pour résoudre ce problème.

La proposition de prise en charge des frais de déplacement des cadres maliens par le projet visait à garantir la disponibilité des moyens pour toute l'équipe et d'en accroître l'efficacité. Si cette pratique admise au niveau d'autres projets n'est pas compatible avec les règlements de l'US AID en la matière, le Mali prendra toutes dispositions nécessaires pour faire face à cette dépense.

Enfin je vous fais parvenir ci-après une note sur les autres aspects de la lettre ci-dessus citée.

AMPLIATIONS :

- I.E.R. 2
- Dossier 1
- Archives 1

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P.J.
- 1 Note
- 1 Copie requête au FAC

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[illegible]/[illegible]

Bamako, le 15 Janvier 1976

LE MINISTRE DU DEVELOPPEMENT RURAL

/-/ Transmet le dossier du Mali à

[illegible]

OBJET :
Projet de financement en faveur pour l'inventaire et l'évaluation des ressources en eau et hydroélectriques.

REF. : 1 Requête,

Par lettre n° [illegible] du 20 décembre 1975, je vous avais transmis une requête de financement relative à l'hydroélectricité en vue de la réalisation de l'inventaire et de l'évaluation des ressources en eau et en eau, au Mali.

Cette requête, élaborée à l'issue d'opérations officielles entre l'OMVS et le Mali, a retenu la place à une intervention conjointe de la coopération française dans certains domaines où celle-ci possède des grands instituts techniques, comme la pédologie, l'hydrologie tropicale, l'hydrogéologie, l'économie rurale et la sociologie, en bonne possibilité de jouer sur des mêmes maîtres la pluridisciplinarité des travaux correspondants. Il convient de contacts étroits entre l'OMVS et les autorités [illegible], il convient maintenant que le gouvernement malien calcule efficacement son dossier pour obtenir leur accord sur la participation au projet d'inventaire et d'évaluation des ressources en eau et en eau.

Il y a lieu de noter que le Mali est intervenant déjà dans le cadre de l'opération Aménagé et des Cultures Vivrières, en l'Isabelle [illegible] l'inventaire des ressources en eau d'un haute vallée (Niger) sur 23 000 km², avec un équipe de pédologues français et maliens, cet complément très intéressant par une participation accrue à la réalisation de l'inventaire général de nos ressources en eau et en sols.

La contribution française serait particulièrement appréciée, et conformément aux premiers contacts elle pourrait fournir les modalités suivantes :

- [illegible] devrait avec des [illegible] [illegible]
- [illegible] qui [illegible] avec des [illegible] maliens,
- [illegible] travaillant avec des hydrogéologues maliens,
- [illegible] qui collaboreront avec des [illegible] maliens et un expert [illegible] en planification des ressources [illegible].

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Monsieur le Ministre des Affaires Etrangères et
de la Coopération Internationale

- BAMAKO -

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La proposition de prise en charge des frais de déplacement des cadres maliens par le projet visait à garantir la disponibilité des moyens pour toute l'équipe et d'en accroître l'efficacité. Si cette pratique admise au niveau d'autres projets n'est pas compatible avec les règlements de l'US AID en la matière, le Mali prendra toutes dispositions nécessaires pour faire face à cette dépense.

Enfin je vous fais parvenir ci-après une note sur les autres aspects de la lettre ci-dessus citée.

AMPLIATIONS :

- I.E.R. 2
- Dossier 1
- Archives 1

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P.J.
- 1 Note
- 1 Copie requête au FAC

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[illegible] partie, il convient [illegible] d'assurer [illegible] le [illegible] de la France la part [illegible] de la sécurité [illegible] et de l'[illegible] du [illegible] doivent [illegible] en [illegible] et qui [illegible] [illegible] INTERET NATIONAL [illegible] sous la nécessité [illegible] [illegible] [illegible] plus en plus [illegible]

LE VERSANT [illegible]

POUR COPIE CERTIFIEE CONFORME
Dakar, le 21 Mai 1976

Le Ministre Général de l'Armée
Directeur Ferlé

[illegible]
Chevalier de l'Ordre National

[illegible]
Commandeur de l'Ordre National

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ANNEX E

AID 1020-28 (1-72)

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Life of Project:
From FY 76 to FY 78
Total U. S. Funding _____
Date Prepared: _____

Project Title & Number: Mali Land Use Potentials Survey

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Program or Sector Goal: The broader objective to which this project contributes: Rational allocation of Malian agricultural and natural resources.	**Measures of Goal Achievement:** a. Use of project outputs in resource planning and allocation. b. Extent of institutionalization of the procedure and its use in resource allocation	External evaluation.	**Assumptions for achieving goal targets:** a. Qualified Malian counterparts b. A dominant socio-economic rationale in the allocation of Malian development resources.
Project Purpose: a. To provide a technological basis for the allocation of resources to agricultural and range development. b. To develop among Malians the capability of natural resource inventorying and planning. 3. To compile the necessary information about Malian natural resources to make rational judgements on their optimal allocation.	**Conditions that will indicate purpose has been achieved: End of project status.** a. Existence of a fully trained, completely staffed office for resource evaluation. b. Completed resource potentials inventory. c. Plans for further more detailed mapping in support of development projects. d. Participation in agricultural and range resource allocations.	External evaluation.	**Assumptions for achieving purpose:** Full cooperation of GOM and FAC.
Outputs: a. Trained Personnel: soil scientists trained on-the-job 5 range ecologists " " " " 3 geo-hydrologists " " " " 2 resource planners " " " " 1 resource economist " " " " 1 soil scientist, MS degree 1 range ecologist, " " " " 1 agronomist, MS degree equivalent 1 b. Collection of existing information on Malian agricultural resources.	~~Magnitude of Outputs:~~ (continued) c. Resource Inventory: 1. 1:200,000 scale maps displaying soil vegetation ecological units south of the Niger River. 2. Detailed narrative description of the soil-vegetation characteristics of the mapping unit, presented in a descriptive legend. 3. Tabular estimates of potential crop and range yield for each soil-vegetation ecological unit, at two to four technically feasible levels of	Evaluation of: a. Interim reports. b. Draft maps, tables and manuscripts. c. Final outputs. Outputs, continued inputs. 4. The map will be printed at the 1:500,000 scale, and the report will be in French and English.	**Assumptions for achieving outputs:** That Malian counterparts with basic science backgrounds are available.
Inputs: AID: Technicians, 168mm $1,008,000 Participants (4) MS degree, 108 mm, $107,000 Commodities, survey tools and supplies, $87,000 Other Costs: Supporting services $57,000 Local Purchases $113,000	~~Implementation Target (Type and Quantity)~~ Inputs, continued: Contract Services $590,000 (incl. helicopter rental) Research & Development $107,000 TOTAL US. $2,062,000 GOM: Technicians, 384mm $93,000 FAC: Technicians, 186mm $1,090,000 TOTAL $3,245,000	Project monitoring and reporting.	**Assumptions for providing inputs:** That FAC will be requested to participate.