

PROJECT EVALUATION SUMMARY (PES) - PART I

1. PROJECT TITLE DRYLAND CROPPING SYSTEMS RESEARCH			2. PROJECT NUMBER 615-0180	3. MISSION/AID/W OFFICE KENYA
5. KEY PROJECT IMPLEMENTATION DATES			4. EVALUATION NUMBER (Enter the number maintained by the reporting unit e.g., Country or AID/W Administrative Code, Fiscal Year, Serial No. beginning with No. 1 each FY) 615-82-06	
A. First PRO-AG or Equivalent FY <u>Aug 30,</u> 1979	B. Final Obligation Expected FY <u>Dec 31,</u> 1985	C. Final Input Delivery FY <u>Dec 31,</u> 1985	6. ESTIMATED PROJECT FUNDING A. Total \$ <u>9,200,035</u> B. U.S. \$ <u>6,000,000</u>	
			7. PERIOD COVERED BY EVALUATION From (month/yr.) <u>Aug 30, 1979</u> To (month/yr.) <u>Mar 20, 1982</u> Date of Evaluation Review	
8. ACTION DECISIONS APPROVED BY MISSION OR AID/W OFFICE DIRECTOR				

A. List decisions and/or unresolved issues; cite those items needing further study. (NOTE: Mission decisions which anticipate AID/W or regional office action should specify type of document, e.g., airgram, SPAR, PIO, which will present detailed request.)	B. NAME OF OFFICER RESPONSIBLE FOR ACTION	C. DATE ACTION TO BE COMPLETED
<p>See Recommendations, pages 13-17</p> <p>A. Objectives Page 2</p> <p>B. Adequacy of Project Design " 3</p> <p>C. Inputs " 5</p> <p>D. Constraints " 8</p> <p>E. Outputs " 9</p> <p>F. Purpose " 10</p> <p>G. Recommendation " 14</p>		

<p>9. INVENTORY OF DOCUMENTS TO BE REVISED PER ABOVE DECISIONS</p> <p><input type="checkbox"/> Project Paper <input type="checkbox"/> Implementation Plan e.g., CPI Network <input checked="" type="checkbox"/> Other (Specify) "To be determined after discussion with FAO & GOK".</p> <p><input type="checkbox"/> Financial Plan <input type="checkbox"/> PIO/T</p> <p><input type="checkbox"/> Logical Framework <input type="checkbox"/> PIO/C <input type="checkbox"/> Other (Specify)</p> <p><input type="checkbox"/> Project Agreement <input type="checkbox"/> PIO/P</p>	<p>10. ALTERNATIVE DECISIONS ON FUTURE OF PROJECT</p> <p>A. <input checked="" type="checkbox"/> Continue Project Without Change as discussed by discussion</p> <p>B. <input type="checkbox"/> Change Project Design and/or of 9</p> <p> <input type="checkbox"/> Change Implementation Plan</p> <p>C. <input type="checkbox"/> Discontinue Project</p>
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<p>11. PROJECT OFFICER AND HOST COUNTRY OR OTHER RANKING PARTICIPANTS AS APPROPRIATE (Names and Titles)</p> <p>Robert E. Armstrong</p> <p><i>Robert E. Armstrong</i></p>	<p>12. Mission/AID/W Office Director Approval</p> <p>Signature</p> <p>Typed Name Allison B. Herrick</p> <p>Date</p>
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UNDP/FAO DRYLAND FARMING RESEARCH AND DEVELOPMENT PROJECT
KEN/74/017

AND

USAID/USDA DRYLAND CROPPING SYSTEMS RESEARCH PROJECT
615-0180

EXECUTIVE SUMMARY

JOINT INTERIM EVALUATION

Nairobi 22 March 1982

A. PROJECTS' OBJECTIVES AND RELEVANCE TO GOK OBJECTIVES

1. The GOK objectives for the arid and semi-arid lands areas can be briefly summarised as follows:

- (a) Increasing productivity, production and reliability of production in dryland areas and establishing a sustainable production system consistent with the natural resources potential of the areas.
- (b) Integration of the arid and semi-arid lands into the national economy.
- (c) Building of institutions and services, i.e., research, extension, cooperatives, input distribution, marketing, credit, transport, and water supply.

2. The combined objectives of the UNDP/FAO and USAID/USDA projects were designed to be responsive to GOK objective (a) and to assist in the attainment of objectives of (c). Achievement of GOK objective (b) will naturally be enhanced through achievement of objectives (a) and (c). The combined objectives of the two projects are:

- (a) To develop technologies for more efficient use of land and water resources.
- (b) To increase productivity and production through improved crop varieties, cropping systems, and crop protection, within a stable, risk averting farming system.
- (c) To develop more productive livestock production systems integrated within whole farm production systems.
- (d) To contribute to development through training and otherwise of the NDFR station at Katumani and of KARI at Muguga, as effective national research institutions.
- (e) To improve the delivery systems through pre-extension trials and involvement of extension personnel in on-farm trials.

3. Given the natural setting in the arid land areas, the constraints imposed by limited and irregular rainfall, past inappropriate use of crop and range lands and the ever increasing population, the above objectives appear to be appropriate and within the capabilities of the resources being committed by the two projects. It was noted, however, that given the usual lag time in moving from project agreement to implementation, the usually long incubation period in research before useful results can be disseminated, and especially the long term nature of institution building, the 4 and 5 year periods of the UNDP/FAO and USAID/USDA projects respectively were too short to assure achievement of either the major short term technical objectives or the longer term institution building objectives.

B. ADEQUACY OF THE PROJECT DESIGNS

4. Project design must take into consideration the constraints addressed and the resources available. The primary constraints in the dryland areas are listed below.

- (a) Rainfall is between 500 and 800 mm per annum, unpredictable as to amount from year to year and erratic as to distribution within a bimodal pattern. This has important implications in terms of possible appropriate technology. The risk of inadequate amounts and distribution of rainfall limits the production options, particularly with respect to those which could contribute to high productivity under more favorable conditions, e.g., use of fertilizers and pest control chemicals and high plant densities.
- (b) In the more densely populated areas--ever expanding as the population increases--there is decreasing land productivity through loss of soil from erosion, depletion of nutrients due to continuous cropping, and degradation of range due to overgrazing and disappearance of useful legume species.
- (c) Availability of human labour and animal draft power, together with the time distribution of labour requirements in the farm unit's production system, determine the area which can be cultivated. Labour demands for activities such as fetching water for human and livestock use are frequently substantial and result in reduction of labour available for production purposes.
- (d) The available land area, for the smallest farms frequently one ha or less, limits the land use options and hence the possible solutions.

- (e) Capital is extremely limited and the capital generating potential of existing production systems is virtually nil. Consequently, capital intensive solutions must be avoided.

5. The projects address these principal constraints in several ways.

- (a) Breeding and selection of earlier maturing, more drought resistant and disease and insect resistant varieties of food, cash and forage crops.
- (b) Expansion and diversification of the production mix to include a wider variety of crops, cereals, pulses, oil seeds, root crops, etc., to complement maize, the staple cereal crop.
- (c) Intercropping and relay-cropping to reduce risks of crop failure due to deficient rainfall and to take advantage of differential water and nutrient needs of different crops.
- (d) Water and soil moisture conserving practices including weeding practices.
- (e) Development and use of practices to reduce and/or prevent soil erosion.
- (f) Improvement of the livestock component of the farming system with greater attention to breed selection, husbandry, management of pasture and range lands, use of crop residues, and production and conservation of fodder and forages.
- (g) Development of more appropriate tools for oxen traction to reduce the demand for human labour in soil preparation and weeding and improve the economy of soil moisture utilization.
- (h) Rotations with legume crops, including study of nitrogen fixation, and use of manures, as alternatives to high cost chemical fertilizers.
- (i) Development of rainfall prediction methods which permit selection among important food crops to be planted in different seasons, and provide guidance for choices of practices and inputs, specifically plant populations and fertilizer rates, in accordance with actual early season rainfall. Research on the relationship of water to crop yield to underlie the above practices.

- (j) Integrated pest management systems for smallholders.
- (k) While the foregoing activities focus principally on components of technology, a farming systems approach was prescribed by both projects as the most effective means for rapidly introducing improvements in technology into the farmers' production systems.

6. The activities outlined were seen as adequate for achievement of stated objectives. Nevertheless, there are a number of design defects. Although the two projects were designed concurrently with a conscious effort to achieve complementarity, the institutional arrangements have not been able to provide for the coordination of inputs and work programs which are necessary to assure this complementarity. The establishment of the USAID/USDA base of operations at Muguga, while providing for use of established office and laboratory facilities, is outside of the dryland area and some 85 km from the principal field station for the dryland area. This has handicapped field work at the NDFR station and on farms in the dryland area. This is also an impediment to close interaction between staffs of the USDA and FAO teams as well as between and among the counterpart teams and the expatriate teams. The project design also made inadequate provision for physical facilities. This is especially true with respect to the UNDP/FAO project based at Katumani. The limited laboratory and office facilities, lack of an adequate water supply and lack of housing have adversely affected work by the FAO team.

6. While these defects of design have contributed to shortcomings in project implementation, use of inputs and the resulting outputs, they do not account for all of the deficiencies.

C. PROJECT IMPLEMENTATION - INPUTS

8. In spite of design defects and a host of other problems incident to establishing the projects operationally, the projects are now well established and carrying out work in keeping with most of the objectives. The principal start-up problems included late and irregular arrival of the expatriate staffs, (one key member of each team is yet to arrive at post) some premature resignations of individuals, delays in recruitment of counterparts and in recruitment and processing of individuals for training, delays in appointment of a coordinator/team leader for the FAO team, and delay in establishment of a mechanism for coordination of project inputs.

9. Both projects are substantially behind schedule in utilization of financial resources originally committed. Although by February 1982 approximately 50% and 40% of the originally projected project time had elapsed for the UNDP/FAO and the USAID/USDA projects respectively, only 37.5% and 23% of the committed funds had been utilized. Late recruitment of personnel accounted for a substantial portion of the shortfalls, but the most serious lag has been in commitment of funds for training. Late and irregular arrival of expatriate staff has had the effect of causing about a 1 year slippage in implementation. Failure to provide certain key individuals, e.g., the maize breeder for the dryland area by the USDA and the agronomist by the FAO, has resulted in neglect of important elements of the research programme and has had adverse repercussions on other elements of the programme which were already staffed.

10. By February 1982, the NDFR station at Katumani had an adequate and reasonably qualified staff. Of 26 individuals 4, 14 and 8 had MSc, BSc and diploma level preparation respectively. On the other hand few had been on the job for more than 9 months, and a majority for about 6 months or less. The assignment of counterpart staff for the USDA team in KARI, on the other hand, was highly unsatisfactory. Only four nationals had been assigned, two individuals for each of two members of the USDA staff.

11. The same relative situation existed between the two projects with respect to training. For the UNDP/FAO project 5 participants for degree training (one of whom had completed his training), of the 8 envisioned, had begun their training. Of the 18 short term training programs scheduled, 4 had been completed, 3 were still in progress and 2 were scheduled to begin in 1982. In the USAID/USDA project, of 35 degree training programs listed in the "Life of Project Plan" for training, only 6 had commenced, and arrangements have been completed for two others. Only 2 of the 26 short term training programs envisioned had been completed.

12. The delays in moving ahead with training in the USAID/USDA project will have a serious adverse impact on the objective of developing a trained cadre of researchers for whatever institutional structure is ultimately established. Given the terms of the agreement between the GOK and USAID, all actions financed by the project must be completed by January 1984. It will not be possible to finance any new advanced training programs which usually require 2-3 years for completion. Unless this provision of the agreement is amended the academic training program of the project is now essentially ended. It is therefore recommended that agreement be reached between USAID and the GOK that the time limit for completion of training with project funds be extended beyond the current project activity terminal date.

13. Procurement and delivery of equipment has been satisfactory. Neither project contained a construction element.

14. The provision of GOK inputs has fallen short of that programmed. Adequate office and laboratory facilities have been provided at Muguga for the USDA team. The provision of facilities for support of the UNDP/FAO team at Katumani has not been entirely satisfactory. Funds earmarked for housing have not been made available. There have been delays in construction and installation of laboratories and a water supply system. Budgeted contributions by KARI for operations have been adequate. However, the use of the funds has been hampered by bureaucratic impediments. Allocations of funds for operations at Katumani have been less than desired. It is understood that this situation prevails in most projects because of general constraints on GOK budgets.

15. The levels of technical inputs were deemed satisfactory and consistent with the project objectives in most areas. A notable exception was in maize breeding for the lowlands with no inputs to date. The absence of the UNDP/FAO agronomist has retarded agronomic work, and has been a particularly serious handicap to more effective planning of pre-extension trials and the development of farming systems work.

D. CONSTRAINTS AFFECTING USE OF INPUTS AND IMPLEMENTATIONS

Institutional Relationships

16. The institutional relationships of the two projects have had a serious adverse impact on use of inputs. The UNDP/FAO project is directly responsible to the Division of Scientific Research of the MOA, while the USAID/USDA project is directly responsible to KARI, which though institutionally autonomous, is in fact dependent on the MOA/DSR. This has created a series of problems, e.g., bureaucratic impediments to effective communication, to assignment of personnel, to use of available resources, and to cooperation between the two project teams. The FAO team posted at Katumani has access to the NDFR station installation of the MOA/DSR for field work. KARI does not have field facilities in the dryland area. Consequently the USDA team must depend for field facilities on the NDFR station, over which KARI has no control. Although approximately 90% of the activities at the NDFR station are project work, the station is managed by a Director, whose relationship to the project and the two project teams remains undefined although he essentially controls the allocations of most national project resources. A further complication is the separation of responsibilities for crops and livestock research between divisions of the two ministries, MOA and MOLD. The NDFR station has a distinct crops bias undoubtedly reflecting the fact that the major resources come from the MOA. Cooperation between the research divisions of the MOA and MOLD in defining program and in the allocation of resources for research in the arid and semi-arid zones was not in evidence.

17. The logistical arrangements, whereby the FAO staff as well as the USDA staff reside in Nairobi and must travel 85 km each way to Katumani, aside from being costly, must inevitably adversely affect performance. Thus it is not possible for the staff to follow in the required detail the research activities. The professional association of the expatriate and the national personnel is seriously impaired. This is undoubtedly an element contributing to the feeling of being less than total participants in the programme by the national personnel. Because of the large amount of time consumed in travelling between Nairobi and Katumani, work in pre-extension and on-farm trials must inevitably suffer.

Inter and Intrateam Cooperation

18. A Technical Coordinating Committee (TCC), with two subcommittees and special ad hoc committees, has been established to coordinate the activities of the UNDP/FAO project. A National Coordinator, who also serves as coordinator of the FAO team, has been appointed for the overall NDFR project. These mechanisms have failed to bring about effective cooperation and coordination among the two project teams, the national counterparts, and the NDFR station, nor even within the personnel of the two teams. The relationship between the National Coordinator and the USDA team leader is undefined. There was no evidence of joint planning by the two teams and the national counterparts. The two counterpart groups are isolated one from the other by location and evidence of interaction was totally absent. It was also clear that effective cooperation and coordination within teams was lacking. This was more noticeable within the FAO team. There was little evidence of a team approach or a joint team approach. At the same time highly effective cooperation between and among individuals within and between teams was in evidence. This level of cooperation, however, was on a personal and/or professional basis. In this connection, it is worthy of note that earlier cooperative work between the Faculty of Agriculture, University of Nairobi and Katumani Station has been discontinued. Apparently the University researchers felt that support for their research program at Katumani was not sufficient to maintain the work at a satisfactory level. The Katumani management on the other hand expressed the view that the University researchers were devoting too little time to the cooperative work and were making excessive demands on the station resources.

E. OUTPUTS

Technical

19. In original concept the USAID/USDA team was to engage in basic and applied research while the UNDP/FAO team was to be concerned mostly with adaptive research with a significant element of pre-extension and on-farm trials. Within the context of the two projects this distinction is a hindrance rather than a useful distinction. An important measure of complementarity is nevertheless implied by this distinction. Whereas substantial complementarity between the plant breeding and variety selection work of the FAO team and the USAID plant pathologist and between the FAO soil conservationist and the USAID soil physicist and agro-meteorologist has been established, this has been notoriously absent regarding the agronomy and farming systems elements of the two teams.

In both cases the farming systems approach was prescribed although the USAID/USDA project was limited in scope to crops and cropping systems while the UNDP/FAO project also included animal production.

20. The combined research programs of the two projects in support of certain of the objectives appeared to the evaluation team to be progressing satisfactorily, e.g., selection and breeding work with pulses, cooperation in selection for disease resistance in pulses, study of water requirements of maize and beans under different levels of fertility and plant populations, the long term study of erosion in run-off plots, cultural methods for weed control, and improvements in animal drawn equipment in cooperation with the UNDP/FAO project KEN/74/019 on agricultural equipment. There are, however, certain important gaps in strategic areas. Nothing has been accomplished with regard to maize variety improvement in the dryland area.^{1/} There has been little study of rotations for soil fertility improvement, especially rotations involving legume crops including the study of nitrogen fixation and the study of Rhizobial activity which is identified with different species. Finally little has been done to improve the soil-water-use economy.

21. The principal accomplishment in the area of soil and water conservation is the establishment of equipment for measuring run-off. This is a long term experiment designed to provide the basis for greater precision in the design of erosion control practices. In the area of soil conservation there is much debate as to the relative emphasis which should be given to research as opposed to application. In past decades practices to reduce run-off and erosion have been established in much of the area. Many of these have been highly effective while others have been less so, and in some cases these measures have aggravated the problem. A diagnostic study of a cross section of these installations to determine the basis for success or failure would probably produce more useful results in the short run than the establishment of carefully designed test installations which will require a long period before yielding useful results. In this regard cooperation with the USAID/ASAL project in Kitui District should be explored.

^{1/} USAID/USDA is providing a maize breeder at Kitale in continuation of assistance in maize breeding which was begun over a decade ago. This maize breeder has been at post since June 1980.

22. The livestock forage and pasture unit has focused on studies of means for improving the nutritional value of crop residues, on feeding of draft animals, on conservation of crop residues and fodder, and to a limited extent on the production and utilization of cultivated pasture and fodder crops. Many of these trials have produced results which are either negative or not relevant to the constraints within which the farmer operates because of a relatively capital intensive orientation. A substantial reorientation was proposed, and accepted, by the unit. The reorientation focused on low capital input operations, e.g., improving natural pasture by introduction of legume species, production of legume fodder species including fodder shrubs on field borders and terraces, genetic improvement of breeds by cross-breeding with superior stock, and use of females as draft animals.

23. The focus of the FAO farming systems unit has been on pre-extension trials in farmers' fields and the establishment of a unit farm. Although there has been collaboration with the livestock group in the work of the unit farm, a livestock element has not to date been incorporated in the pre-extension trials. The pre-extension trials were begun with the 1980 short rains season, about 2 months after the arrival of the farming systems agronomist. The design of the pre-extension trials appeared to have been arbitrarily made without any basis in experimental results nor in traditional practice. The design apparently represented the best judgment of the staff and was perhaps acceptable for a start. However, there has been little or no effort to determine the validity of this best judgment in more rigorously controlled tests. In the design of the pre-extension tests, proposals from the results of several years work by the USDA agronomist were totally ignored. As a consequence there has been no cooperation between the USDA agronomist and the FAO farming systems unit. The pre-extension trials of the latter and the verification trials of the former are being run in complete isolation from one another. Where both are working at the same site (the unit farm) there are conflicting reports as to the results being obtained.

24. The farming systems work has ignored one fundamental concept, i.e., the first step in farming systems work is a thorough understanding of the farmers' current systems and constraints before attempting to introduce modifications. The pre-extension work is introducing a pre-planned package without an adequate analysis of the existing systems nor an adequate experimental data base on the use of the package itself.

This is not to imply that the pre-extension trials have not had any useful effect. On the contrary, the inclusion in these trials of an early maturing composite pigeon pea variety has attracted much attention from the farmers. They are asking for seed of this variety to replace the longer maturing traditional varieties. Up to this point the focus of the research has been on the individual technologies and components of the system and not on the system itself. It is understood that the farming systems unit will now undertake in-depth analyses of existing systems including the livestock component and the family living component to serve as a basis for more rational integration of improved practices which can be recommended and which can be accommodated within the constraints within which the farmer works.

25. The pre-extension trials and the farming systems approach provide the essential linkages to the extension services. The extension personnel at the field level, technical assistants (TAs) and junior technical assistants (JTAs) play an essential role in monitoring these trials. The monitoring has not been entirely satisfactory. This is due in part to difficulties in logistics but also because of the lack of adequate understanding of their roles in the pre-extension program and in the extension program itself. Although some training has been provided to the TAs and JTAs at the Katumani Station it is doubtful that they have a clear understanding of their roles. Traditionally personnel at this level do little more than carry out instructions from various technical specialists from the District Offices. They are poorly equipped by training and orientation to interpret farmer problems and to provide effective reverse flow of information which could be helpful in the design of extension programs or as guidance which district level specialists could give.

Relations With The Extension Service

26. With respect to the role of extension service personnel in the pre-extension trials and eventually in farming systems work, it is clear that the research staffs have not established adequate communications with the DAOs, DLOs and the specialists so that there is no clear understanding of the respective roles. Thus far, working contacts by the research staffs with extension have been largely limited to those with the TAs and JTAs. The multiplicity of extension services of which the DAO and DLO organizations represent only a part does little to engender effective use of the field level worker.

Institutional Building

27. The rationale for relating the USAID project to KARI rather than the MOA/SRD was the belief that KARI would provide a better basis for building a long term research institution for agriculture broadly defined. KARI had recently been established in implementation of the 1979 amendment to the Science and Technology Act of 1977. As a semi-autonomous institution it was designed to overcome the problems of maintaining qualified personnel in research positions.^{1/} In practice, however, KARI has remained subordinate to the MOA/DSR. The latter is inconsistent with inclusion of animal science research in KARI without establishment of mechanisms for relating this to the research division of the MOLD. KARI has remained an institution in name only, without its own staff and dependent on the MOA/DSR for budgets. Under this arrangement a suitable base for developing KARI as a national agricultural research institution does not exist. Consequently the institution building element of the USAID project is seriously compromised if in fact not totally negated. Given the long term nature of research and the need for continuity, this defect will seriously compromise the contribution of the project to the GOK objectives.

28. The UNDP/FAO project is tied to the MOA/DSR and the NDFR station at Katumani. This institutional arrangement does provide a suitable relationship for strengthening the institutional capabilities of the NDFR station. Its effectiveness, however, is compromised by the lack of a clear definition of roles and relationships between the NDFR station director and the NDFRD project coordinator. It is further compromised by unsatisfactory relationships between the expatriate team and the national counterpart team. Substantial personal conflicts within the FAO team do little to facilitate the strengthening of the station as a well rounded institution.

29. The recent (February 1982) creation of a new ministry (Ministry for Regional Development, Science and Technology) may substantially alter the institutional setting for agricultural research. Should all of research, including crops and livestock production, be transferred to this new ministry, either within the framework of KARI or some other institution, it is possible that a sound basis will be established upon which to build an agricultural research institution. Should agricultural research, including animal science research, continue to be fragmented, a re-evaluation of the institutional arrangements of the two projects will become indispensable.

1/ This issue is discussed in depth by the ATAC report of 1977.

30. Any recommendations for organizational changes in the two projects at this time must be deferred pending a clear demonstration of intent by the new ministry. Nevertheless, whatever the form the new institutional arrangements for crops and livestock production research will take, it is imperative that a more effective mechanism be developed for coordinating and managing the two projects' inputs into the research system. We should perhaps envision a truly joint project with pooled resources under a single coordinator.

F. PROJECT PURPOSES (FOR USAID PROJECT ONLY)

31. The purpose of the project is still valid, but little progress has been made to date towards the development of improved technical packages. Given the lag time in initiation of effective implementation it is unreasonable to expect applicable new technologies at this time.

32. The magnitudes of outputs projected in the log frame are clearly unrealistic. It is not likely that the project will have any impact on production and incomes in the project area during the life of the project, except for the relatively few farmers with which the project will work in verification and pre-extension trials. The most likely "End of Project Status" will be packages of technology adequately tested in pre-extension trials and ready for broader dissemination by the extension services. Unless the PACD date is amended degree training will fall far short of project targets.

F. RECOMMENDATIONS

1. Recommendations for Institutional Changes

33. Recognizing that the unsatisfactory state of the institutional relationships of the two projects is a major impediment to effective cooperation and coordination, it is clear that restructuring of them is a matter of urgent necessity.

34. However, because of the recent creation of a new Ministry of Regional Development, Science and Technology and the uncertain impact that this may have on the institutional organization of research in agriculture (crops and livestock) it is difficult to suggest what changes should be made in the existing institutional relationships of the two projects.

35. Therefore, it is recommended that within the next nine months and no later than December 1982 a review of intervening institutional changes be made by a group of three individuals.^{1/} If such a review should reveal that little progress has been made toward greater integration of agricultural (crop and livestock) research institutions, the institutional ties of the two projects should be critically reappraised. The reappraisal should focus on establishing a satisfactory institutional arrangement for assuring effective coordination of the two projects. It should also include a review of the posting arrangements of the two expatriate teams.

Action: GOK, UNDP, and USAID.

36. In the meantime, and recognizing the difficulties which are likely to be faced in attempting to restructure the management and coordinating aspects of the two projects without the basic institutional remedies, some immediate measures should be taken to improve the existing situation. These are as follows:

- (a) It is recommended that a Senior Kenyan Research Officer be appointed National Coordinator of Research in Agriculture (crops and livestock) for the arid and semi-arid lands.

Action: GOK.

- (b) The National Coordinator should be responsible for coordinating the use of inputs provided by the UNDP/FAO and the USAID/USDA projects and for the allocation of all national resources committed to the project.

Action: GOK.

- (c) A team leader should be named (this has already been done for the USAID/USDA team) for each expatriate team with responsibilities for directing the activities of his respective team and assuring that team members fulfill their roles in the overall program. The team leaders should be responsible to the National Coordinator.

1/ Were it not for the recent creation of the Ministry of Regional Development, Science and Technology, the evaluation mission would most likely have recommended an immediate transfer of the USAID/USDA project to the MOA/DSR in order to pull the two projects together, recognizing however that this would not contribute to the solution of the fundamental problems facing the development of Agricultural Research in Kenya.

- (d) In order that the National Coordinator may fulfill the responsibilities stated in (b) above he should also be director of the National Dryland Farming Research Station, Katumani. An effective estate manager to manage the day-to-day operations of the station will also be essential.

Action: GOK.

- (e) The National Coordinator should have executive authority to implement recommendations and decisions of the Technical Coordination Committee, whose mandate should be extended to include the operations of the USAID/USDA project.

Action: GOK: Chairman of the TCC.

37. Recognizing that the problems of management and coordination of the two projects, as well as other related projects, are to a large extent due to the lack of a well-defined program for research and development in the arid and semi-arid lands, and recognizing that a large number of donor supported projects have been substantially developed by the respective donors without the guidance of a national plan, it is recommended that a plan for research and development be mapped for a 10-20 year period, establishing priorities and defining resource requirements. This plan should specifically address the question of research-extension linkages and propose mechanisms and resource requirements for strengthening these linkages. The several donors should be prepared to assist the Government in preparing this plan, independently of the ongoing projects.

Action: GOK and Major Donors.

2. Operational Recommendations

38. In order to improve implementation of research and pre-extension programs by the national staff of the Katumani Station and the two expatriate teams, it is recommended that:

- (a) Joint planning of annual work programmes be undertaken, involving the national staff and the two expatriate teams.

Action: The National Coordinator.

- (b) An organogram of the Katumani Station be developed showing major divisions, defining the responsibilities of each staff member and identifying linkages and lines of communication.

Action: The National Coordinator.

- (c) Regular meetings should be held involving the National Coordinator and the two expatriate team leaders.

Action: The National Coordinator and the FAO and USDA Team Leaders.

- (d) Regular meetings should be held of the national staff and the expatriate teams. Smaller group discussions along commodity and/or discipline lines should be encouraged.

Action: The National Coordinator and the FAO and USDA Team Leaders.

3. Technical Recommendations

39. Progress in several areas in the work programs of the two projects was deemed to be satisfactory. On the other hand, some deficiencies were noted in others for which the following recommendations are made:

(a) Soil and Water Conservation

It is recommended that the work of this unit should focus more than heretofore on demonstration of the best practices which are currently available while continuing the more basic run-off studies. These practices should be introduced in the pre-extension trials, in the unit farm and in farm units selected for pilot testing of whole farm systems.

Action: FAO and USDA Team Leaders.

- (b) A wider range of legume species including bushes and trees, should be included in studies of nitrogen fixation. Particular attention should be focused on identification of multipurpose species--useful for animal feed, in soil and water management and for enhancing soil fertility and physical structure.

Action: FAO and USDA Team Leaders.

- (c) The livestock program should be expanded and substantially reoriented toward less capital intensive technologies. Proposals for this reorientation are detailed in an Annex to the report.

Action: Project Coordinator and FAO Team Leader.

- (d) Pre-extension and Farming Systems:

The design of these elements should involve the combined effort of all team members. Because it is this aspect of the program which forges the link between the commodity and discipline research and the application of results by the farmer, it should be expanded as rapidly as improved elements of technology become available. It is recommended that a combined team consisting of the economist, the farm manager, the agronomist and the livestock specialist complete an in-depth analysis of a sample of typical farms as soon as possible. Based on this, further design of pre-extension trials should be undertaken, finally leading to testing of whole farm systems.

Action: Farming Systems Specialist.

- (e) Since the satisfactory implementation of the pre-extension trials depends on active involvement of the extension personnel, especially at the local level, and since this involvement is an important element in extension/research linkages, understandings between the projects and the Katumani staffs and the District Agriculture/Livestock Officers for participation of the District staffs and the local technical assistants should be formalized. Project resources should be committed for the enhancement of this cooperative involvement of extension personnel, especially the technical assistants.

Action: National Coordinator.

UNDP/FAO DRYLAND FARMING RESEARCH AND DEVELOPMENT PROJECT
KEN/74/017

AND

USAID/USDA DRYLAND CROPPING SYSTEMS RESEARCH PROJECT
615-0180

JOINT INTERIM EVALUATION

Nairobi 22 March 1982

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LIST OF ABBREVIATIONS

ASAL	Arid and Semi-Arid Lands Development Project
ARCs	Advisory Research Committees
ASARC	Agricultural Sciences Advisory Research Committee
CIMMYT	Centro Internacional de Mejoramiento de Maiz y Trigo
DAO	District Agricultural Officer
DLO	District Livestock Officer
EAAFRO	East African Agricultural and Forestry Research Organization
EAVRO	East African Veterinary Research Organization
FAO	Food and Agriculture Organization/United Nations
HIID/TAP	Harvard Institute for International Development/ Technical Assistance Pool
IBRD	International Bank for Reconstruction and Development
ICRISAT	International Centre for Research in the Semi-Arid Tropics
ICIPE	International Centre of Insect Physiology and Ecology
ICRAF	International Centre for Agro-Forestry Research
IITA	International Institute of Tropical Agriculture
ILCA	International Livestock Centre for Africa
ILRAD	International Laboratory for Research in Animal Diseases
ISNAR	International Service for National Agricultural Research
KARI	Kenya Agricultural Research Institute
MOA	Ministry of Agriculture
MOLD	Ministry of Livestock Development
NCST	National Council for Science and Technology
NDFRS	National Dryland Farming Research Station
SRD	Scientific Research Division
UNDP	United Nations Development Programme
USAID	United States Agency for International Development

SUMMARY OF FINDINGS AND RECOMMENDATIONS

A. Findings

1. Despite the priority given to dryland farming by the Government, there is as yet no long-term programme for the research and development of the arid and semi-arid lands of Kenya. Similarly, there is not yet any national coordination mechanism for the planning and implementation of dryland farming programmes (paras 2.25 - 2.26).

2. A number of donor-assisted projects are being implemented with direct or indirect benefits to the arid and semi-arid areas. The interaction and feedback between these projects is still weak (paras 2.27 - 2.28).

3. The emphasis of the two projects is on the systems approach, a cropping system for the USAID/USDA project and the whole farm system for the UNDP/FAO project (para 3.4).

4. During their life time, the two projects are unlikely to have a significant impact on the farming population of the project area. However, by establishing a sound foundation, a favourable impact will ultimately spread (para 3.8).

5. Both projects have common long-term goals which are in accord with Government objectives for the development of the marginal rainfall areas of Kenya. The sub-objectives of the two projects, however, differ somewhat because of divergency in their orientation. The major thrust of the USAID/USDA project is on basic and applied problem-solving research in the crop sector; the UNDP/FAO project emphasises adaptive field research covering both crops and livestock and testing the results on family farm units (paras 4.2 - 4.5).

6. The beneficiaries of both projects are poor farmers with small holdings as well as the extension service (paras 4.6 - 4.8).

7. In the soil and water conservation work, both teams have concentrated on moisture-conserving cultural practices while neglecting to a large extent trials and demonstrations of physical structures for erosion control (para 4.10).

8. There are overlap, duplication and, in some cases, opposing viewpoints in the agronomic work carried out by the two projects (para 4.12).

9. Because of the lack of a proper livestock survey and some dubious assumptions, the activities of the UNDP/FAO project have stressed the introduction of high input/high output animal production systems which the small farmers cannot possibly accept at the present time due to high capital cost and higher labour demand (para 4.16).

10. The planning process leading to the verification and pre-extension trials has not been thorough (para 4.18).

11. The design of the two projects has underestimated the ramifications arising from their institution-building activities (para 4.20).

12. The implementation of the two projects has been less than satisfactory due to various factors and circumstances (para 5.1 - 5.2).

13. The utilization of inputs (external and internal) has fallen behind the original targets (para 5.3 - 5.5).

14. There have been serious delays in the recruitment of some experts and most of the counterparts. The counterpart situation is particularly serious in the case of the USAID/USDA project (para 5.8 - 5.10).

15. The implementation of the training programmes has been slow especially in the case of the USAID/USDA project (para 5.12 - 5.14).

16. While the Technical Coordination Committee (TCC) of the UNDP/FAO project provides a useful forum for assessment of technical achievements, its mandate does not cover the work of the USAID/USDA project. Moreover, there has been no follow-up to the recommendations of the TCC (para 5.24).

17. Regretfully, the University of Nairobi is left out of the research programme conducted at the Katumani Station (para 5.25).

18. The institutional set-up for agricultural research is not clear, and especially the role of the Kenyan Agricultural Research Institute (KARI) is not satisfactory (para 5.27).

19. A number of operational problems have slowed down the progress of the two projects, e.g., location of the two projects in separate entities, absence of working arrangements between the USAID/USDA project and the Katumani Dryland Farming Research Station, lack of interaction between the UNDP/FAO and USAID/USDA projects, inadequate physical facilities at Katumani Station, frustration of counterpart staff, and lack of technical backstop support of the USAID/USDA project (paras 5.29 - 5.35 - 5.36; 5.39).

20. The work on soil and water conservation has to be made part of the overall farm development package and should conform to standards which the farmers can carry out at their own pace and ability (para 6.6).

21. The agro-meteorological studies have demonstrated a potentially useful technique for manipulating cropping systems according to rainfall expectations. This technique is, however, still to be tested in farm situations.

22. In agronomy good progress has been made with pulses, mainly pigeon peas and cowpeas, but because of delay in the arrival of personnel, little work has been done on maize, the main cereal crop (para 6.9 - 6.10).

23. Major plant diseases and insect pests have been identified and control measures taken; an improved maize storage crib has been demonstrated (para 6.11).

24. Some work on animal production and forage and pasture improvement has taken place but the package cannot be used in pre-extension trials due to high cost and the risks involved (para 6.12).

25. Some progress has been made in introducing improved tillage equipment and a less expensive ox cart (para 6.14).

26. Excellent progress has been made in conducting descriptive socio-economic surveys in selected sub-locations (para 6.14).

27. For pre-extension trials some technological components have been introduced on selected farms but not the whole farm system (paras 6.16 and 7.2).

28. Progress in insitution building has not been forthcoming due to delays in the training programme, lack of counterparts and faults in expatriate/counterpart relationships (paras 6.17 - 6.18).

29. The effects of the verification and pre-extension trials on the extension service have been minimal but fairly successful in the case of the participating farmers (para 7.6 - 7.7).

I EVALUATION METHODOLOGY

A. Introduction.

1.1. This evaluation covers two related and complementary projects concerned with research and development in the arid and semi-arid lands in the Eastern Province of Kenya, i.e., UNDP/FAO Project, Dryland Farming Research and Development (KEN/74/017) and the USAID/USDA Project 615-0180, Dryland Cropping Systems Research. The project agreements were negotiated at approximately the same time, at mid-year 1979. The UNDP/FAO project has a duration of 4 years (1979-83); the life of the USAID/USDA project is 5 years (1979-1984). By the end of 1979 only three members of the FAO staff were appointed, one of whom resigned in March 1980. The majority of the staff, including the National Coordinator, assumed their duties between February and September 1980. One position is still vacant. As a consequence, the entire FAO team, with one exception, has been at the project site for approximately 20 months.

1.2. Similar delays occurred in the appointment of personnel for the USAID/USDA team. While two individuals who were already in country on other projects undertook their duties promptly, in many respects a continuation of their former work programmes, there were considerable delays in posting the remaining personnel. However, by September 1980 all team members were at post except for the senior maize breeder, who is expected shortly. Thus, the evaluation is being conducted approximately 20 months after the majority of personnel had joined the projects.

1.3. Both project documents provide for external mid-term evaluations. Some within-agency assessments and consultations with respect to the UNDP/FAO project activities had been done by FAO between July and December 1981. No similar assessments have been made of the USAID/USDA project. As this evaluation covers both projects, the the purpose of the foregoing brief introduction is to put in perspective the time lag in implementation and its implications for joint evaluation.

B. Methodology

1.4. A summary of the purposes of the mid-term evaluation follows.

- (a) Evaluate the relevance of the long-term and immediate objectives of the two projects in terms of expected benefits from improved dryland farming systems to small farmers in the semi-arid areas of Kenya and assess the feasibility of their immediate objectives in terms of inputs provided by UNDP, USAID, and the Government of Kenya.
- (b) Identify major factors which promote or hinder the implementation of planned activities and the achievement of intended results.
- (c) Highlight complementary activities which enhance or will enhance the effectiveness and impact of both projects.
- (d) Make recommendations for future actions by the two projects.

A more detailed term of reference for the evaluation mission is appended as Annex I.

1.5. The evaluation team included individuals from, or recruited as consultants to, the Government of Kenya, FAO, UNDP and USAID. The membership of the team is given in Annex II. The team spent four weeks in Kenya. The team leader and the FAO senior evaluator remained for another week to complete the evaluation report. Consultations as a team were made with key individuals from the MOA, MOLD, KARI, FAO, UNDP, IBRD, HIID/TAP, ILCA, Egerton College, Faculty of Agriculture, University of Nairobi, ICRAF and USAID. Throughout its stay, the team worked very closely with the national staff of the National Dryland Farming Research Station at Katumani and the two expatriate project teams.

1.6. Field visits included 2 days of intensive consultations at Katumani, 3 days in Machakos and Kitui Districts including meetings with District Agriculture Officers and their staffs, field observations of several verification and pre-extension trials on farmers' fields, and 2 days in the western Kenya dryland area. Two members of the team also visited the National Maize Breeding Station at Kitale, which is assisted by the USAID/USDA project. For all except the visits to the western area and Kitale and some consultations of individual technical interest, the evaluation team worked as a group. Ample time for individual discussion between members of

the evaluation team and project personnel, both national and expatriate, was afforded during field travel. Each member of the evaluation team looked closely at activities within his area of specialization and made recommendations to the FAO and USDA teams. The evaluation team screened a considerable amount of literature related to dryland farming in Kenya (see Annex III).

1.7. The consultations and field visits covered a wide range of topics and issues, but the primary focus was on: projects' objectives; their relation to the Government strategy for dryland farming; methodology and approach employed by the staffs of the two projects; substantive technical problems; relations with District and related subdivisions' agricultural and livestock staffs and work programmes, as well as with individual farmers; intra and interproject cooperation; implementation problems; interaction with other-donor funded projects; and finally, short and medium-term outlook in terms of technical accomplishments and institution building.

1.8. Review meetings were held by the evaluation team with the expatriate and counterpart personnel of each project and with MOA, MOLD, and KARI. These meetings served to highlight the more significant findings, problems, and issues before undertaking major report writing.

1.9. Finally, a debriefing session was held with key personnel from the MOA and MOLD, KARI project team leaders, and representatives of FAO, UNDP, and USAID to review findings, conclusions, and recommendations before the final draft of the report was completed. The evaluation mission leader and the FAO senior evaluator also briefed donor agencies as a group on the findings and recommendations of the evaluation team.

1.10. Lists of contacts made and individuals consulted as well as the detailed itinerary followed by the evaluation mission are given in Annexes IV and V respectively.

II. AN OVERVIEW

A. The Importance and Potential of Dryland Farming in Kenya

2.1. Limited knowledge is presently available on the resource potential of Kenya's arid and semi-arid lands.^{1/} The publications that exist often contain gaps in basic data and their findings are sometimes conflicting. So far, no serious effort has been made to fill the critical gaps in data and information with a view to establishing a consolidated inventory of resources and agricultural practices as a first step towards the formulation of a long-term development programme for arid and semi-arid regions.

2.2. Nevertheless, the available data indicate that the arid and semi-arid lands (i.e., regions with annual rainfall of 800 mm and below) constitute roughly 80% of Kenya's land area, contain 50% of its livestock population, and account for 20% of its human population. The contribution of these areas to national crop and livestock production is not well known. What is clear is that these regions produce little surplus in food crops over the subsistence needs of their inhabitants, though the surplus in livestock products is significant.

2.3. For a long period, the thrust of the development effort was on increasing the production and productivity of crops and livestock in the high potential regions which account for only 12% of the country's land area. The medium and low potential regions, representing 6 and 74% of the total land area respectively, received little attention. On the other hand, the high growth of population (estimated at 4% annually), coupled with rapid migration from the densely populated high potential

1/ One important study carried out in 1977 is entitled Kenya: Marginal/Semi-Arid Land Pre-Investment Inventory. It was carried out jointly by the Consortium for International Development (a USAID Contractor), the United States Soil Conservation Service (USDA) and the staff of the Kenyan Ministry of Agriculture, Water Development and Natural Resources. with rapid migration from the densely populated high potential

areas to semi-arid regions, has progressively weakened the productive base for agriculture in the semi-arid regions. The situation is exacerbated by the pressure of population on arable land. As a result, there are now threatening signs regarding food production in the semi-arid regions as well as widening disparity in per capita income between these regions and the rest of Kenya.

2.4. From the point of view of balanced national development, it is no longer feasible or economical for the population of the arid and semi-arid regions to remain dependent for part of their food requirements on high potential areas in exchange for livestock. They must be encouraged and assisted to grow their food requirements on family owned farms as well as develop a system of integrated livestock production as a permanent source of cash income. It is the recognition of these basic premises which has compelled the Government of Kenya to give high priority to the development of arid and semi-arid regions in its development plans for 1974-78 and 1979-83.

2.5. The long-term potential of the arid and semi-arid regions of Kenya is still a matter of conjecture and there are no easy and quick solutions. In fact, considering the dimension and complexity of the problems, progress is bound to be slow and unpredictable. Nevertheless, the prevailing opinion is that the introduction of appropriate low cost technology geared to the whole-farm systems approach would make it possible to increase crop and livestock production. Most important are soil and water conservation and management and those improved crop and livestock husbandry practices which require few capital inputs and which make more efficient use of family labour.

2.6. Even if quick progress can be achieved, it is still unrealistic to assume that improvements in crop and livestock productivity alone can resolve the socio-economic poverty of the arid and semi-arid regions. Any uplifting of their economic and social well-being will inevitably demand the creation of opportunities for off-farm income and the provision of basic services at the village level. The significance of off-farm income (estimated to represent at least 50% of family cash income) should not be overlooked. Apart from supplementing family consumption, it is the main source for capital formation on the farm as well as the means for purchasing inputs needed to increase output per unit of land, livestock, and family labour.

B. Major Constraints

2.7. The development prospects of arid and semi-arid regions hinge on finding solutions to a number of interdependent constraints, taking into account the capability of small farmers and the resources which they possess. Briefly, the constraints can be listed as follows:

2.8. Land Degradation: This is caused by inadequate soil erosion control practices, excessive water run-off, population pressure, overstocking of range and pasture, and crop husbandry practices which are ill-suited to dryland farming. One estimate made in 1977 pointed out that the annual loss in production due to soil erosion was 3% in the Machakos-Kitui-Embu Districts, or approximately KShs 12.7 million. It also concluded that one millimetre of rainfall in 1976 produced only half as much food as it did in 1970.

2.9. Erratic Rainfall and Moisture Conservation: The bimodal rainfall ranging from 250-400 mm per season (long rains from March through May and short rains from late October to late December) is adequate to obtain two crops per year provided the rains come on time and are well distributed. However, the rainfall is erratic and its timing and length are unpredictable. On average in 3 out of 10 seasons agricultural production is seriously curtailed by inadequate and/or erratic rainfall. Another limiting factor is the loss of moisture content in the soil due to excessive run-off and lack of improved tillage practices.

2.10. Low Land Fertility: Most soils are low in nutrients and the open range has declined to fair or poor condition. The deterioration in land fertility due to severe soil erosion is accentuated by the neglect of a sound crop rotation system for soil improvement as well as the limited use of animal manure on the land.

2.11. Lack of Homestead Water: At present the harvesting of rain-water is not practised by farmers and the economic justification of the initial capital required for this purpose has not yet been determined. Supplies outside the homestead are limited by the intermittent flow of the numerous streams, and groundwater resources are either not available or too costly to develop. In general, the population is too scattered to be served by piped water. Because of these limitations, farmers (especially women) travel an average of 5 km to fetch water from the nearest source; this journey is often made twice a day in dry seasons.

2.12. Shortage of Labour (including ox power): During periods of high labour demand (March-May; July-August; November-December) livestock husbandry competes with crop husbandry for available labour. As a result, some farmers sow and weed too late. These difficulties are compounded by the fact that although oxen are utilized for the major part of the year, it is most difficult to provide feed for them at the end of the dry season when their labour is in greatest demand. Unavailability of labour at certain periods is therefore a constraint on increasing crop and livestock production. It also makes it difficult for the farm family to attend to other essential activities such as terracing and other soil erosion control practices.

2.13. Other Constraints: These include the abundance of insect pests causing severe pre-harvest and post-harvest losses; lack of early maturing, drought tolerant and drought-evading plant material for food crops which at the same time are disease resistant; absence of forage crops as a rotation for better animal nutrition; inadequacy of social infrastructure; and the absence of capital, farm credit, price incentives, and nearby marketing centres.

C. Scope and Characteristics of Project Area

2.14. The area covered by the two projects is estimated to be approximately 5 million ha at medium altitude and is largely semi-arid. The two projects extend over four districts, all of Machakos and Kitui and parts of Embu and Meru. This represents roughly one-third of the Eastern Province and more than 10% of Kenya. The population of the project area is estimated between 2 and 2.2 million of which more than 50% live in the district of Machakos. The area is served by the Dryland Farming Research Station at Katumani (450 ha) which lies 85 km east of Nairobi. In addition, there are two sub-stations, one at Kampi ya Mawe (40 ha) located in Southern Machakos and another at Ithookwe (20 ha) located in Kitui District. There is a range management station (3000 ha) at Kiboko not far from the project area.

2.15. The project area has an annual rainfall of 500-800 mm depending on altitude. The rainfall is bimodal but the dry seasons extend over five months. In normal years the duration of each rainy season is about 60 days. The major part of the project area is of medium to low potential depending on rainfall, soil characteristics, and the extent of erosion. Some pockets, however, are considered to be of high potential. The traditional bush fallow system of land cultivation has disappeared and most of the land is now under homestead. Although the project area is suitable for dry-land farming, small scale irrigation can be developed in limited places using surface dams.

2.16. It is estimated that about 12% of the land in the project area is cultivated annually and the rest is under grazing. Although the median farm size is about 5 ha, there are substantial differences in land ownership, ranging from 1.5 to more than 17 ha. Nearly all cultivators are subsistence producers. The land is prepared with the ordinary mould-board ox-plough and most farmers practice dryplanting just before the arrival of rains. Mixed farming is the predominant feature and family labour is the principal input. The use of chemical fertilizers and insecticides is beyond the purchasing power of the great majority of farmers.

2.17. The cropping pattern is dovetailed to the production of food crops for subsistence; the extent of cash crops is limited and there is a complete absence of grasses and fodder legumes in crop rotation. A fairly wide range of food crops is produced. Among cereals, the Katumani maize which is an early maturing variety, is of major importance followed by sorghum and millet in relatively drier areas. The average yield of maize is between 1 and 1.2 tons per ha in years of normal rainfall. The main pulses grown in the area are the Mwezi-moja bean, pigeon pea, cowpea, mung bean and other minor pulses. All pulses are early maturing and drought tolerant with fairly good yields. Some oil crops, (castor, sesame, sunflower), sweet potatoes, and cassava (mainly as a famine crop) are also grown. Fruit trees are also found with higher concentration in the high potential areas.

2.18. The indigenous livestock are well acclimatized to semi-arid conditions, but are as a consequence relatively poor producers. Because of the shortage of water and feed and the low genetic potential of the animal, the livestock have low growth and productivity. If the demand for more productive livestock is stimulated, they will be difficult to obtain in the early stages of development. Tick borne diseases, particularly East Coast Fever, could be a major constraint, especially if exotic stock are introduced in greater number into the farming system.

2.19. The average farm holds about 7 head of cattle including a team of draft oxen. In addition, an average of 10 goats, 3 sheep, and a small flock of poultry are kept. With the exception of goat or cow milk for children and occasional slaughter of a goat or chicken for special ceremonies, none of the livestock products are consumed on the farm but are sold to meet cash needs.

2.20. The shortage and variation of watering facilities are important factors limiting livestock development. High ambient temperatures increase water demand and adversely affect the productivity (growth, milk production, and reproductive behaviour) of all types of livestock. These effects may to some extent be ameliorated by good management.

2.21. Grazing is by far the most common way of feeding ruminant livestock. Crop residues and by-products are also commonly used to supplement grazing. Pasture rotation is not practised and would be unacceptable to the farmers as they reserve the best part of the land for crop production.

2.22. Overstocking would appear to be extreme in the project area, one livestock unit for every 0.04 ha on the smallest farm. Nevertheless, livestock inspected by the mission appeared to be in good condition, suggesting a high level of livestock husbandry skills.

2.23. Reliable data on net farm income are not available. However, one farm survey of lowland Machakos (Mwala location) carried out by the UNDP/FAO project has revealed a somewhat low net income (subsistence and cash) from farming, KShs 2,218 per family and KShs 246 per capita for the period September 1979 - August 1980. Two thirds of the net farm income was derived from the sale of animals and animal products. The farm income was supplemented by off-farm earnings of KShs 2,368, thus bringing the net family income to KShs 4,586 during the same period.^{1/}

2.24. The survey also revealed a high dependency ratio (1:4), a large proportion of farms managed by women (47%), the predominance of mixed farming (91% of farmers), a major share of labour time being absorbed by weeding (50%), lack of measures to protect field food crops against insects (80% of farmers), and the low use of chemical fertilizers (only 8% of the farmers).

D. Institutional Structure for Dryland Farming

2.25. Although 80% of Kenya's land area is arid or semi-arid and the Government is anxious to promote dryland farming with the assistance of many donors, there is as yet no institutional structure for coordinated action at the national level. In fact, many ongoing and proposed projects are inspired and formulated by donors in accordance with their own assessment of the problems and priorities.

2.26. This haphazard approach has serious consequences. Firstly, it makes it difficult to maintain balance between various components contributing to the development of arid and semi-arid regions, e.g., balance between production-oriented activities, resource conservation, and socio-economic infrastructure. Secondly, it hinders planning and implementation at the District level and below by limiting the ability of the Government machinery to avoid the duplication of efforts and to match donor assistance with national inputs. Thirdly, it leads to complications in delineating the role and participation of various ministries engaged in the development process at the field level, e.g., distribution of responsibilities between the Ministry of Agriculture and the Ministry of Livestock Development in an environment where mixed farming offers the only promising solution. The mission is of the opinion that a central coordination machinery responsible for the overall development of arid and semi-arid regions is long overdue.

E. Assistance by Other Donors

2.27. Commitments through Official Development Assistance to the Government of Kenya stood at US \$2,334 million as of December 31, 1980 (the latest date for which data are available). The share of agriculture in total aid was 24.1% by narrow definition and 37.1% by broader definition.^{1/} The distribution by grants and concessional loans and the relative share of agriculture is given in Annex VI, Table 1. It should be noted, however, that commitments extend over many years and some projects have started as far back as 1972. Consequently, a substantial share of the commitments has already been delivered, though the actual amount spent cannot be determined.

1/ One U.S. \$ is equivalent to K.Shs.10.5.

2.28. It is difficult to arrive at a precise estimate of assistance by all donors to the area covered by the UNDP/FAO and USAID/USDA projects. A rough estimate made by the mission shows that there are 22 projects (ongoing or in the approved pipeline) which directly assist the project area. The commitment value of these projects amounts to U.S. \$139 million or 16% of assistance to agriculture, broader definition (see Annex VI. Tables 2 and 3). In addition, there are a number of other institutions and donor assisted projects whose work is of indirect benefit to the project area and these are listed in Annex VI., Table 4. However, the interaction between these projects is weak.

III. RATIONALE OF THE UNDP/FAO AND USAID/USDA PROJECTS AND PROPOSED STRATEGY

A. The Rationale and Strategy

3.1. The rationale for the UNDP/FAO and the USAID/USDA project is to be found in the Government's Development Plan (1978-83), the Sessional Paper on Food Policy (1981), and the National Livestock Development Policy Paper (1980). These documents provide the Government's strategy for overall development of crop and livestock production on a national scale. They also identify the problem of development of the arid and semi-arid areas as one requiring highest priority attention. In the development of programmes for these areas three broad objectives have been established.

- (a) Increasing productivity, production and reliability of production in dryland areas and establishment of a sustainable production system consistent with the natural resources potential of the areas.
- (b) Integration of the arid and semi-arid lands into the national economy.
- (c) Building of institutions and services, i.e., research, extension, cooperatives, input distribution, marketing, credit, transport, and water supply.

3.2. The plan for achieving these objectives emphasizes the following suggestions.

- (a) Research must be of increasing relevance to the farmer's situation, not only to his physical environment but also to his social-economic setting.
- (b) Research for the semi-arid areas should emphasize a whole farm approach.

1/ Narrow definition includes assistance to agriculture, livestock, forestry, fisheries and cooperative development and agricultural financing. Broader definition includes items under narrow definition plus irrigation, rural water supply, agricultural education, rural access roads, rural planning and multi-sector rural development projects including rural development funds.

- (c) zero grazing on small farms should be encouraged.
- (d) On-farm testing should be accelerated to reduce the time between preliminary research findings and application of improved technology.
- (e) The application of technology should be monitored and results fed back to the research.

3.3. The projects' strategies encompass four categories of activities: development of improved individual components and associated technologies, insertion of improved components within a whole farm production system, pre-extension testing of farming system, and training of manpower and development of institutions capable of carrying the work forward after termination of donor assistance.

3.4. The following activities relate specifically to the development of improved technologies.

- (a) Breeding and selection of earlier maturing, more drought resistant and disease and insect resistant varieties of food, cash and forage crops.
- (b) Expansion and diversification of the production mix to include a wider variety of crops, cereals, pulses, oil seeds and root crops to complement maize, the staple cereal crop.
- (c) Intercropping and relay-cropping to reduce risks of crop failure due to deficient rainfall and to take advantage of differential water and nutrient needs of different crops in time and space.
- (d) Water and soil moisture conserving practices including weeding practices.
- (e) Development and use of practices to reduce and/or prevent soil erosion.
- (f) Improvement of the livestock component in the farming system with greater attention to breed selection, husbandry, management of pasture and range lands, use of crop residues and production and conservation of fodder and forages.
- (g) Development of more appropriate tools for oxen traction to reduce the demand for human labour in soil preparation and weeding and to improve the economy of soil moisture utilization.

- (h) Rotation with legume crops, including study of fixation as a means of providing nitrogen, and use of manures as alternatives to high cost chemical fertilizers.
- (i) Integrated pest control management adapted to small farmers.

These activities address components of the production system. However, considering that each farm unit operates within closely interrelated social, economic, and technological constraints, improvements of individual components will be useful only to the extent that these can be accommodated into the farmers' production systems. Hence the accent of the two projects is on a systems approach, a cropping system for the USAID/USDA project and the whole farm system for the UNDP/FAO project.

3.5. The farming systems approach involves three main steps: obtaining a thorough understanding of existing systems on individual farm units, developing alternative systems for incorporating new and improved practices and technologies, and finally, the testing of technologies in established farm units.

3.6. Unit farm and pre-extension trials provide the vehicle for field testing the system under actual farmer conditions, and a basis for making appropriate adjustments. The pre-extension trials, carried out in close cooperation with extension, provide the essential linkage between extension and research with a two-way flow of information: information to the farmer and feedback of experiences from the farmer to the researcher. This feedback, often ignored, is essential for providing orientation to research on a continuing basis.

B. Contribution Expected from the two Projects

3.7. It is expected that the two projects will establish a solid foundation for continuing research on problems of arid and semi-arid agriculture. A clear understanding of the farming systems approach for improving traditional agriculture will be established and strong linkages developed between the research institution and extension within the framework of the projects. Moreover, methodologies for closer integration of extension and research will be developed.

3.8. It is expected that technological improvements in production practices will be developed, tested, and accepted by farmers. It is not likely that the two projects will have a significant impact on the well being of the farming population of the region during their life spans. However, by establishing a sound foundation for carrying forward the work, with or without further donor assistance, a favorable impact, accelerating over time, should be assured.

IV. ASSESSMENT OF PROJECT OBJECTIVES AND DESIGN

4.1. This chapter includes an assessment of the objectives and designs of the two projects. Specifically, it covers the relevance of objectives to the needs of the intended beneficiaries, the suitability of design for implementation, and the provision for linkages with other projects.

A. Relevance of Objectives to Identified Needs

4.2. Both projects have common long-range goals and these are in accord with the overall objectives of the Government for the development of the marginal rainfall areas of Kenya. Some of these objectives as stipulated in the Development Plan 1979-83 are listed below.

- (a) Developing less risky farming systems that could make semi-arid areas self-reliant for food requirements and sustain higher levels of overall agricultural productivity while at the same time conserving and upgrading the status of natural resources.
- (b) Integrating semi-arid lands more closely into the main stream of national economic activity.
- (c) Developing an agricultural support infrastructure through the training of national staff and the provision of farm support services.

4.3. To meet the overall development objectives, the designs of the two projects stress the following priority areas which the project documents define as "immediate objectives".

- (a) Developing technologies for improving land and water management systems, improving crop varieties, and strengthening plant protection.
- (b) Developing farming systems and associate sub-systems which would increase and stabilize production and productivity including a method of integrating livestock and family living activities into the farm production system.
- (c) Conducting verification trials and on farm pre-extension trials under real farming conditions.

- (d) Ensuring that smallholders' needs and wishes are made known to the researchers, that research is adapted to those needs, and that the results of research are made available to, and used by, smallholders.
- (e) Identifying production constraints which require future scientific research for solution.
- (f) Strengthening the Katumani Research Station and integrating it into the overall strategy for the development of the dryland farming areas.
- (g) Training Kenyan staff in dryland farming research and development.

4.4. The time element must be considered in judging the relevance of the objectives of the two projects to the national goals and the needs of small farmers in the semi-arid areas. While the results of basic research may generate benefits over a longer period, their impact on production and productivity over the life of the two projects is likely to be minimal. This applies particularly to research in plant pathology, soil physics, and, to some extent, in animal breeding and agro-meteorology. On the other hand, applied research has a better chance of producing quick benefits.

4.5. While the long term objectives of the two projects are almost identical, their sub-objectives differ somewhat because of divergence in orientation. The major thrust of the USAID/USDA project is on basic and applied problem-solving research in the crop sector; the UNDP/FAO project, on the other hand, emphasizes adaptive field research covering both crops and livestock and testing the results on family farms units. The distinctions between basic, applied research, and adaptive research within the context of the two projects do not appear to be useful, but rather are more likely to be a hindrance to effective cooperation between the two.

4.6. The beneficiaries of both projects are the farmers with small holding who reside in the districts of Machakos and Kitui and the lower parts of Kenya's Eastern Province. In the long term, the results of the two projects should benefit the entire population of the marginal rainfall areas, approximately 20% of Kenya's population.

4.7. At present the target group, or immediate beneficiaries, are the farmers and their interested neighbours who are involved and associated with the on-farm verification and pre-extension trials. These number about 30 participating farming families and an unknown number of neighbouring farmers. Their number is expected to grow as more verification and pre-extension trials get underway.

4.8. Other intended beneficiaries are the extension workers in the project area, especially the technical assistants and the junior technical assistants who work directly with small farmers. The designs of both projects provide for interaction between the UNDP/FAO and USAID/USDA teams and the extension workers in sub-locations. This is done through training, meetings, conduct of verification and pre-extension trials on small farms, as well as the monitoring of results. The mutual benefits could be enhanced by expanding the efforts through more frequent field contacts, recognizing the constraints of poor transport facilities and the multiple demands on the time of the extension workers.

B. Design of Implementation

4.9. The design of implementation of the two projects can be summarized under five subsystems.

1. Soil and Water Conservation Subsystem:

4.10. To arrest land degradation and to reduce the risk of crop failure, the designs of both projects allow work for developing appropriate methods for soil erosion control as well as tillage practices for enhancing water infiltration rates and moisture retention. For ensuring complementarity, the USAID/USDA project was to give special attention to adaptive research while the UNDP/FAO project was expected to concentrate more on the field application of the results emerging from such adaptive research. The UNDP/FAO project was also expected to put into practice the methods of soil and water conservation already tested in Kenya. In retrospect, both projects seem to have given their primary attention to moisture-conserving efforts (mulching, minimum tillage, crop rotation, etc.) with little adaptive research and demonstration on terracing and associated erosion control structures. The latter are of primary importance to the needs of small farmers in the project area. In the pursuit of moisture conserving efforts, the activities in this subsystem appear to duplicate the work on agronomy and farm machinery. This diversion in the orientation of design related to soil and water conservation needs to be corrected. The most urgent task is to draw up a research

programme which addresses itself to the key problems of soil erosion in the project area and to supplement this work by implementing on various soils and slopes, preferably on a watershed basis, some improved soil erosion control practices which farmers can master quickly with their own efforts or with minimum cost of using hired machinery.

2. Crop Subsystem:

4.11. The designs of both projects in this subsystem cover activities involving plant breeding, agronomy, agro-meteorology, plant pathology, and insect and disease control. The findings of the work in all these disciplines are expected to converge into cropping systems packages based on improved technologies suitable for dryland farming. Here again, the designs of the two projects are somewhat different in orientation. The USAID/USDA project is exclusively concerned with developing a "cropping system" based on research and its subsequent testing through verification trials on farmers' fields. The design of the UNDP/FAO project makes provision for incorporating the field tested cropping systems into the whole-farm approach for the purpose of its pre-extension trials. In this way, the complementarity and interaction between the two projects related to the crop subsystem is to be assured.

4.12. In theory this sounds plausible, but in practice such a sequential design is not workable for several reasons, especially as the Government of Kenya is pressing for shortening the time-lag between research and extension. The development of new varieties of crops, methods of disease and pest control, crop/water use, etc., is not an instantaneous process. Quite often, work of this nature can be developed and adapted only over a period of several years and not necessarily with proven results. Members of the UNDP/FAO project, who are pressed to initiate the pre-extension trials as soon as possible, cannot wait for this evolutionary process to take its course. Hence, they have initiated similar adaptative crop research efforts on their own which have resulted in considerable overlap, duplication of efforts, and in some cases, such as the most appropriate time for planting, into sharply opposing viewpoints. As a result, the trials to date have led only to selected cropping interventions, rather than a cropping system package, without any deliberation with and evaluation by the livestock scientists.

3. Livestock Subsystem:

4.13. Only the design of the UNDP/FAO project makes allowance for livestock development. The Project Document [Part II D (c)] implies that it is not that livestock greatly exceed the carrying capacity of the land but that both livestock and land are badly managed. Unfortunately, until very recently the planning and implementation of research activities in animal production was based on this false premise.

4.14. The first socio-economic survey of selected farms has shown that at least some areas are grossly overstocked; average stocking rate on all farms covered by the survey is found to be 0.65 ha per livestock unit and on 25% of the smallest farms only 0.04 ha per livestock unit. It is most likely that the whole semi-arid region is overstocked by conventional standards. Kamba livestock are certainly not badly managed. The mission was surprised that all the farms visited had their livestock in good condition at the end of the dry season and, according to the Ministry of Livestock Development, the Machakos District produces some of the highest livestock offtake rates in Kenya.

4.15. Thus, the research activities proposed for the livestock sector were, in general, unrelated to the realities of the farming system. A very first activity undertaken by a team comprising animal scientists, an anthropologist, and an economist should have been an in-depth survey of livestock production and practices on a representative sample of farms in order to understand how the nutritional system works and how it can sustain high offtake under such adverse environmental conditions.

4.16. As a consequence of not understanding the existing livestock system, investigations into the possibility of immediately introducing high input/high output animal production systems were commenced as suggested in the Project Document [Part II, F 6 (d)]. These programmes could not be incorporated into the pre-extension trials at this time because of their unacceptability to the farming community due to the high capital cost and high labour demand.

4. Verification Trials and Whole-Farm Systems Approach:

4.17. The design of the USAID/USDA project provides for crop verification trials to evaluate technological components of the UNDP/FAO project for whole-farm systems approach. Both are pertinent and valuable efforts and complementarity between the

two is unquestionable. In the context of the realities of farming in the dryland areas, the whole-farm systems approach carries more weight as it embraces all facets of the family farm. Associated with this work is the need for socio-economic surveys for which the design of the UNDP/FAO project makes adequate provision.

4.18. While the design of the two projects adopted the right course, the planning process leading to the verification and pre-extension trials was not spelled out in a logical sequence, as follows: identifying fundamental constraints facing the small farmer, conducting the necessary basic and adaptive research to seek alternative technologies, testing the findings of the research on the unit farm at Katumani Station, analysing the various technologies and packages for their comparative advantages, charting the course by which the extension staff at sublocations could be tutored and involved in the entire process and procedures of the verification and pre-extension trials, and subsequent monitoring of the trials. In short, the whole-farm systems approach has been bypassed in favor of developing and testing individual technologies and packages which may not be accepted by farmers who are reluctant to take risks.

5. Institution Building:

4.19. The designs of both projects provide for substantial inputs in institution building. This implies strengthening the capabilities of KARI and the Katumani Research Station in the conduct of research, its management, and its application through extension in the dryland farming areas. For the Katumani Station, it also implied the establishment of the necessary physical infrastructure in support of adaptive research and development. In manpower development, the designs provided for both academic studies as well as on-the-job training.

4.20. While stressing the urgency for institution building, the designs of both projects underestimated the ramifications in terms of the availability of counterpart staff, the ability of the Government to put in place the necessary physical infrastructure at Katumani Station, the incentives to national staff for their retention in dryland farming research and development, the need for a phased plan to develop and strengthen the various sections of KARI and Katumani Station and, last but not least, the necessity to work out the modus operandi between the expatriate and counterpart staff in developing the various research programmes and the responsibilities in sharing the work. All these limitations have now emerged during the implementation phase. As a result, there are serious doubts about the ability of KARI and the Katumani Station to develop a permanent cadre of trained and experienced research staff to take over when the two projects are terminated.

C. Linkages with other Programmes and Projects

4.21. The complex and comprehensive nature of activities envisaged by the UNDP/FAO and the USAID/USDA projects can be strengthened greatly and promoted by strong linkages and joint actions with other related activities sponsored by international, regional, and national programmes, as well as projects supported by a large number of donors. As a dryland smallholder operates a farming system which covers every facet of his family life, there are many linkages from many sources. The list of programmes and projects with which the UNDP/FAO and the USAID/USDA projects should maintain close links are listed in Annex VI Tables 3 and 4. The most convenient and workable links will probably continue to be the informal personal contacts between individuals, but more formal ties should also be initiated by the team leaders of the two projects. The development of a national framework or plan for research and development of the arid and semi-arid lands could contribute to strengthening these linkages and promoting complementarities.

V. ASSESSMENT OF IMPLEMENTATION

5.1. There have been a number of difficulties in implementing the two projects such as delays in establishment of the projects, late arrival of some expatriate staff, shortage of counterpart staff and delays in their recruitment, logistic problems which are still not fully resolved, and especially the impediments in communication and interaction between the entities responsible for the management of the two projects.

5.2. Despite the above difficulties, the two projects have made some progress in initiating a number of activities, some relevant and some not so relevant, with mixed results. In some disciplines tangible results have been recorded, e.g., the introduction of high yielding and early maturing varieties of grain legumes and agro-meteorological experiments, while in other areas progress has necessarily been slow, as in animal production and pasture development. Least progress has been recorded in the vital sector of soil and water management. In fact, the lack of visible progress in establishing sound recommendations in the economy of water use has been a serious setback to both projects. This lack of balance in achievements has hindered progress towards the realization of their main objectives. A brief assessment of the efficiency of implementation is discussed in this section.

A. Utilization of Inputs

5.3. Both projects are falling behind in the utilization of resources allocated to them. During its first two and half years, the USAID/USDA project was expected to deliver services and equipment worth approximately US \$2.5 million. Actual expenditures during this period amounted to US \$1.4 million or 56% of funds allocated over this period. In the period 1979-81, the UNDP/FAO project was expected to provide services and equipment valued at approximately US \$2.3 million. Actual delivery, however, amounted to US \$1.4 million or 61% of the funds allocated to the project over the same period. The underutilization of funds has been more serious with respect to the training programme (see Table 1).

Table 1. TOTAL ALLOCATIONS AND ESTIMATED EXPENDITURES^{1/}

	<u>USAID/USDA Project</u>		<u>UNDP/FAO Project</u>	
	Allocations FY 1979-84	Estimated Exp. as of 31/12/81	Allocations FY 1979-83	Estimated Exp. as of 31/12/81
US\$ Thousands				
Personnel Services	3611	915 ^{2/}	2563	960
Training	1072	263 ^{3/}	590	153
Travel	78	---	48	19
Equipment	467	212	370	212
Supplies	55	---	---	---
Adminis- trative Support	---	---	101	40
Miscel- laneous	720	---	179	62
TOTAL	6003	1390	3851	1446^{4/}

1/ excludes contributions of the Government of Kenya

2/ includes allowances, housing and travel

3/ committed for students currently in training

4/ includes unpaid commitments of US \$68,000.

5.4. The evaluation mission was unable to obtain precise data on expenditures incurred by the Government of Kenya in support of the two projects. Nevertheless, it is estimated that from July 1980-February 1982, the expenditures by KARI, in support of the USAID/USDA project, amounted to KShs 474 thousand. This amount, however, excludes the salaries paid to counterpart staff for which figures are not available.^{1/}

5.5. In the case of the UNDP/FAO project, approved budgetary estimates by the Government of Kenya during the three fiscal years 1979/1980, 1980/1981, and 1981/1982 were much below the figures envisaged in the project document. Moreover, some of the budgeted allocations have not been carried out, e.g., the construction of housing, offices, and laboratories at Katumani Station. However, in fiscal year 1981/82 there has been a sharp increase in the approved budget estimates, reaching K.Shs. 384 thousand against K.Shs. 146 thousand in 1979/80. This increase is largely due to the rapid-increase in the number of counterpart and support staff. In addition a request for additional funds of K.Shs. 26 thousand has been submitted to the Ministry of Agriculture for approval.

5.6. It should be noted that the Government of Kenya is facing severe financial difficulties and nearly all donor-assisted projects are affected by budgetary constringency. Hence, it is unlikely that there will be any spectacular improvement in counterpart contribution to the two projects in the immediate future.

B. Recruitment of Experts and Counterparts

5.7. The UNDP/FAO project was initiated in June 1979 and the USAID/USDA project in November 1979. Two FAO experts were recruited before the signing of the Project Document by the Government of Kenya. In July 1980, the UNDP/FAO project was revised to accommodate changes in the position of international staff and the appointment of the National Coordinator; in June 1981 further budgetary adjustments were made. At present, there are 7 experts assigned to the USAID/USDA project and 7 to the UNDP/FAO project, excluding the National Coordinator.^{2/}

1/ It also excludes cost of transport and operating expenses during July 1980 - June 1981.

2/ One USAID expert (plant breeder) is not concerned with dryland farming; he is engaged in maize breeding at Kitale.

In addition, one agricultural engineer of KEN/74/019 (Agricultural Equipment Improvement) is based at Katumani. The UNDP/FAO project is also assisted by two associate experts, one in seed production who joined the project in January 1981 and another in farming systems who commenced work in November 1981.

5.8. Annex VII shows the list of experts in the various disciplines and their expected and actual dates of arrival. The most serious delays have occurred in the recruitment of the UNDP/FAO agronomist (who has just arrived) and the three experts assigned to the USAID/USDA project, i.e., senior maize breeder (not yet at post), the plant pathologist, and the agricultural economist (team leader).

5.9. In the case of the USAID/USDA project, the counterpart situation is extremely serious. At present there are only 4 counterparts, 2 in agro-meteorology and 2 in soil science. Two counterparts are in the USA for training, one in agronomy and another in soil chemistry. Three experts (agricultural economist, plant pathologist, and agronomist) are still without counterparts. Unless the status of KARI is clarified, the prospects for getting additional counterparts do not seem promising.

5.10. The counterpart situation of the UNDP/FAO project has improved considerably with the rapid increase of staff at the Katumani Station. There are now 26 technical staff working at the station, an increase of 250% over 1979. These include 4 technical staff with MSc degrees, 14 with BSc degrees and 8 with diploma in agriculture. Of the 26 technical staff, 5 are currently in training. All the FAO experts have counterparts, with the exception of the animal production/nutritionist.

5.11. It is important to note that apart from budgetary difficulties mentioned earlier, the shortage of counterparts results basically from the very small number of graduates in agriculture and animal husbandry produced by the University of Nairobi, about 90 graduates per year. These graduates are assigned to respective ministries and agencies on a strict quota basis. At present, the small pool of trained and experienced manpower in agriculture does not permit any quick improvement in the counterpart situation. One solution could be the recruitment of science graduates for the two projects, e.g., graduates of biology and physics for plant breeding and soil physics respectively.

C. Training of National Staff

5.12. Both projects have made provisions for academic as well as short-term practical training. However, the USAID/USDA project has its major thrust on academic training while the UNDP/FAO project has concentrated principally on short-term practical training. The two projects have fallen behind in the implementation of their respective training programmes. The slippage is one year for the UNDP/FAO project, which corresponds with the delay in getting the project fully staffed. The training programme of the USAID/USDA project is approximately two years behind schedule of which one year may be counted for as normal slippage. The second year delay was caused by a series of failures on the part of the responsible officer in MOA in approving the "Life of Project Training Plan" required by the agreement with USAID, the secondment of candidates to KARI for training, and delays in obtaining the necessary clearance for accepted candidates. Much of the difficulty can be attributed to the peculiar status of KARI (it is short of staff and depends on MOA for personnel) and the provision in the USAID/GOK agreement that candidates for training should be from the staff of KARI.

1. USAID/USDA Project:

5.13. The project had made provisions for 35 Kenyans to receive long-term academic training (30 in the USA and 5 at the University of Nairobi) and 26 nationals to benefit from short-term training abroad. The academic training consists of 5 PhD, 20 MSc, 5 BSc, and 5 diploma degrees.

5.14. After a long and arduous process, 31 candidates were identified (April 1981) and secondment to KARI was proposed so that they could be considered for training. However, it was only in January 1982 that the first 6 candidates departed to enroll in US universities. The following is the schedule of trainees thus far approved and/or proposed.

January 1982, candidates already sent to US universities:

- 4 for BSc degree in general agriculture
- 1 for MSc degree in soil chemistry
- 1 for MSc degree in plant pathology

June/September 1982, candidates whose admission to US universities is in process:

- 1 for PhD degree in soil science
- 2 for PhD degree in plant breeding
- 1 for PhD degree in agronomy
- 1 for MSc degree in plant pathology
- 1 for MSc degree in agricultural economics
- 1 for MSc degree in biometrics

In addition, two candidates will be placed for PhD degrees in the University of Nairobi (agro-meteorology and soil physics respectively) and one for a diploma degree in computer science.

1983, candidates yet to be selected for US universities and their disciplines defined:

- 3 for PhD degree
- 6 for MSc degree
- 4 for BSc degree

Largely because of the same problems cited earlier, most of the short-term training of 26 individuals originally envisaged has not been undertaken. Only two observation tours for two individuals have been completed.

5.15. Because of the delays, it will be difficult (if not impossible) to place the remaining candidates for academic degrees in time to have the entire training programme completed. Given the scarcity of personnel adequately trained in research, it would be unfortunate if the programme outlined in "Life of Project Training Plan" were to be suspended by the present termination date of the USAID/USDA project. The evaluation mission would urge extending the time limits for training beyond the expiry date.

2. UNDP/FAO Project:

5.16. This project provided for 8 Kenyans to receive academic training (PhD 2; MSc 6) and 18 to benefit from short-term practical training of 6 months each. Provision was also made for 6 group training courses. In addition, it was stipulated that the staff of the Katumani Station would participate in conferences, seminars, and workshops.

5.17. Five counterparts have been sent for MSc degrees abroad, 2 in 1980 and 3 in 1981. The fields covered include agronomy (2), plant breeding (2), and 1 in farming systems. In 1982, one counterpart is scheduled to go abroad for PhD degree (agronomy) and another for MSc degree (plant protection). Seven individuals have already completed short courses, mostly in India, ICRISAT, and two more are expected to receive such training in 1982.

5.18. The project has also assisted the Katumani Station in organizing 8 group training courses. Five of these were intended for the extension staff (technical assistants) involving 77 participants and 3 were for training farmers, involving 32 participants. The group training is designed to facilitate the pre-extension trials initiated by the project. Six individuals participated in workshops organized in Kenya at no cost to the project, two participated in a workshop at ICRISAT and one in a course at IITA.

5.19. The only candidate who has completed his MSc degree was neither selected from the staff of the Katumani Station nor was he among the project counterparts in February 1982. The other four candidates now in training for MSc degree work at the Katumani Station, as does the one proposed for MSc degree in 1982. The Director of the station is proposed for PhD training to begin in 1982. The usefulness of the short-term training must be questioned as only 2 out of the 7 individuals selected for such training were among the staff of the Katumani Station, and one is now away for academic training. As none of the counterparts have yet returned, it was not possible for the mission to assess the quality of training received.

D. The Role of the Technical Coordination Committee

5.20. The UNDP/FAO project document recognized that due to the interdisciplinary nature of the project, its objectives and work programme would relate to and coincide with a number of ongoing and planned projects. It was expected that informal interaction between personnel in these projects would of necessity develop, but in order to ensure proper and sustained flow of information, a Technical Coordinating Committee (TCC) was established. Although it was envisaged that this committee would be chaired by the Director of Research, MOA, it was finally decided that the chairman would be the Director of Agriculture. The membership of the committee is listed in the UNDP/FAO project document.

5.21. The TCC held its first meeting on 31 July 1980 and decided to establish two subcommittees, one on crops and land use and the other on pasture and animal production, under the chairmanship of Chief Research Officer, Ministry of Agriculture, and Deputy Director (Research) of the Ministry of Livestock Development respectively. The subcommittees were to meet at least once a year in order to discuss in greater depth the progress achieved and orientation of the ongoing or planned research work. Each of these subcommittees has met twice and has provided opportunities, as expected, for detailed discussion of the individual component of the UNDP/FAO project and related activities.

5.22. The second meeting of TCC was held on 28 January 1981 and endorsed various recommendations of the subcommittees. The meeting noted in particular the problem of allocation of counterparts for training and appointed an ad hoc committee to locate suitable personnel from the entire research system. The TCC also noted the need for drawing up an integrated programme covering the contributions of the various donors in dryland farming research. An ad hoc committee was appointed to work out the mechanism for such programming. The ad hoc committee met on 18 February 1981 and prepared a report which was communicated to the TCC and the relevant aid projects. The ad hoc committee on training also met and identified national staff to be trained under the UNDP/FAO and the USAID/USDA projects.

5.23. The third meeting of the TCC took place on 16 September 1981. In addition to discussion relating to operational problems of the project, it discussed in particular the proposed absorption of the sorghum and millet project into the Dryland Farming Research and Development Project, and the joint review of the USAID/USDA and the UNDP/FAO projects.

5.24. From the minutes of the TCC, its subcommittees and ad hoc committees, it is evident that this committee has an important role in promoting cooperation between the various related activities sponsored by other agencies. However, its work is hindered by lack of follow-up on decisions taken and recommendations approved. Regretfully, the USAID/USDA project has no provision for coordination at a formal level, and although the team leader and the staff have cooperated willingly in the exercise, they have not subjected their activities to the same degree of detailed discussion at the committee and subcommittee level as is the case with the UNDP/FAO project. The TCC is, therefore, not strictly a coordinating committee but a forum for evaluation of progress made by the UNDP/FAO project.

5.25. The evaluation mission has also noted with regret the serious problems encountered in incorporating the valuable experience gained in related research conducted by the University of Nairobi. There seems to be an atmosphere of mutual suspicion and lack of confidence which has resulted in a certain degree of duplication of effort. The University has not participated as envisaged in the TCC and it is recommended that ways and means be sought urgently to resolve this situation.

E. Implication of Existing Institutional Structure for Agricultural Research

5.26. Responsibility for conducting agricultural research is shared by a number of institutions in Kenya but the main ones are the Ministries of Agriculture and Livestock Development and the Faculty of Agriculture of the University of Nairobi. The Kenya Agricultural Research Institute (KARI) operating under the Ministry of Agriculture has, so far, an undefined role vis-a-vis the Scientific Research Division of the Ministry. For the historical development of agricultural research in Kenya and the concept of basic versus applied research see Annex VIII.

5.27. This plural research responsibility has had a number of implications in the performance of the UNDP/USDA projects, reflected initially in the inability of the two projects to draw on counterpart staff from the entire research manpower pool. The sharing of common facilities at Katumani between the UNDP/FAO project based there and reporting to Director of Research (MOA), and the USAID/USDA project, based at KARI, Muguga and reporting to Director of KARI also depended on the goodwill and understanding of the Director of the Station at Katumani and cannot therefore be guaranteed through changes in leadership. It has already been pointed out that the University group had to pull out of the programme at Katumani with misgivings. The mission has observed that with few exceptions cooperation between the UNDP/FAO and USAID/USDA project staff has been minimal and the presence of two donors in the same area and similar terms of reference has not been without difficulties. It is understood that the recent reorganization of Government Ministries has restricted research functions exclusively to the Ministry of Regional Development, Science and Technology. It is too early to speculate on the extent to which the operational problems at Katumani will be resolved by these changes but there is a case for redefinition of the objectives and terms of reference of the two projects to minimize the elements of competition and overlap.

F. Major Operational Problems

5.28. The implementation of the two projects has been affected by a number of operational difficulties which are briefly discussed below.

1. Institutional Problems:

5.29. As hinted earlier, the location of the two projects in two separate entities does not contribute to effective research and development connected with dryland farming. The USAID/USDA project is attached to KARI (Muguga) and the UNDP/FAO project linked to the Katumani Research Station in the Machakos District. The distance between the two locations is more than 100 km.

5.30. The USAID/USDA project has no farm of its own and must rely for experimental field work on the Katumani Research Station. This involves travel back and forth at least two days a week. For its experimentation, it relies on the support and goodwill of the Katumani Station Director and there are no formal arrangements. The Director of the station has little say about the experiments carried out by the USAID/USDA project at the Katumani farm and these experiments are not incorporated in the station's annual programme of work. Hence, any benefits derived are coincidental. Although the USAID/USDA has a plot in the unit farm for its experimentation and in a way contributes to the activities of the unit farm, it does not participate in the pre-extension trials of the UNDP/FAO project due to lack of any invitation. The USAID/USDA project has its own verification trials on 12 farms in Machakos but these are exclusive of the 20 pre-extension trials conducted by the UNDP/FAO project.

2. Interaction Between the Two Projects:

5.31. There is no joint programming between the two projects, despite the similarity of objectives and the linkages between their respective activities. On a personal basis, however, some experts of the two projects have closer links. For example, the agro-meteorologist and the plant pathologist of the USAID team work closely with the UNDP/FAO plant breeder. Similarly, there is a closer interaction between the soil physicist of the USAID team and the UNDP/FAO soil and water conservation engineer. On the other hand, there is little evidence of any interaction between the pathologist of the USAID/USDA team and the UNDP/FAO entomologist. In particular, the agronomic work of the two teams is not coordinated and this is a serious hindrance in the planning and implementation of the pre-extension trials and the development of the farming systems.

5.32. The National Coordinator has no jurisdiction over the activities of the USAID/USDA project. As a result, there are no formal meetings to discuss common issues, share experiences, and evolve a coordinated programme of action. Three members of the evaluation team attended the session of the UNDP/FAO project in which the work planned for the 1982 long rains was discussed. To their surprise, the USAID team was absent from this discussion. The mission also found that the UNDP/FAO team does not participate in similar discussions related to the annual work programme of the USAID/USDA project.

5.33. From several long discussions with each team, as well as a joint meeting with both teams, the evaluation mission clearly noted the wide gap between the two distinct approaches on agronomy work pursued by the two projects. It also detected suspicion and mistrust among the two teams. In addition, there are visible disagreements on technical matters within each team which have not yet been resolved. The evaluation mission also got a clear impression that there was little contact, if any at all, between the counterpart staffs of the two projects.

3. Facilities:

5.34. The laboratory facilities of the USAID/USDA project at Muguga are adequate, except that the team has no dryland farm facilities to conduct applied research and, as explained earlier, it relies on the Katumani Station for field experiments.

5.35. The facilities made available to the UNDP/FAO project at Katumani are improving. The system for the provision of clean water supply is under construction, the temporary workshop for agricultural machinery has been completed, and temporary accommodations for officers and laboratory equipment have been provided. Housing remains the most serious problem both for the UNDP/FAO and the national staff. At present, the UNDP/FAO staff make daily trips in the project vehicle from Nairobi to Katumani and back, a distance of 85 km each way. This arrangement is not conducive to research work based at the station and visits to surrounding farms. The national staff live in the town of Machakos and make daily trips to the Katumani Station, a distance of 12 km each way. Efforts to persuade the UNDP/FAO staff to live in the town of Machakos have not proved successful although the mission was informed that houses for rent are available in the town. In fact, the agricultural engineer of KEN/74/019, who is assigned to the Katumani Station, lives in Machakos.

G. Transfer of Technology to Counterparts

5.36. The evaluation mission had lengthy group discussions with the counterpart staff of the two projects and heard their views and impressions regarding working relations with the USAID/USDA and UNDP/FAO experts. With few exceptions, the majority of the counterpart staff feel that they are neglected or by-passed. They conveyed to the mission their lack of involvement in the preparation of the programme of work and the absence of opportunities and encouragement to take independent initiatives. They feel that their capabilities are not adequately recognized and/or put to the test. The mission felt that the majority of the counterpart staff were frustrated.

5.37. While the statements made by the counterpart staff may be exaggerated, especially as they are still lacking experience in research work, their feeling of isolation and frustration is harmful to the harmonious implementation of the two projects and requires the immediate attention of the National Coordinator and the leader of the USAID/USDA team to rectify the situation. The mission also proposes that the counterpart/expert relationships should be reviewed by the TCC.

H. Technical Backstopping by FAO and USDA

5.38. The technical backstopping of the UNDP/FAO project by the FAO headquarters technical staff has been adequate. In late 1981, four FAO technical officers visited the project and reviewed its work in crops, livestock, soil and water conservation, and entomology. All have submitted their reports, some of which received negative comments by the project staff. Another FAO headquarters staff member visited the project in May/June 1981 and made a review of the work carried out. In consultation with project team, he also prepared a document entitled Farming Systems Approach to Research and Development. The UNDP/FAO project has also been visited by some senior FAO officials, including the Assistant Director General, Agriculture Department.

5.39. While there is no systematic technical backstopping mechanism by USDA, the team leader of the USAID/USDA project can at his discretion request special consultants to review and advise on the activities of the project. These services have not been satisfactorily rendered.

5.40. Regarding future technical backstopping, the mission proposes that every year the two projects should be visited by a combined team of 4-5 FAO and USDA technical staff for at least two weeks, and they should submit a joint report. It would be extremely useful if the visit of the team could coincide with the annual meeting of the TCC.

VI. ASSESSMENT OF OUTPUTS

6.1. Recalling that field implementation of activities in both projects has been going on for less than two years for many of the project elements and given the usually long gestation period of research projects, it is not expected that outputs of major dimension would have been produced. Nevertheless certain significant results have been obtained. These have been mostly in the individual crop or discipline components. Achievements in the development and testing of systems have been negligible, although a basis for moving more aggressively into this area is being established.

6.2. Results in the institution building sphere, one of the major outputs expected of the project, have been less satisfactory. Not only has little progress been made in training, especially by the USAID/USDA project, but the establishment of an institutional foundation upon which to build has been frustrated by the administrative relations of the two projects to the Government of Kenya.

A. Development of Appropriate High-Yielding Risk Averting Technologies

6.3. Outputs in terms of technology available for dissemination to farmers have been limited. Given the nature of research this is not unexpected. On the other hand, a number of findings have been made which contribute to a better understanding of the problems in the area and which will be useful in developing practical solutions.

1. Soil and Water Conservation:

6.4. Conservation activities have been limited to establishment of run-off plot and collection systems to study the impact of land use and cultural practices on erosion and water run-off. Results from these studies will be used to establish coefficients for design of soil conservation measures. Several years of observations, however, will be required before any recommendations can be made to the farmers. An experimental design for testing the effectiveness of different soil and water conservation structures has been developed and is being established at Katumani Station.

6.5. Studies on the effectiveness of ridging and mulching to reduce soil erosion and water loss suggest possible advantages to both practices. Resolving the implications on labour demand for ridging, including tied ridging, remains a problem before this practice can become widely used. The utility of mulching with crop residues must be weighed against their use as feed for livestock.

6.6. A substitute tool for the mould-board plough has been introduced which should reduce erosion. Its acceptance by the farmer will require some modifications and adjustments particularly with respect to weight. These adjustments are now underway. The control of weeds is an important element in the economy of water and the management of soil fertility for crops. A method for more effective mechanical (ox drawn) control of weeds has been demonstrated in experimental plots. This remains to be tested in farmers' fields. More attention should be given to conservation activities in the development of the pre-extension trials and unit farm on a whole farm basis. Any work done to date has been on an ad-hoc basis and no attempt has been made to develop overall farm plans which would take into consideration the physical resources of the farm, the watershed, the soil conservation requirements, and a step-by-step development strategy which would allow the farmer's conservation package to be developed at the farmer's own pace and ability.

2. Climatological Studies:

6.7. Intimately related to soil and water conservation and overall water management are the amount, distribution, and intensity of rainfall during different periods of the cropping cycle. These rainfall factors determine the level of production for different crops during a given season, and moreover, they condition plant population and fertilization levels which will give optimum productivity. Studies by the agro-meteorologist have shown that the date of onset of the rainy season and the amount received during the first 35 to 50 days can be used to predict the rainfall for that season. The ability to predict the likelihood of rainfall being adequate or deficit becomes an important tool for making farm level recommendations concerning crops to be planted, the relative proportions of these, seeding and initial fertilization rates, intercropping, and final plant populations and nitrogen fertilizer rates, as adjusted by thinning and side dressing respectively. Recommendations associated with these

conclusions must be field tested and refined in farmers' fields before they can be promoted by extension. The application of these principles will require a drastic change in the thinking of both the extension staffs and the farmer. Moreover a more extensive network of rainfall measuring stations will be required.

6.8. The relationships of different plant populations of maize and beans, in sole and intercropped plantings, and with different levels of fertility, to water requirements and crop yields have been measured in experimental plots. These data will be useful in determining cropping systems for testing in farmers' fields.

3. Food Crops Improvement:

6.9. The improvement of food crops is one of the principal activities of the project. It has suffered, however, because of delays in arrival of personnel. The major accomplishments have been in the introduction of a pigeon pea composite with a range of maturities from early to medium early, an outgrowth of earlier work by the Faculty of Agriculture, University of Nairobi, and a variety of cowpeas resulting from selection from earlier introductions from IITA. Introduction of other pulses, root crops, and oilseed varieties and species have been made in an attempt to broaden the crop mix and introduce cash crops into the production systems.

6.10. Although maize and beans are the most common grain and pulse crops in the area, they have received little attention to date. The presently grown Katumani maize variety and the Mwezi-moja bean variety remain the best adapted available varieties of these crops for the area. Some improvement work has been carried out with sorghum and millet under a separate project (UNDP/FAO KEN/78/046). Both crops should have an important role in the drier areas where maize production will be unreliable. Varieties and lines of grain and pulses are being screened for resistance to prevalent diseases and insects. Agronomic work has been carried out by both projects on the main food crops. Sole cropping versus intercropping, row spacing, time of planting, plant population, fertilizer application, relay cropping and weed control experimentation have produced results which have been reported in technical papers and incorporated in project recommendations. Some of the work has been done in cooperation with the other team scientists. Regretfully, the two teams have not collaborated sufficiently and each has in fact

emerged with its set of recommendations to be tested. This state of affairs is unworkable and needs to be resolved before the pre-extension trials may continue. It is suggested that replicated verification trials be run to resolve conflicting recommendations. Economic analysis as well as social acceptability must be taken into account for a given practice, along with its agronomic worth. The agronomists as a team must participate in the varietal screening programme with the breeders and crop protection specialists. With the agro-meteorologist and the water and soil scientists the agronomic potential of various combinations of crops and dates of planting could be investigated as intercropping or relay cropping. This interdisciplinary approach will increase the possibility of the development of an appropriate and acceptable package of practices for the dryland smallholder farmer.

4. Plant Protection and Prevention of Post Harvest Losses:

6.11. The major disease and insect pests in the area have been identified. Control measures for a number of insects which cause important losses to the growing crops have been developed using chemicals and equipment which are available in the project area. A maize storage crib has been designed based on locally available materials. Demonstration units have been installed on certain pre-extension farms. The control of disease is being approached principally through testing and selection for resistance. Subsequent work should concentrate on the development of integrated pest control programmes and the development of a crop protection package for pre-extension trials. In collaboration with the project agricultural economist and agronomists an efficient package of simple practices should be developed which will help protect the smallholders sown, growing, and stored crops. This would include protection against soil pests, soil born pathogens, bird and rodent damage, and storage losses. Economic thresholds for insect damage for the various crops must be considered as well as the ability of the project farmers to undertake chemical control. More information needs to be collected from the smallholders by careful monitoring as to the most economically and agronomically serious pests and diseases throughout the production cycles.

5. Animal Production, Pasture and Range Improvements:

6.12. The activities in animal production have focused on methods of improving the feeding value of crop residues and by-products as well as on studies on the productivity and utilization of natural pastures, on proper feeding of draft animals, on conservation and utilization of fodder including methods for producing silage and hay, on utilization of cultivated pasture and fodder crops, and on multiplication of forage crop plants for distribution to farmers. A laboratory has recently been equipped for study of the nutritive value of feedstuffs.

6.13. Unfortunately a considerable part of this output cannot be used in the pre-extension trials at the present time as the production package developed is a high input/high output type which is beyond the labour availability and the capital means of the small farmer. This situation undoubtedly developed as a consequence of deficiency in the original project design (see part V.D.) and from subsequent advice from consultants. Under the circumstances the mission is recommending a reorientation of the livestock and forage programme, in order to make it more relevant to the immediate needs of the farmer. This reorientation was accepted by the team. Details are provided in Annex IX.

6. Farm power, Equipment and Labour Reducing Inputs:

6.14. About 80% of all farmers in the project area use ox traction for ploughing and to a limited extent for weeding. The "victory" mould-board plough is the principal implement used for land preparation and tillage. Ox carts and locally made slides are also used, but to a limited extent, for carrying loads. The project effort has focused on testing designs for improved tillage equipment and in producing a less expensive ox cart. Some progress has been made in both undertakings. A less expensive ox cart will have an important impact on the farm unit by enhancing the productivity of labor. An alternative to the victory plough could have an important impact on soil preparation and cultivation by reducing erosion resulting from mould-board ploughing and improving water infiltration. Both the plough and the ox cart are ready for more extensive testing and should be tested on pre-extension farms.

7. Farm Management and Socio-Economic Investigations:

6.15. The farm management research programme was designed to serve two major objectives.

- (a) To gain a thorough understanding of the existing farming systems in the project area in order to provide accurate and detailed information to research scientists on the team.
- (b) To evaluate in socio-economic terms technical research findings and recommendations, and to determine their acceptability, feasibility, and profitability to the target groups.

With these objectives as a guide, four major activities were included in the project plan of the UNDP/FAO project: (a) the conduct of diagnostic (descriptive) surveys in selected areas; (b) collaboration with other scientists in designing on-farm tasks and in making economic evaluations of results; (c) assisting with economic evaluation of records from field tests on farms and from pre-extension farm trials; and (d) initiating farming systems research on selected farm units. Considering the time and field staff available, excellent progress has been made in conducting the descriptive surveys. One has been completed in the Mwala location in Machakos District and others are in progress in the Kitui and Lower Embu Districts (field work on the latter two should be completed in March, 1982). The Mwala survey was completed in November 1980 and a well-written, concise report of the findings has been produced.

B. Farming Systems Development and Pre-Extension Trials

6.16. While the focus of USAID/USDA project is on cropping systems, overall farm systems planning is a major objective of the UNDP/FAO project, but has not been undertaken by the staff to date. The concept of the whole farm systems approach has not been fully grasped by the UNDP/FAO team. The mission tried to dispel some of the confusion which persists in terminology and has outlined in Annex X necessary steps required to develop the whole farm system. A more detailed methodology was developed by one member of the mission and his report is being submitted to the UNDP/FAO team for their consideration and guidance. Some very useful background information is becoming

available through the area surveys. These surveys, characterizing farm units within each of four stratified groupings, provide a good description of typical farms within each category. The in-depth analysis of a more limited number of farms within each category is now planned and will form the basis for analysis of the existing systems as the first step in defining systems which would include improved varieties, crop cultural practices, livestock management practices, etc. To date the research efforts have focused on components rather than the whole farm system. Some practical groups of components are included in pre-extension trials. The selection of these, however, was not based upon a careful study of the existing production systems on the chosen farms. It does appear that certain components will be compatible with the farmers' systems and will be accepted. There has been no integration of livestock in the pre-extension trials except for some planting of improved forage crops. Likewise, few specific measures, either to control erosion or to enhance water retention and efficiency of water use by crops, have been introduced in the pre-extension trials.

C. Institution Building

6.17. The institution building output is determined by three factors: the effect on organization, the effect on counterparts and/or peers in terms of in-service training, and the effect of formal training. The effect of the two projects on institutional organizations has been negative, for the most part, because of the specific institutional relations which were set up for the two projects in terms of on-the-job training. The development of nationals by association with the expatriate staffs undoubtedly has had some positive elements. However, the expected effect has been compromised by the institutional and spatial separation of expatriate and counterpart staffs. The evaluation team made a special effort to understand the relations between and among the expatriate and counterpart staffs by holding joint and separate meetings with the four groups. While the expatriate teams had little to say about their Kenyan counterparts, the Kenyan staffs expressed a number of concerns about their relationships with expatriate counterparts. The chief concern expressed by most members was that of minimal participation in programme planning and experimental design. Evidently, individual discipline programmes have been largely defined and designed by the expatriate staffs. Concern was also expressed about the limited opportunity for group discussions along discipline

lines as well as on a multi-disciplinary basis. With respect to the latter, most Kenyan counterparts mentioned that they generally were left out. The foregoing relates especially to relationships among the staff members at the Katumani Station. In defense of the expatriate staff, it should be mentioned that most of the counterpart personnel had been on the project for less than nine months, and had come on the scene after programmes had been developed. On the other hand, a greater effort by the expatriate staff to discuss the programmes with the counterparts, explaining the rationale behind the work programmes and inviting suggestions, would probably have gone a long way to defuse the apparent feeling among the Kenyans of being nonparticipants. The principal issue raised by the very limited counterpart group (four individuals) in KARI was a feeling that they were not allowed sufficient opportunity to develop research programmes of their own. While accepting the need to work as a team with the expatriate group, the view was articulated that each as an individual should remain free to pursue individually defined research undertakings.

6.18. The formal training aspects of the UNDP/FAO project are essentially on schedule. It is, however, too early to judge the effects of the degree training element since four of the individuals involved are still in training. The one individual who has completed his training, unfortunately, is no longer assigned to the project. Seven individuals have completed short term training programmes. Of these, only two are still assigned to the project, and three are currently enrolled for degree training in the US. Consequently the short-term training has had little institutional building effect. The training programme of the USAID/USDA project is about two years behind schedule. Except for two short term programmes, none of the scheduled training has been completed; hence effects on institutional development are essentially nil. One exception has been the informal participation of the agro-meteorologist in the training of post-graduate students of the University of Nairobi in agro-meteorology. This contribution has been appreciated by the University.

VII. ASSESSMENT OF EFFECTS AND IMPACT

7.1. The two projects have completed their establishment phases and are in the process of generating the expected output which is to be tested in the field for effects and impact. At present, there is some evidence of the ensuing effects but none in terms of impact which, understandably, will require considerable time and effort, especially by the extension staff. Consequently, the assessment that follows is limited in scope and tentative regarding the conclusions reached.

A. Technical and Economic Viability of the Farming Systems Approach Developed by the Projects

7.2. As indicated earlier, the farming systems approach has had no impact to date since it has not yet been initiated. However, all, or most, of the research undertaken thus far by scientists in the two projects can provide valuable input data for initiating the farming systems approach. Perhaps a more important step in this direction will be the good judgement gained by each scientist through many years of research and practical experience. This is especially necessary in the development of semi-arid areas where the accumulation of useful data on new technology is unavailable. Farm surveys completed and in progress will also provide useful information for getting started on a farming systems approach.

7.3. Whether or not the farming systems approach becomes viable depends on the degree of administrative support and on the willingness of the scientists to devote some of their time to become thoroughly acquainted with procedures for planning the integration of their individual contributions. In addition, it will require intensive continuation of individual research efforts on farming system components and technologies, with such modifications as the researcher considers desirable as a result of evaluating the inter relationships and particular impacts revealed by the systems approach.

B. Utilization of the Projects' Outputs

1. By the Extension Service:

7.4. Mission observations of the structure and organization of the extension services show that considerable distances and lack of communications make adequate supervision very difficult. The field workers themselves (technical assistants, TAs and junior technical assistants, JTAs) have

received a conventional education, or in the case of the JTAs some in-service training. This training cannot, as yet, take into account any new developments, but by working with project staff on the verification and pre-extension trials the extension staff should be able to gain useful experience which they can apply to other farms in their areas. The TAs and JTAs are young and inexperienced and lack confidence when confronted by mature farmers. At present, they are poorly prepared to interpret farmer problems and to provide adequate reverse flow of information which could be useful in design of extension programmes or as guidance to research. However, the few who have had contact with the pre-extension farmers have gained confidence after having been shown improved techniques that work.

7.5. The staff responsible for pre-extension trials should, within one year, and in liaison with District Agricultural Officer (DAO), prepare extension material (which can be reproduced by the Agricultural Information Centre) and arrange courses and field days for extension staff to bring them up to date with the latest experiences.

7.6. Both projects depend on TAs for monitoring the verification and pre-extension trials. The adequacy of this monitoring is highly variable. For example, in only half of the pre-extension trials were the data required for economic evaluation secured. There also appears to have been little contact between the expatriate staff and the Kenyan specialists at the district level. In short, while there is regular interaction between the expatriates and the TAs in the sub-locations, broader contacts with the DAO and DLO specialist staff have been irregular and not yet institutionalized. Thus the effects and impact of the two teams on extension have been minimal.

2. By Farmers:

7.7. The selection of the pre-extension farmers covered a broad spectrum of the types of farmers that one would expect to find in any given area. It is to be expected that there would be an initial reluctance on the part of selected farmers to make any changes in their production techniques which might increase the already considerable risks they normally carry. However, it is obvious that the farmers by having continued with the new techniques, in some cases for the third cropping season, consider them valuable. Indeed, examples were seen in this last difficult season in which total crop failure occurred

using conventional methods, whilst some yield was produced using the improved practices. This can be considered a major advance in an area where total failure is a frequent occurrence. The last growing season, when rainfall was poor, can be considered very advantageous for the two projects in separating the wheat from the chaff in terms of the viability of agronomic techniques.

7.8. There is no doubt that a considerable amount of unofficial extension work is carried out by the pre-extension farmers with their neighbours. They acknowledge willingness to improve their production and are perfectly capable of deciding for themselves which of the techniques they wish to emulate. This was particularly evident in the universal interest shown in the new double cropping variety of pigeon peas where requests were made from neighbouring farmers for seed. However, it should be noted that as this was the only green podding plant at that time of year it also attracted the interest of a variety of insects, birds, and wild animals.

7.9. The pre-extension farmers were in many cases loaned equipment and were provided with seed and other inputs but the true impact of the work of the projects will be seen when other farmers on their own initiative and utilizing their own capital are prepared, in large numbers, to make changes in their techniques.

C. Effects of the Projects

1. On National Policy For Dryland Farming:

7.10. At this early stage in the development of the dryland research programme it is difficult to assess the overall effect of the two projects on national policy for dryland farming. It is, however, possible to assess tentatively the extent of the constraints revealed by the two projects which call for speedy action. These include the following.

- (a) A lack of coordination among the many ministries and aid programmes involved in the semi-arid areas. The evaluation team has noted that not only is there some duplication of effort but a lack of knowledge by one agency of what other agencies are attempting to accomplish.

- (b) A difficulty, particularly on the smallest holdings, in introducing high input/high output sub-systems into what is essentially a low input/low output farming system.
- (c) The lack of long term credit facilities that would enable farmers, who cannot generate sufficient capital from present farm operations, to adopt higher inputs.
- (d) The lack of sufficient collective soil and water conservation measures to reinforce individual effort on small holdings.
- (e) Confusion as to how best to shorten the time between obtaining research results and implementing them on farms.

7.11. Thus the first years of work in the two projects have emphasized the necessity for a reformulation of the national policy for dryland farming which will address itself to solving the above problems.

2) On Overall Research for Dryland Farming:

7.12. Without a national policy framework, the effects of the two projects on overall research for dryland farming are difficult to assess at this time. Gaps in the present research programme have, however, been revealed as have some of the administrative constraints on the research programme. The most obvious gaps in the research programme are summarized below.

- (a) ~~Insufficient concentration on the overall problems~~ of the livestock sector despite the fact that this is the only agricultural sector that continuously produces a cash return and that the Machakos District demonstrates the highest livestock off-take percentages in the country. In this context it should be noted that no provision for livestock research was made in the KARI/USAID Dryland Cropping Systems Research Project despite the fact that livestock are essential for crop production in the semi-arid areas and that there are excellent underutilized animal nutrition and other investigation facilities at Muguga.
- (b) Minimal investigations within the livestock sector on the problems of sheep, goat, and poultry production.

- (c) Limited studies to date on low-cost methods of soil conservation, particularly on the natural pasture areas.
- (d) No investigations as to the most economic method of providing water for humans and livestock on small farms in order to save scarce labour from fetching water from distant sources.
- (e) Major omissions of research in the crop sector, including:
 - (1) investigations as to the possibility that fruit and high horticultural crops could be grown on small farms for additional cash income;
 - (2) studies on the potential for agro-forestry and silvo-agro-forestry systems for small farms, particularly the use of legume tree and bush species for improved soil fertility, firewood, shade, and high quality forage for livestock; and legume bush species for hedges and high quality forage on natural pastures; and
 - (3) investigation of all possible methods of protecting sorghum and millet crops from bird damage.

7.13. Obvious administrative constraints on the research programme are given below.

- (a) A lack of coordination of research effort not only within the project area, but also between and within Katumani and KARI.
- (b) Difficulties in the coordination of efforts between Katumani and KARI to translate research results into farm practices.

7.14. At present the unit farm at Katumani is a mixed investigational, demonstration, partly simulated, small farm holding. No research investigations should be conducted on the unit farms as there is ample land for this at the Katumani Station. The unit farm should simulate, as far as possible, small conditions on small holdings and the only innovations and demonstrations should be those practices that previous investigations have shown to be economic and viable on small holdings.

D. Prospects for Wider Adoption of Results (links with extension services and agencies providing farm inputs.)

7.15. Prospects for the wider adoption of results are excellent, once proven new technology is available and some form of coordination of the efforts of all the ministries and aid agencies working in the semi-arid areas is achieved.

7.16. It would be a mistake to wait for a wider dissemination of results until the projects can provide a new whole farm system. Relatively small inputs, such as the new variety of pigeon peas, should be introduced as soon as possible over as wide an area as is practical.

E. Long Term Impact of the Two Projects

7.17. The long-term impact of the projects on the farming system in the semi-arid areas could be considerable, even dramatic, if the constraints on the operations of the projects discussed in previous sections of the report, can be minimized.

7.18. It must, however, be realized that investment in research is necessarily long-term in nature and that the evolution of more productive farming systems will be a relatively slow undertaking. At the same time, the situation in the region will be changing very rapidly as population increases, farms become smaller, land fertility declines, and the total resource base dwindles. Under these circumstances it is imperative that coordination of all resources be achieved as quickly as possible and that a dynamic approach to the problems be adopted by all concerned.

VIII. PROPOSALS

8.1. Based on the analysis and findings presented in the previous chapters the mission wishes to make proposals for institutional, operational, and technical changes that they consider are necessary if present impediments to effective coordination are to be removed and the effectiveness and future impact of the two projects are to be improved.

A. Institutional Changes

8.2. Recognizing that the unsatisfactory state of the institutional relationships of the two projects is a major impediment to effective cooperation and coordination, it is clear that restructuring is a matter of urgent necessity. However, because of the recent creation of a new Ministry of Regional Development, Science, and Technology and the uncertain impact that this may have on the institutional organization of research in agriculture (crops and livestock), it is difficult to suggest what changes should be made in the existing institutional relationships of the two projects.

8.3. Therefore it is recommended that within the next nine months, and no later than December 1982, a review of intervening institutional changes be made by a small tripartite group. If such a review should reveal that little progress has been made toward greater integration of agricultural (crops and livestock) research institutions, the institutional ties of the two projects should be critically reappraised. The appraisal should focus on establishing a satisfactory institutional arrangement for the effective coordination of the two projects as well as a review of the posting arrangements of the two expatriate teams.

8.4. In the meantime, and recognizing the difficulties of attempting to restructure the coordination aspects of the two projects without any basic institutional remedies, the mission recommends that the following measures be taken to improve the existing situation.

- (a) A Senior Kenyan Research Officer be appointed National Coordinator of Research in Agriculture (crops and livestock) for the arid and semi-arid lands.

- (b) The National Coordinator be responsible for coordinating the use of inputs provided by both the UNDP/FAO and the USAID/USDA projects and for the allocation of all national resources committed to the projects.
- (c) A team leader be appointed for each expatriate team. There would be no change in the USDA team as it already has a leader. The team leader would be responsible to the National Coordinator for directing the activities of his respective team and ensuring that the team fulfill their respective roles in the overall programme.
- (d) The National Coordinator also be appointed as Director of the National Dryland Farming Research Station, Katumani, and that he be supported in this task by the appointment of an effective estate manager, who would manage the day to day operations of the station.
- (e) The National Coordinator take guidance from and be accountable to the Technical Coordination Committee (TCC) whose mandate should be extended to include the operations of the USAID/USDA project.

8.5. Recognizing that the problems of management and coordination of the two projects, as well as other related projects, are to a large extent due to the lack of a well-defined programme for research and development in the arid and semi-arid lands, and considering that a large number of donor supported projects have been substantially developed by the respective donors without the guidance of a national plan, the mission recommends that a plan for research and development be mapped by the GOK for a 10-20 year period, defining priorities and establishing resource requirements. This plan should specifically address the question of research-extension linkages and propose mechanisms including resource requirements, for strengthening these linkages. The several donors, including USAID/USDA and UNDP/FAO, should be prepared to assist the government in preparing this plan, independently of their on-going projects.

B. Operational Changes

8.6. While the TCC will be responsible for overall coordination, the two projects must work hand-in-hand on

programming and operational matters. This cooperation is essential to maintain a focus on technical problems of high priority and to circumvent temptations for departure from core activities and/or duplication of work. The mission therefore recommends that the following measures be taken:

- (a) An organogram of the NDFS Katumani Station should be prepared without further delay, as proposed earlier by the TCC. In preparing the organogram the respective tasks of the expatriate and counterpart staff should be clearly defined and their responsibilities for interdisciplinary activities be delineated. Linkages and lines of communication should be clearly identified.
- (b) Monthly meetings should be held between the USAID/USDA and the UNDP/FAO teams, together with the national staff, for the joint planning of annual work programmes and for exchange of experience. These meetings should be chaired by the National Coordinator and agreed work programmes submitted to the TCC and/or its two sub-committees.
- (c) Regular meetings should be held between the National Coordinator and the two team leaders to monitor the joint work programmes and solve minor problems arising from their operation.
- (d) Verification and pre-extension trials should be conducted jointly by the two teams. Experimental results, identified in verification trials, should be included in appropriate technical packages for the pre-extension trials. The USAID/USDA team should also take a more active part in the planning of unit farms at Katumani or elsewhere.
- (e) Both teams should have access to experimental facilities (insofar as they are available) at Muguga and Katumani subject to the approval of the TCC.
- (f) Consulting services to the two projects should be a joint venture of USAID/USDA and UNDP/FAO projects and should be provided on an interdisciplinary and not an individual discipline basis.
- (g) The fellowships provided by either project should be available for the most suitable counterpart personnel at either KARI, Muguga or NDFS, Katumani.

C. Technical Proposals

8.7. The technical programmes of the two teams have been discussed in previous chapters and in general have been deemed satisfactory. There are, however, some deficiencies and the mission makes the following recommendations for resolving them.

8.8. Soil and Water Conservation. The work of this unit should focus more than heretofore on demonstrations of the best practices currently available, whilst continuing the basic run-off studies. These practices should be introduced into the pre-extension trials, on the unit farms and on farm units selected for pilot testing of whole farm systems.

8.9. Livestock Production. The vital importance of the work of this unit in the development of dryland farming systems should be emphasized, and it should be more strongly supported at all levels in the development of its reorientated investigation programme, particularly by the provision of suitably trained counterpart staff.

D. Counterpart Support

8.10. As mentioned in Chapter V, there is a serious shortage of trained counterpart staff assigned to the USAID/USDA project and the mission recommends that this be corrected in the shortest time possible. On the other hand, in recent months a rapid increase has occurred in the number of counterpart staff located at Katumani, although in the livestock sector no counterpart support has yet materialized.

8.11. For institution-building, a function shared by both projects, there is no other alternative but to maintain an adequate number of trained staff with some experience on a full time basis in Muguga and Katumani.

8.12. The mission is aware of the dilemma facing Kenya regarding trained agricultural staff and the excessive demand made on their services. Nevertheless, the possibilities of transfer from the Ministries of Agriculture and Livestock Development should be explored and backed up by the promise of further academic education and/or short-term training in prestigious research institutions abroad.

8.13. Another weakness of the counterpart situation is the absence of experienced technical officers in the major disciplines covered by the two projects. Such officers are essential to interact on equal footing with the expatriate staff, to provide guidance to the newly recruited national staff, and to avoid any disruption in the continuity of the programme after the departure of the expatriate staff. The mission recommends that the Government give serious consideration to the appointment of at least one such experienced technical officer at Katumani and one at Muguga this year and similar appointments in 1983 and 1984, by which time the return of staff now in training abroad will ease the counterpart situation.

E. Interaction with the Extension Services

8.14. Interaction with the extension services on a regular basis has been principally with the technical assistants (TA) and the junior technical assistants (JTA) in connection with the verification and pre-extension trials. Less regular contact has been made with the District Agricultural Officer (DAO) and the District Livestock Officer (DLO) and their respective specialist staffs. It is recommended that relations with the DAOs and DLOs be formalized to assure greater integration of the specialist staffs, as well as the TAs and JTAs, with the pre-extension, verification and eventually whole farm systems work. It is further recommended that a special training programme be organized in farming systems methodology for the extension staffs.

F. Interaction With Other Institutions and Projects

8.15. Both projects need to strengthen their collaborative efforts with Government institutions and projects supported by various donors. One such effort calling for special attention is the need for bridge building between the Agricultural Faculty of the University of Nairobi and the Katumani Station for joint research in dryland farming. At present, the dialogue between members of the Faculty of Agriculture and the expatriate staff at Katumani and Muguga is maintained on a personal basis and for professional interest. While recognizing the beneficial value of such personal contacts, the mission strongly feels that the relationships ought to be institutionalized with firm commitments on both sides for commonly agreed objectives and tasks.

8.16. There is ample room for dryland farming research by the University personnel and the Katumani Station should do its utmost to use their talents in support of its research activities. It is necessary to fit the research activities of the University into the overall programme of the Katumani Station and provide its staff with the necessary facilities, materials, and manpower to enable them to implement their share of the programme. The mission therefore recommends that a well-defined programme of research between the Agricultural Faculty of the University of Nairobi and the Katumani Station be formulated and sanctioned by the TCC.

8.17. A similar collaborative effort is needed with the animal production division of KARI, which would make it possible for personnel at the Katumani Station to make use of the extensive facilities at Muguga in support of the livestock activities of the UNDP/FAO project.

8.18. A considerable number of donor assisted projects exist which wholly or partially operate in one or more of the districts covered by the UNDP/FAO and USAID/USDA projects, or whose work is relevant to dryland farming. The Katumani Station interacts with some of these projects through give and take arrangements, e.g., with the Machakos Integrated Development Project funded by the EEC/EDF, the World Bank supported project in Baringo, the UNDP/FAO Agricultural Equipment Improvement Project, and the FAO/TF Project for Rural Structures in Eastern and Southern Africa. The mission recommends that collaborative efforts be expanded with other donor-assisted projects. Such links are essential for follow-up activities based on the findings and recommendations of the UNDP/FAO and USAID/USDA projects and they will be easier to make if the proposal in paragraph 8.5 is effected. In particular the mission wishes to draw attention to closer collaboration with projects listed in Annex VI, Tables 3 and 4.

G. Modifications of the UNDP/FAO Project

8.19. Based on the recommendation of the UNDP/FAO Agriculture and Rural Development Review and Programming Mission, which took place in April/May 1981, and some proposals made by the TCC, a new draft Project Document has been prepared for KEN/74/017 covering the period 1982-86 with a total UNDP input of US \$4877 thousand and Government contributions of

Kshs 1152.8 thousand.^{1/} Although the objectives and design of the new draft Project Document remain the same, a number of substantive changes have been introduced regarding the composition of UNDP/FAO experts.

- (1) Abolition of the post of soil and water conservation engineer and the animal production/nutritionist.
- (2) Change in the title of the farming system specialists to production agronomist but without any alterations in post description.
- (3) The creation of six new posts consisting of;
 - plant breeder (sorghum and millet)
 - plant breeder (other cereals and root crops)
 - agronomist (cereals)
 - agronomist (pulses and oilseeds)
 - seed production specialist
 - seed production specialist.

The existing posts of the plant breeder (pulses and oilseed crops), agronomist (pasture), plant protection specialist, and farm management specialist have been retained.

8.20. The new draft Project Document also makes provision for five associate experts (agronomy, plant breeding, farming systems, agricultural engineer and seed production). The training components have been strengthened through the provision of 15 fellowships for academic training, 24 fellowships for short-term training as well as study tours and group training.

8.21. The mission has reviewed the new Project Document and its comments are given in Annex XI.

^{1/} However, the 1982-86 Programme Cycle of the UNDP provides for a sum of US\$4273 thousand for KEN/74/017.

H. Modification of USAID/USDA Project

8.22. The mission does not wish to propose any reorientation in the objectives and design of the USAID/USDA project. It should continue as proposed in the original project agreement. However, with a view to strengthening interaction with the UNDP/FAO project, the mission suggests that, within the limits of existing contracts, arrangements should be made for the agro-meteorologist, agronomist, and the senior maize breeder to work essentially full time at Katumani Station. The work of these experts is intimately linked with the activities of the UNDP/FAO team and placing them in one place would be a major advantage in achieving coordination and strengthening interdisciplinary research and development. The plant pathologist and the soil physicist could work half-time at Katumani and half-time at Muguga. The same arrangement would apply to their existing and future counterparts. The Katumani Station should provide them with office space and the necessary facilities and support staff.

8.23. In the terms of reference of each expert a line should be added to indicate specifically the nature of the joint activities with the UNDP/FAO team as well as with other donor-assisted projects where activities of a similar nature are conducted.

8.24. With January 1984 as the terminal date for the USAID/USDA project, and assuming that reasonable progress has been made in the solution of the institutional, administrative and operational problems cited in the report, USAID should initiate in early 1983 a review of its position with respect to undertaking a second phase of the project, so that the necessary steps can be taken to begin the second phase with minimal interruption.

I. Future Outlook

8.25. The development of institutional capability in Kenya for dryland farming research and development is a long-term proposition and it would be unrealistic to expect miracles over the next few years. More time and resources are needed to come to grips with the most critical technical, economic and institutional problems, and to achieve rewarding and lasting results. Hasty actions will not leave behind anything that is based on solid technical work and which has the potential for

making rapid progress in the future. Consequently, further assistance by UNDP and UNHCR beyond the termination of the two projects should be considered. However, it is difficult for the mission to reflect on the precise nature and quantum of such assistance at the present time. What it wishes to propose is that another joint evaluation of the two projects should be carried out in February/March 1984. This evaluation should not be an all-embracing exercise but confined to three aspects: (a) results of the two projects since their inception and the impact generated; (b) the relevance of the results and impact in relation to policies and programmes of the Government of Kenya regarding dryland farming; and (c) the need for further assistance, if required.

8.26. The findings of the impact evaluation should be discussed in June 1984 by a National Seminar on Dryland Farming to be organized by the Government of Kenya and to which USAID, UNDP, FAO, and other donors would be invited. This seminar should also advise the Government of Kenya on the need, or otherwise, of future external assistance to Kenya in the research and development of its dryland farming programme.

SCOPE, PURPOSES AND OBJECTIVES OF THE EVALUATION

The primary purposes of the evaluation of the two projects are below.

1. evaluate the relevance of the long-term and immediate objectives of the two projects in the light of expected benefits from improved dryland farming systems to small farmers in the semi-arid areas of Kenya and assess the feasibility of their immediate objectives in the light of inputs provided by UNDP, USAID, and the Government of Kenya.
2. Identify major factors which promote or hinder the implementation of planned activities and the achievement of intended results.
3. highlight complementary activities which enhance or will enhance the effectiveness and impact of both projects.
4. make recommendations for future actions by the two projects.

In particular the evaluation mission will perform the tasks outlined below.

1. Review the programme of work and progress of the two projects since their inceptions and determine the extent to which targets have been met.
2. Evaluate the results achieved in major technical field covered by the two projects.
3. Evaluate proposals for improved dryland farming systems recommended by the two projects and assess their operational relevance to the needs and capabilities of the intended beneficiaries.
4. Assess the strengths and weaknesses of the two projects' collaborative arrangements.

5. Assess the appropriateness and utilization of project inputs or components contributed by AID, FAO/UNDP, and the Government of Kenya in achieving project outputs to date:
 - (a) type, number, qualifications, timeliness of arrival and scope of work of the US and FAO/UNDP provided technicians;
 - (b) integration of the technicians into their designated project activities; their relationships with USAID, FAO/UNDP, other donor, and GOK organizations, especially the extension and research activities of the GOK; the effectiveness with which these technicians have been utilized; and the appropriateness of their duty stations;
 - (c) assessment of counterpart and support personnel with respect to (a) and (b) above; and
 - (d) administrative and project management support for the projects by the GOK, USAID, USDA, and FAO/UNDP.
6. Review research/extension links which fall within the scope of the two projects and assess the current viability of the relevant Kenyan research institutions in regard to planning and implementing effective research programmes.
7. Assess the potential contribution of the two projects to the training of national staff.
8. Identify constraints and problems which are hindering or expected to hinder future activities and make proposals for their solutions.
9. Make recommendations on the future orientation of the two projects, including the desirability of increased assistance particularly in light of current inflation rates.
10. Assess the degree of farmer and community involvement in the planning and implementation of research activities in the farming areas. Ascertain the appropriateness of project design to meet the needs of the intended farming community.

EVALUATION TEAM

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REFERENCES, REPORTS AND PAPERS CONSULTED BY THE MISSION

Agricultural Sciences Advisory Research Committee, Annual Report 1980-81.

Desrosiers, Russell et al. Agricultural Research In Kenya: Assessment of Capabilities. ATAC/USAID, November 1977.

Dryland Farming Crops Catalogue, 1982. NDFRS, Katumani.

FAO REPORTS

Dryland Farming Research and Development Project. Annual Reports 1980-81, KEN 74/017:

Animal Production Research
Soil and Water Conservation
Farming Systems Section
Farm Management Research
Crop Protection Research
Seed Production Unit
Pulses and Tuber Crops Improvement

Project Document, Dryland Farming Research and Development KEN 74/017/01/12 June 1979. Amendment May 1980.

Project Revision and Orientation. KEN/74/017, 1981.

Reports of FAO/Rome Staff Visits to DFRD Project. KEN/74/017, November/December 1981:

Crop Protection
Animal Production
Soil Conservation
Crop Production

Status of the Dryland Farming Research and Development Project. KEN/74/017, February 1982.

Terms of Reference for Project Staff: Dryland Farming Research and Development, KEN/74/017.

Carpenter, N.A., Dryland Farming Research and Development Project, Katumani, Kenya. Working Document KEN/74/017, May - June 1981.

Review of achievements, problems encountered, objectives, implementation methodology, institutional requirements, and suggestions for improvements. Report with 2 Annexes.

IBRD, Country Economic Memorandum and Annex on Agricultural Issues, June 1981.

ISNAR, (International Service for National Agricultural Research): Kenya's National Agricultural Research System, 1981.

Kenya Agricultural Research Institute. Newsletter, 1982.

Kenya Marginal/Semi-arid Lands Pre-Investment Inventory, Volume 1: Analysis. August 1978.

Leonard, David K., Reaching the Peasant Farmer: Organization Theory and Practice in Kenya. University of Chicago Press, 1977.

Marimi, A.M. Senior Staff Establishment Proposals 1981/82, NDFRS, Katumani.

Summary of Meeting of the Dryland Program Agronomists, July 1981.

Meyers, Richard L., Organization and Administration of Integrated Rural Development in Semi-arid areas: The Machakos Integrated Development Program. USAID 1981.

MOA, Drylands Cropping Systems Research Project.
Life of Project Training Plan, 1981.

Ministry of Agriculture, Visitors Guide, National Dryland Farming Research Station, Katumani. February 1982.

Nadar, Hassan M., Agronomic Recommendations for Maize Cropping Systems in the Machakos Area. Mimeo 1982.

Nadar, Hassan M., et al., Agronomy Research for Marginal Rainfall Areas in the Eastern Province of Kenya, 1982.

Rukandema, Mwita, Economic Evaluation of Pre-extension Trials. Results for the Long Rains Season 1981, NDRD Project.

Rukandema, Mwita, Farm Survey Questionnaires, 1981.. NDRD. Project.

Rukandema, Mwita, et al., Report of Farm Survey Results from Kwale Location. DFRD Project KEN/74/017/Technical Report No. 1.

Technical Coordination Committee, DFRD Project. Minutes of the Meetings:

First meeting July 1980
Second meeting January 1981
Third meeting September 1981

Technical Coordination Committee, DFRD Project. Minutes of the Crops and Land Use Subcommittee, October 1980.

Technical Coordination Committee, DFRD Project. Minutes of the Ad Hoc Committee, February 1981.

UNDP/FAO REPORTS

Agricultural and Rural Development Review and Programming Mission, Kenya/Rome, 1981.

Kenya Sorghum and Millet Development Project, KEN/78/016, Progress Report. March 1982.

USAID REPORTS

Kenya Agricultural Systems Support Project. Project Paper 615-0169, 2 Volumes, June 1978.

Kenya Arid and Semi-arid Lands Development Project. Project Paper 615-0172, August 1979.

Kenya Drylands Cropping Systems Research Project. Project Paper 615-0180, August 1979.

USDA REPORTS

Dryland Cropping Systems Research Project, Summary Statement of Status and Plans for 1980-81. October 1980.

Dryland Cropping Systems Research Project, Summary Report and Plans for 1980-81. November 1980.

Dryland Cropping Systems Research Project, Status Report - KARI/USAID, September 1981.

Peters, L.V., Kenya Maize Breeding: USAID Program, 1981, Work Plan.

Stewart, J. Ian, How Research Assists in Managing Crops to Maximize Water Availability, Yields and Returns. Mimeo, 1982.

Stewart, J. Ian, Visit to Agro-Meteorological Research Experiments at Kiboko Range Research Station and Katumani National Drylands Farming Research Station, January 1982.

Stewart, J. Ian, and Charles T. Hash, Impact of Weather Analysis on Agricultural Production and Planning Decisions for Semi-arid Areas of Kenya. Mimeo, 1981.

Stewart, J. Ian, and Joseph O. Mugah, Lysimeter Water Balance for Bare and Cropped Soil. Mimeo, 1979.

Stewart, J. Ian and Fred Wang'ati, Research on Crop Water Use and Drought Responses in East Africa. Mimeo, 1978.

Stewart, J. Ian and Fred Wang'ati, Studies and Methods to Stabilize and Increase Food Crops Production in the Marginal Rainfall Areas of Kenya. Mimeo, 1978.

Ulsaker, Larry, The Design and Installation of Run-off Plot Equipment for the National Dryland Farming Research Station, Katumani, Machakos, 1981.

Republic of Kenya, National Food Policy: Sessional Paper No. 4, 1981.

Republic of Kenya, National Livestock Development Policy, 1980.

Wang'ati, F.J., Scientific Research in Kenya: The Role of ASARC in the New Management System, 1981.

Whiteman, P.T.S., Sorghum and Millet Agronomy in Eastern Province, Kenya. Report on UNDP/FAO Kenya Sorghum and Millet Development Project, KEN/78/016. December 1981.

Whiteman, P.I.S., Sorghum and Millet Agronomy Investigations in Eastern Province. Technical Report, UNDP/FAO Project, KEN/78/016. December 1981.

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Mihui, S.G.	Pulse Improvement
Muhammad, L.	Farm Management Economics
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Nguluu, S.	Farming Systems
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Enkule

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Simbas, J.

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Kingori

District Coordinator

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Maweu, K.

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Muli, J.

Farmer, MIDP Cooperator

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Wilkins, M.	Assistant Resident Representative

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Pinto, F.	Sorghum and Millet Project Leader

USAID/KENYA

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Hash, C.T.	Agricultural Officer
Lefes, W.	Programme Officer
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Kus'ewa, P.K.	Maize Breeder
Ochi'eng, J.	Maize Breeder
Muthoka, D.K.	Chief Maize Breeder
Ndambuki, F.M.	Senior Maize Breeder
Kiarie, A.W.	Maize Breeder
Muksya, F.	Maize Breeder
Odhiambo, M.	Maize Breeder

KENYA SEED COMPANY

Motanya, P.	Maize Manager
Abincha, W.	Financial Controller

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Critchley, W.	Crops Officer
Chesumbia, F.	Range Management Officer

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Lundgren	Director
Torres, F.	Fodder Tree Crops Specialist

WORLD BANK (IBRD) Nairobi

Worker, N.	Senior Livestock Development Officer
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INTERNATIONAL LIVESTOCK CENTRE FOR AFRICA (ILCA), Kabete

De Leeuw, P.	Research Officer
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ITINERARY OF EVALUATION MISSION

- Feb 21 Team arrives in Nairobi
- Feb 22 Briefing for team by Government of Kenya,
FAO and USAID.

Technical briefing by FAO and USDA team leaders

Evaluation mission strategy session
- Feb 23 Meeting with Director of Research,
Ministry of Agriculture

Evaluation mission discussion and planning
- Feb 24 Meeting with Director of Research, Ministry
of Livestock Development

Visit to the Agricultural Information Center

Visit to the National Agricultural Laboratory

Meeting with Faculty of Agriculture, University
of Nairobi
- Feb 25 Meeting with the Resident Representative, UNDP

Meeting with KARI and with USAID/USDA Team
at Muguga
- Feb 26 Visit to Katumani Research Station and briefing
by the station director, the Dryland Farming
Research and Development Project Coordinator,
FAO and USDA team members; laboratory and field
visits

- Feb 27 Visit to Machakos District Agricultural Office
- Consultation with the District Agriculture
 Officer and District Livestock Officers and
 FAO team members; laboratory and field visits
- Visit to Machakos Integrated Development Project
 farmer tests; FAO pre-extension trials and USDA
 verification trials in farmers fields
- Feb 28 Evaluation team stocktaking and planning meeting
- March 1 Visits to FAO pre-extension trials in farmers
 fields in Machakos District.
- Visits to Kampi ya Mawe sub-station
- March 2 Visits with Kitui District Commissioner,
 Kitui District Agriculture Officer, District
 Livestock Officer and staff
- Visit to farms and pre-extension trials, Kitui
 District
- Visit to Ithookwe Sub-station
- March 3 Visit to the unit farm, the pasture research unit
 and the seed farm, Katumani Station
- Discussion session with FAO team at Katumani
- March 4 Meeting with Harvard Institute for International
 Development/Technical Assistance Pool
- March 5 Meeting with World Bank, Nairobi
- Meeting with FAO Project Managers
- March 6 Meeting with the Deputy Director of Agriculture,
 MOA
- Meeting with the Director of Research,
 Ministry of Livestock Development

- March 7 Evaluation team stocktaking and planning meeting
- March 8 Discussion session with USDA research team
Discussion session with KARI counterpart staff
Travel to the Western Kenya Drylands area by part of the team
- March 9 Visit by part of team to Katumani Research Station for in-depth discussions with the counterparts of the UNDP/FAO team; Observation in a staff meeting for planning the 1982 long rains programme of work
Continued observations by remaining team members in the Western Kenya semi-arid zone as follows:
Visit to the Goat and Sheep Breeding project at Kimono
Visit to the Kenya Livestock Research Station at Naivasha
Return to Nairobi
- March 10 Visit to Egerton College.
Visit to IBRD supported Baringo Pilot Semi-arid lands Project
Continuation of Western Kenya Visit as follows:
Continuation of discussion and observations at Baringo
Report drafting and administrative work by remaining team members in Nairobi

- March 11 Meeting of entire team in Nairobi; exchange of information related to activities of March 8, 9 and 10; review of drafts of sections of the report which had been prepared; and planning for additional consultations and individual tasks in compiling the draft report. Meeting with ILCA by the livestock members of the evaluation team.
- March 12 Observation by two team members of the maize breeding program at Kitale and the Kenya Seed Company
- Report writing by remaining team members
- March 13 Meeting with the UNDP/FAO team as a whole by the evaluation team; report writing
- March 14 Stocktaking of the status of report writing
- March 15 Joint meeting with the FAO and USDA research staff concerned with soil and water conservation and management and crops
- Report writing
- March 16-18 Intermission discussion and report writing
- Further consultations with individuals already contacted.
- March 19 Debriefing with GOK, FAO, UNDP, and USAID representative
- March 20-21 Continuation of report preparation
- March 22 Meeting with major donors involved in dryland projects
- March 23 Completion of report

OFFICIAL DEVELOPMENT ASSISTANCE AND RELATED INSTITUTIONAL
INVESTMENT IN DRYLAND RESEARCH AND DEVELOPMENT

Table 1: Official Development Assistance Commitments to Kenya^{1/}
(in US\$ Million as of 31/12/80)

	<u>Grants</u>	<u>Loans</u>	<u>Total</u>
All Sectors	836.2	1497.9	2334.1
Agriculture:			
a. Narrow definition ^{2/}	208.1	354.8	562.9
b. Broader definition ^{3/}	341.8	542.2	866.0
Agriculture as percent of total			
a. Narrow definition ^{2/}	24.9	23.7	24.1
b. Broader definition ^{3/}	40.9	35.0	37.1

^{1/} Includes both technical assistance and capital aid; projects terminating before 31/12/80 or commitments incurred after are excluded; some projects may be excluded due to lack of reporting by donors; data do not include assistance by all non-governmental organizations and exclude intercountry projects in which Kenya participates. The exchange rate used in converting to US\$ is of 31/12/80.

^{2/} Includes assistance to agriculture, livestock, forestry, fisheries, cooperative development, and agricultural financing.

^{3/} Includes items under narrow definition plus irrigation, rural water supply, agricultural education, rural access roads, rural planning, and multi-sector rural development projects including rural development funds.

Source: Compendium on Development Assistance to Kenya as of 31 December 1980, UNDP, Nairobi, July 1981.

Table 2: Projects Assisted by Donors which directly benefit
The Project Area

<u>No of Projects</u>	<u>Value</u>	
	<u>(US\$ Thousand)</u>	<u>Percentage</u>
Crops	4	22,892 16.5
Livestock	2	3,367 2.4
Rural Water Supply	2	1,438 1.0
Rural Access Roads ^{1/}	5	72,641 52.3
Rural Health	3	1,231 0.9
Food and Nutrition	1	78 -0-
Multi-sector		
Rural Development	4	36,378 26.2
Agricultural Machinery	1	1,000 0.7
TOTAL	<u>22</u>	<u>139,025 100.0</u>

^{1/} Includes main roads in the area covered by the UNDP/FAO and USAID/USDA Projects.

Source: Compendium on Development Assistance to Kenya as of 31 December, 1980, UNDP, Nairobi, July 1981.

Table 3: Projects Assisted Etc By Donors Which Directly Affect The Project Area

<u>Title of Project</u>	<u>Donor</u>	<u>Amount US\$ Thousand</u>	<u>Duration/ Starting</u>	<u>Year</u>	<u>Area Covered</u>
<u>Crops</u>					
1. Dryland Cropping System Research.	USAID	6000	1979	5	Machakos, Kitui, Embu, Meru Districts.
2. Dryland Farming Research and Development	UNDP	3782	1979	5	Machakos, Kitui, Embu, Meru Districts.
3. Arid and Semi-Arid Lands Development	USAID	13000	1979	5	Kitui District
4. Soil and Water Conservation	UNDP	110	1982	1	Embu and Machakos Districts.
<u>Livestock</u>					
1. Sheep and Goat Development	UNDP	1353	1972	9	Dryland Farming Area
2. National Poultry Development Programme.	Netherlands	2014	1975	6	Machakos District

Rural Water Supply

1.	Special Rural Development Programme; ENA Water Supply	NORAD	1400	1976	on-going	Embu District
2.	Muthetheni Rain Tank Project	Catholic Relief Service	39	1976	on-going	Machakos District

Rural Access Roads

1.	Secondary and Minor	CIDA	11440	1974	9	Machakos, Embu
2.	Rural Access Roads Programme	DANIDA	7746	1978	4	Machakos
3.	Rural Road Project	Japan	15854	1978	4	North Eastern and Eastern Province.
4.	Thuchi-Nkubu Road	UK	32217	1981	3	Embu, Meru Districts.
5.	Meru-Maria Road	African Development Bank	5837	1978	on-going	Meru District

Rural Health

1.	Kibwezi Primary Health Care	Switzerland	292	1979	3	Machakos District
2.	Kibwezi Primary Health Care	USAID	818	1979	3	Machakos District
3.	Kitui Primary Health Care	USAID	413	1979	3	Kitui District

Food and Nutrition

1. Oilseed Pilot	Catholic Relief Service	78	1980	3	Machakos and Kitui Districts.
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Multi-Sector Rural Development

1. Mutungu Rural Development Project	Federal Rep. of Germany	1562	1979	on-going	Meru District
2. Muka Muvu Rural Development Project	Federal Rep. of Germany	9375	1979	on-going	Machakos District
3. Machakos Integrated	EED/EDF	23257	1978	5	Machakos District
4. Agro-Forestry Ecology	ICRAF	2184	1982	5	Machakos District

Agricultural Machinery

1. Agricultural Equipment Improvement Extension and Training	UNDP	1000	1981	3	Covers also Machakos and Embu
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Table 4: Related Institutions and Projects

IITA, Cowpea and cassava improvement training
ICRISAT, Sorghum and millet improvement, dryland farming training
CIMMYT, Maize improvement, regional activities (Nairobi based), adaptive on-farm trials (farming systems); training
ICRISAT, Sorghum shoot fly control, training
ICRAF, Agro-forestry (Nairobi based)
ILCA, Goat survey

National

University of Nairobi/Faculty of Agriculture and Veterinary Medicine, Crop management research counterpart training

National Research Laboratory at Kabete, Maize breeding seed production

Egerton College, Training

National Agricultural Laboratories (NAL), Storage pest control, soils testing.

National Resources Conservation Project, directed by NAL in cooperation with KARI and University of Nairobi

Donor Assisted Projects

UNDP/FAO (KEN/78/016), Sorghum and Millet Improvement for Human Consumption (completed)

Netherlands, Dry Bean Project Thika/National Horticultural Research Station

UNDP/FAO (KEN/75/028), Horticulture Research and Development - role of horticulture in marginal rainfall areas.

UNDP/FAO (KEN/77/1022), Crop Protection Against Bird Damage

FAO/TF - Rural Structures in Eastern and Southern Africa, mainly for on-farm storage facilities and other structures

UNDP/FAO, Forage Development and Seed Multiplication, mainly in the selection of best species of grasses and legumes suitable for the Project area

USAID - Agricultural System Support Project, agriculture training at Egerton College.

USAID - Arid and Semi-arid Lands Development, soil conservation farmer training, Kitui.

USAID, Goat Milk Scheme

ODM, Cassava Improvement at Maguga

World Bank, Baringo Pilot Semi-Arid Area Project

Germany, Integrated Project Arid lands, Maralal and Marsabit

Norway, Turkana Livestock Marketing.

RECRUITMENT OF EXPATRIATE STAFF

<u>USAID/USDA Project</u>	<u>Expected Date of Arrival</u>	<u>Actual Date of Arrival</u>	<u>Delay (Months)</u>
1. Agricultural Economist (Team Leader)	11/79	8/80	9
2. Agrometeorologist	11/79		0
3. Agronomist	11/79	11/79	0
4. Soil Physicist	<u>11/79</u>	2/80	3
5. Plant Breeder ^{a/}	11/79	6/80	7
6. Plant Pathologist	1/79	3/81	16
7. Senior Maize Breeder	11/79	4/82	29
<u>UNDP/FAO Project</u>			
1. Project Manager	5/79	- recruited; Replaced by National Coordinator	Not
2. National Coordinator ^{b/} ^{c/}	3/80	3/80	0
3. Farming Systems Specialist (Agronomist)			
a. Agronomist	12/78	12/78 March 1980	Resigned
b. Farming Systems Specialist ^{c/}	7/80	9/80	2

4.	Animal Production/ Nutritionist	1/79	2/79	1
5.	Plant Breeder	10/79	2/80	4
6.	Plant Protection Officer	10/79	2/80	4
7.	Farm Management Economist	7/79	10/79	3
8.	Agronomist (Pasture and Forage Crops) <u>c/</u>	7/80	9/80	2
9.	Soil and Water Engineer	2/80	3/80	1
10.	Agronomist (Pulses and Oilseeds) <u>d/</u>	7/80	Joined late March 1981	21

a/Attached to Kitale and not engaged in dryland farming..

b/With appointment of National Coordinator, the post of project manager was deleted.

c/Added after the revision of the Project Document in July, 1980.

d/Originally classified as agronomist/physiologist and to arrive on 10/79 but subsequently changed to agronomist/pulses and oilseeds.

INSTITUTIONAL SETTING FOR AGRICULTURE RESEARCH

A. Historical Background

1. In order to understand the current institutional setting for agriculture research it is necessary to consider the institutions from an historical perspective.
2. After independence the Governments of Kenya, Tanzania, and Uganda agreed to maintain a number of institutional and service entities on a regional basis to serve what became known as the East African Community. Two research institutions are of particular interest to the subject at hand: The East African Agricultural and Forestry Research Organization (EAAFRO) and the East African Veterinary Research Organization (EAVRO). These institutions occupied substantial physical facilities developed during the pre-independence period at Muguga, 27 km from Nairobi. The role of these two regional institutions was to conduct research of a basic nature, while the national research institutions and research stations would carry out adaptive research more directly applicable to the conditions of the respective countries.
3. During the post-independence period and up to the collapse of the East African Community in 1977, assistance by donors for research in agriculture and animal science was largely channelled through the two regional institutions.
4. The collapse of the East African Community was followed by the Kenyanization of the two regional research institutions. At the same time ongoing efforts in Kenya to develop a national framework for research in general were given added impetus. In order to respond to a long realized need for an institutional arrangement for developing a national science policy, the Science and Technology Act was passed in October 1977. This act created the National Council for Science and Technology (NCST) within the Office of the President. The NCST was primarily a policy making and advisory organ. The same act provided for the establishment of Advisory Research Committees covering agricultural, medical, industrial and natural sciences. The Science and Technology Act did not alter the status of EAAFRO or EAVRO. These continued to operate as wholly Kenya Government institutions.
5. In 1979 the Science and Technology Act was amended to provide for semi-autonomous research institutes in various scientific disciplines. In implementation of the amendment the Kenya Agriculture Research Institute (KARI) was established as a semi-autonomous body responsible to the MOA.

6. KARI established itself in the former facilities of EAAFRRO and EAVRO, with limited staff. The major national agricultural research structures remained in the MOA, the MOLD (in October 1979 MOA was split into two ministries, MOA for crops and MOLD for livestock), and the existing semi-autonomous commodity (coffee, tea, etc.) and discipline (irrigation, etc.) oriented entities.

7. KARI's focus is on basic agricultural/livestock research, while the ministries of Agriculture and Livestock Development concentrate on applied research. This division, while not explicit, stems from the historical role of the Muguga establishment.

8. The foregoing historical perspective is important to the understanding of the organizational relations of the UNDP/FAO and the USAID/USDA projects and resulting issues and problems.

B. Dryland Farming Research and Development and Dryland Cropping Systems Projects

9. Discussions between the Government of Kenya and UNDP/FAO leading to project KEN/74/017 (Dryland Farming Research and Development) began in 1974. These culminated in a project agreement whereby the FAO and the UNDP would provide assistance for carrying out research and development activities at the station (NDFR) at Katumani, under the direction of the Scientific Research Division of the MOA.

10. At the same time parallel discussions between the Government of Kenya and USAID were going on. These discussions originated from a need to refocus the USAID funded Food Crops Research Project which had been developed under EAAFRRO, and had continued after 1977 on a bilateral basis with the MOA. The discussions culminated in a project agreement in August 1979, Project 615-0180 Kenya: Dryland Cropping Systems Research, whereby USAID would provide research assistance to the MOA through KARI, located at Muguga.

11. By agreement with the MOA, the two projects would be complementary and coordinated. The USAID/USDA project would focus initially on basic aspects of dryland farming research, while the UNDP/FAO project would concentrate on adaptive research including pre-extension trials of improved production packages.

12. It is believed that the separation of basic from adaptive research should be carefully reexamined. While such a separation would seem to be invalid on philosophical grounds it would seem to be especially so as applied to the two projects

under consideration. Both projects have a strong production systems focus, the one (USAID/USDA), with a cropping systems focus and the other, (UNDP/FAO), to include livestock, with a broad focus on the whole farm system. Implicit in the production systems focus is applicability of results for insertion within systems now practised by the farmer with the view to satisfying usually multiple objectives. In the short-term view of the farmer, the objective is usually a higher living standard based upon a combination of improved subsistence and increased cash income. In the longer view it usually means greater security in maintaining and improving living standard. On the national level the objective is usually defined in terms of greater productivity and production to satisfy internal needs for food, revenue, and foreign exchange. The long term sustainability of productivity through proper resources management is also a concern.

13. Basic and adaptive research must be complementary. Crop, livestock, or discipline research must seek technological innovations such as improved seeds, better soil and water management practices, and better livestock husbandry while farming systems analysis and synthesis must fit improvements into existing systems. Any distinction between basic and applied research becomes a hindrance rather than an aid in finding solutions.

14. Improving a farming system requires, in the first instance, the development of technologies which can be compatible with the system (here compatibility does not mean no change), which can be inserted into the system, and which will make the system more responsive to the objectives of the farmer. This usually means more production from given resources use.

15. A senior Kenyan officer was appointed National Coordinator of the UNDP/FAO project, but no mandate was given with respect to the USAID/USDA project. Another significant feature of the USAID/USDA project is the failure to provide KARI with a full complement of personnel; at present all of the personnel in KARI remain on the establishment roles of the MOA. This has created a number of problems in connection with availability of counterpart personnel and the implementation of the training programme.

16. Without its proper staff, KARI has not been able to provide adequate professional or technical counterpart staff to work with the USAID/USDA team. As of March 1982 only 4 professional level staff had been assigned to the USAID/USDA project. Another aspect of this problem arose in connection with providing participants for training. This is discussed more fully under a section on training.

17. While the intent was to have a coordinated dryland farming research and development programme with complementary inputs from the UNDP/FAO and the USAID/USDA projects, an effective mechanism to achieve such complementarity and coordination was not established. On the contrary, by relating the two projects to two different institutional structures in the MOA the opportunity for common direction by the MOA was to a large extent foreclosed. As a result, the USAID/USDA project leader reports to the MOA Division for Scientific Research through the Division of Agriculture Research of KARI who in turn reports through the Director of KARI. The national coordinator of the UNDP/FAO project on the other hand reports directly to the Division of Scientific Research of the MOA. Consequently, there is no effective machinery for insuring complementarity as originally envisioned.

18. In a broader sense it is the intent of the Government of Kenya to establish a National Programme for Drylands Development, within which several ongoing and planned research and development projects would be integrated. Since this national programme has not been defined, the several related research and development projects concerned with the problems of the arid and semi-arid regions have remained to a large extent isolated from one another and their overall management and direction has proven to be extremely difficult.

19. A technical coordinating committee (TCC) for the Dryland Farming Research and Development Project was established in 1980 and held its first meeting in July 1980. Two subsequent meetings were held in January 1981 and September 1981. There was no representation from USAID/Kenya, from the USAID/USDA Dryland Cropping Systems Research Team, or from KARI, although KARI was invited at the first meeting. At subsequent meetings representatives of KARI as well as from the USAID/USDA team were present.

20. The terms of reference for the TCC, elaborated by the National Project Coordinator at the first meeting, referred only to the Dryland Farming Research and Development Project and made no reference to the USAID/USDA Dryland Cropping Systems Research Project. However, in establishment of representation on subcommittees of the TCC, representation of USAID/USDA as well as six other projects was established.

21. The TCC and its two subcommittees for crops and livestock have attempted to relate the several projects to the whole by including individuals from these projects at their meetings. While these meetings, usually held annually, play a useful role in exchange of information and in providing advice on orientation, they do not have executive authority to effect coordination and cooperation.

22. Cooperation between the two projects has been achieved by personal initiative of individual scientists in the two project teams. In some cases this has been highly effective while in others there has been little or no cooperation. Something less than full cooperation between project teams was clearly evident in the preparations made for the evaluation mission's consultations and field visits. Moreover, evidence of strong personal differences among individual members within the teams and between the two teams was clearly in evidence. Many of the differences have remained unresolved suggesting a need for more forceful leadership. Because of these differences and a resulting lack of coordination, some efforts have been duplicated while other areas, requiring priority consideration, have been neglected.

23. The evaluation mission made an effort to understand relations between expatriate and Kenyan staffs by holding joint and separate discussions with the four groups. While the expatriate teams had little to say about their Kenyan counterparts, the Kenyan staffs expressed a number of concerns about the interrelationships with expatriate counterparts. The chief concern expressed by most Kenyans was that of minimal participation in programme planning and in experimental design. Evidently individual discipline programmes have been largely defined and designed by the expatriate staffs. Concern was also expressed about the limited opportunity for group discussions along discipline lines as well as on a multi-disciplinary basis. The Kenyans felt that they were excluded from such discussions. The foregoing relates especially to relationships among the staff members at the NDFR station at Katumani. In defense of the expatriate staff, it should be mentioned that most of the counterpart personnel had been on the project for less than nine months, and had come on the scene after program plans had been developed. On the other hand, a greater effort by the expatriate staff to discuss the programmes with their counterparts, giving the rationale behind the work programmes and inviting suggestions, would probably have gone a long way in defusing the apparent feeling among the Kenyans of being nonparticipants and less than peers.

24. The principal issue raised by the very limited counterpart group (four individuals) in KARI was a feeling that as individuals they were not allowed sufficient opportunity to develop research programmes of their own. While accepting the need to work as a team with the expatriate group, the view was articulated that each individual should remain free to pursue individually defined research undertakings.

THE ANIMAL PRODUCTION, PASTURE AND FORAGE CROP
RESEARCH PROGRAMME

1. To date, only minor elements of the proposed animal production package have been included in the pre-extension trials. In order to understand the reasons for this decision, it is necessary first to understand the constraints to increasing livestock production in the region and second, to critically assess the current research programme that would have formed the basis for the proposed animal production package.

A. Constraints on Livestock Production in Semi-arid Areas

Climate

2. A relatively low, seasonal and erratic rainfall is the cause of:

- (a) a generally inadequate water supply for man and beast (according to one survey only 1 farm in 10 has adequate year-round supplies); and
- (b) major seasonal fluctuations in the quantity and quality of forage.

Rainfall is therefore probably a major constraint, although neither the survey report nor the farmers interviewed by the mission suggested that this was so. High ambient temperatures increase water demand and adversely affect the productivity (growth, milk production and reproductive behaviour) of all types of livestock, but these effects may to some extent be ameliorated by good management.

Availability of land

3. The average size of farms surveyed in Mwala location, Machakos District was 7.47 ha (Table 1), but almost one quarter of the farms were only 1.30 ha in area and 75 percent of the farms had less than 0.6 ha per livestock unit (l.s.u.) available for grazing (Table 1). Thus the area of land available for livestock production could be a major constraint. Additional problems are that 40 percent of the

holdings in the survey were fragmented, whilst 61 percent of the farmers stated that soil erosion was a serious problem.

Availability of animal feed

4. Natural pasture is one source of livestock feed for 90 percent of the farmers; 92 percent reported using maize stover and pigeon pea threshings and 81 percent stated that they stored crop residues in some manner - usually in trees; 8 percent of the farmers reported that they grew some forage crops. Farmers with the smallest area (Class 1) generally fed their cattle in a boma and tethered their small stock in the field. Class 1 farmers really have no choice as according to the survey they only possessed 0.04 ha of grazing per l.s.u. As Rossiter and Ndegwa (1974)^{1/} estimated that the carrying capacity of natural pasture in lower Machakos is of the order of one l.s.u. per 1.5 to 6.0 ha, even the largest farmers (Class 4) cannot depend entirely on natural pasture as a source of feed for their livestock. The average numbers of livestock on the various classes of farms are shown in Table 1 whilst the total number of cattle, sheep and goats in Machakos, Kitui and Embu districts are detailed in Table 2.

5. Overstocking would appear to be extreme in the survey area. Nevertheless, livestock inspected by the mission appeared to be in good condition, suggesting a high level of livestock husbandry skills. Further evidence of these is provided by the survey data on cattle herd composition (Table 3) in which it will be seen that 57 percent of the total herd are female, despite the fact that most small farmers keep at least two mature males for work purposes.

Availability of productive livestock

6. The indigenous livestock are well acclimatised to semi-arid conditions but are, as a consequence, relatively poor producers. If a demand for more productive livestock was stimulated by project operations, these would be difficult to obtain in the early stages of development.

Incidence of disease

7. Tick borne disease, particularly East Coast Fever (ECF), could be a major constraint, especially if exotic stock are introduced in number into the farming system.

^{1/} Rossiter, J. and Ndegwa, J.A. (1974) GOK-UK Pasture Project Report, Katumani.

Labour (including ox labour)

8. At present 56 percent of the total available labour is required for livestock husbandry purposes; 47 percent of the farms being managed by women and 16 percent and 25 percent of all farms hiring full-time and casual labour, respectively. During periods of high labour demand (March-May; July-August; November-December) livestock husbandry competes with crop husbandry for available labour. As a consequence some farmers sow and weed too late. These difficulties are compounded by the fact that although oxen are underutilized for the major part of the year it is most difficult to provide adequate food for them at the end of the dry season when their labour is in most demand. Availability of labour at certain periods could therefore be a constraint on increasing livestock production.

Availability of capital

9. The survey data suggest that net income per capita is very small on all farms (Table 4) and, apart from livestock operations that contribute an average 65.4 percent of the cash income from the farm (Table 4), capital formation is so small that few developments can be financed from farm income. Livestock are an insurance against crop failure, as at such times they are sold to purchase cereal and legume grains; otherwise they are raised and sold to pay school fees, etc. As a consequence of lack of capital, although 78 percent of the farmers in the survey owned a plough, only 20 percent owned an ox cart and few could afford water tanks.

Availability of credit

10. An additional factor restricting any form of livestock development that requires capital is that few farmers possess title to their land and therefore cannot obtain long-term credit.

Availability of relevant experimental data

11. Lack of relevant data could be a major constraint on livestock development. It has been suggested that a consultant with a "systems approach" to the problems is required. At present the essential requirement is a rapid acquisition of meaningful data and the application of a systems methodology in its analysis. An in-depth study of the social, economic and technical factors involved in the livestock industry of the

region should be conducted. Once such information is available and analysed, hypotheses as to the most suitable development methods can be tested experimentally. Present developmental ideas are based on inadequate data.

B. Critical Assessment of the Existing Livestock and Forage Research Programmes

Studies on the utilization of poor quality roughage

12. These include attempts to improve roughage quality by chemical treatment, physical treatment and supplementation. It is suggested that studies to improve roughage quality by chemical treatment should be suspended as similar studies are being conducted world-wide and if an economical method suitable for the smallholder is ultimately developed the technology can rapidly be transferred to Kenya.

13. Chopping roughage may increase intake but past studies have shown that one reason why livestock thrive better than expected during the dry season in semi-arid regions is because they are very selective feeders. Chopping roughage reduces selectivity and will only increase productivity if it is accompanied by supplementation. Supplementation studies should concentrate on the cheapest supplements (preferably farm grown) for specific types of livestock, i.e., rapidly growing young animals, draft animals immediately before and during work periods, and milking animals.

Studies on the productivity and utilization of natural pastures

14. Cattle, sheep and goats graze six paddocks using a variable livestock biomass technique. Records are kept of livestock weight and pasture samples are clipped and analysed for total yield, dry matter content, nutritive value and digestibility. It is also proposed to study intake using a tracer with faecal collection and selectively using an oesophageal fistula technique. This experiment is of interest but not particularly relevant to the immediate problems of improving the very small area of rough grazing now used by the majority of farmers.

Studies on the proper feeding of draft animals for improved and efficient power

15. The trial utilizes eight teams; four teams of small E.A. Zebu and four teams of Friesian X Sahiwal crossbreds. Two

teams of each breed receive a maintenance ration whilst the other teams are fed twice the maintenance ration. Each team performs all draft animal tasks on 2 ha of land. Traction is measured by dynamometer and speed tests, energy requirement by livestock changes, and efficiency of operation by crop yields.

16. It is suggested that this trial may provide only part of the information required. First, if it is intended to increase milk production by the use of crossbreds, then the most available and economical cattle will be Small E.A. Zebu X Friesian (or some other highly productive milk breed), the male or female crossbreds being used for draft purposes. Thus the comparison should be between Small E.A. Zebu X Friesian draft oxen. Secondly, the small farmer needs to feed his oxen at the minimal level commensurate with efficient work performance; this is probably a regime in which oxen are fed a maintenance or even at times a sub-maintenance ration, except for times before and during work periods when an above maintenance ration will be required.

Studies on the conservation and utilization of conserved fodder

17. These include:

- (a) a series of demonstrations on the cost and efficiency of various silo structures using various forages that would include failed crops and one harvest of a ratooned sorghum crop; and
- (b) hay making demonstrations (using tripods for drying and simple racks for storage).

Experience elsewhere suggests that these practices are unlikely to be accepted very quickly by small farmers. It is suggested that project staff should also study conservation of standing hay that it is possible to produce in the Machakos climate, and of bush and tree legumes lopped in the dry season for forage.

Studies on the utilization of cultivated pasture and fodder crops

18 Pennisetum purpureum variety bana has been identified as a suitable fodder crop. The feeding of bana as a sole source of feed to four milking cows is being compared with the feeding of bana supplemented with dairy meal. This trial is statistically

invalid as a minimum of seven to eight milking cows in each treatment would be required and the results can only be used as a demonstration.

Investigations of the nutritive value of locally available feedstuffs

19. A laboratory has been equipped for proximate analysis and "in vitro" digestibility studies of local feeds. It will be a useful service for the future investigational programme.

C. Project Proposals For The Animal Production Package Designed to be Used in Pre-Extension Trials

20. As there was constant pressure on the livestock and forage production sectors to quickly design an animal production package for inclusion in pre-extension trials, the following package designed as an integrated feeding and management system was proposed.

- * inclusion of fodder crops in the cropping system
- * improved utilization of crop residues
- * improvement in the productivity of natural grazing land by the introduction of more productive grasses and legumes
- * adjustment of livestock numbers and types to the feed resources available
- * provision of appropriate livestock housing and watering facilities
- * the introduction of exotic livestock (dairy cattle and goats) and their management on a zero grazing system

21. It was proposed to introduce this untested "package" on eight smallholdings. It is very different from any proposed agronomic "package" and would attempt to fit what is essentially a high input/high output sub-system into a low input/low output farming system. The survey shows that the capital requirement for such a package would be far in excess of the farmer's capacity to generate capital and the labour requirement could be excessive at planting, weeding and

harvesting periods. The mission therefore suggested that the plan to introduce this package on the eight farms be deferred and that the programme as outlined in the section below be adopted.

D. Proposals by the Mission for a Modified Research and Development Programme

22. Although the survey has been conducted in only one area of the region it is obvious that several different micro-environments exist and that it will be easiest for the larger (Class 4) farmers to introduce the new technology. Under these circumstances a number of different "packages" will be required but the project staff cannot provide these without detailed information on the operation of present systems. This they do not possess.

23. The first requirement is to prepare an in-depth one year survey of existing production methods on the four classes of farm detailed in the survey and in different environments. This survey should include an inventory of livestock by number, type, birth, purchase, mortality, slaughter and sale data. It should also include details of breeding, management, feeding and watering methods; measurement of weight gains and milk production; a study of disease control measures; and analysis of home consumption, marketing, and prices. The survey should be a joint endeavour of animal husbandmen, social anthropologists and economists.

24. Whilst the in-depth survey is being conducted it should be possible to prepare a number of simple "packages" that could be included in one or other of the pre-extension trials. It is possible that these would include some or all of the following suggestions:

- (a) The planting of small areas of fodder crops, and leguminous fodder bushes and trees on the holding. The fodder crops should be planted as close as possible to the boma. They could be planted on farm boundaries, replacing existing species such as sisal and euphorbia. Acacia Tortilis might be a suitable fodder tree to utilize. Varieties of Panicum maximum appear to be the most suitable forage grasses. The possibility that some varieties of this grass grown on the seed farm may be fixing nitrogen should immediately be investigated.

- (b) Improved utilization of crop residues, primarily by storing stover and leguminous haulm so that they cannot be destroyed by termites, and also by modest supplementation of the residues.
- (c) Improvement of the productivity of natural grazing by:
 - (i) bunding to improve water retention;
 - (ii) clearing toxic weed species such as lantana and sodom apple but not legume bushes; and
 - (iii) overseeding with suitable legume and/or grass seeds at the beginning of the rains.
- (d) Production of one or more crossbred calves by the use of AI so that farmers can get experience in the raising of crossbred calves before they manage mature animals. It is likely that the most suitable crossbred would be the small E.A. Zebu X Friesian as this animal is already known and favoured in the region.
- (e) An attempt to persuade farmers to use crossbred dry milking cows for draft purposes. In this way the efficiency of offtake of the herds would be improved, young bulls being sold. Milking cows would not be used for draft purposes for two months before calving. The crossbred cows should increase farm milk production by at least a factor of four. As even the smallest farmers own an average of four head of cattle, and on these farms the male calves could be sold at weaning, it should be possible to use the cows for both milking and work purposes. ILCA should be consulted as this organization is attempting to introduce the use of females as draught cattle in Ethiopia.
- (f) There should be no attempt to limit livestock numbers in the first stages of development as this would be resisted by the farmers as livestock are their insurance against famine. As crop and livestock productivity increases the idea of restricting livestock numbers might slowly take root.
- (g) During the first stages of development there should be no attempt to provide housing. Legume forage trees should be planted around the bomas, and the latter should be "live-fenced". A number of

indigenous species are available for live fencing. Water can be collected from the roofs of houses. Simple feeding boxes should be constructed of local materials. Mineral licks should be introduced.

- (h) Milk goats might be introduced onto the smallest farms. Generally, more attention should be paid to the management of small stock and there should be close cooperation with the Sheep and Goat Development Project (KEN/71/527).
- (i) An attempt should be made to promote poultry production, particularly if crop production is increasing as there will be additional quantities of waste cereals and pulses available from threshing operations. The possibility of feeding termites to poultry should be examined.

25. At the same time as the in-depth survey is conducted and some simple "packages" are included in pre-extension trials, the possibility of transforming holdings into cropping/dairy farms should be explored at three unit farms, one sited at Katumani and two at sub-stations in the Machakos and Kitui Districts. At these unit farms, operations should be tested in terms of cash and energy (labour plus animal power) for a period of at least three years. If the studies show that cropping/dairy farms could be economic in the region, then some method of financing their introduction would have to be found.

TABLE 1

Date from the farm survey in Mwale Location, Machakos District

Class of farm (ha)	% Total farms	Av. area of farm			Crops as % total	Av. number of livestock			Total l.s.u.	ha grazing per l.s.u.
		total (ha)	crop (ha)	grazing (ha) ^{1/}		cattle	sheep	goats		
1. 0.1-2.0	23	1.30	1.02	0.18	78	4	3	5	4.6	0.04
2. 2.1-5.0	26	3.24	1.62	1.52	50	5	3	9	6.2	0.25
3. 5.1-10.0	26	7.54	1.92	5.52	25	8	3	13	10.1	0.55
4. 10.1-	25	17.80	3.24	14.46	18	11	3	13	12.7	1.14
All farms ^{2/}		7.47	1.95	5.42	26	7	3	10	8.4	0.65

Notes: ^{1/} 0.10 ha of land allowed for the homestead
^{2/} Data from 100 selected farms from a total of 692

Source: Rukandema, M., Mavua, J.V. and Audi, P.O. (1981). Report on Farm Survey Results for Mwale Location. Tech. Rep. No. 1. Dryland Farming Res. Deve. Project: Katumani, Machakos, Kenya

TABLE 2

Estimated Livestock Population (1979) in Machakos, Kitui and Embu Districts
(000)

District	Zebu	Cattle		Total	Hair	Sheep		Total	Hair	Goat		Total
		Grade	Beef Dairy			Wool	Milk					
Machakos	299.3	40.0	8.9	348.2	121.5	20.1	141.6	267.4	0.1	267.5		
Kitui	290.1	nil	0.3	290.4	85.9	nil	85.6	380.6	nil	380.6		
Embu	74.6	nil	14.5	89.1	35.2	2.0	37.2	108.0	0.1	108.1		

Source: Ministry of Livestock Production

TABLE 3

Average Composition of the Cattle Herds in the Surveyed Farms

<u>Class of Livestock</u>	<u>Total</u>	<u>Sub-Total</u>	<u>% Total</u>
Cows 3 yrs old	215		
Heifers 1-3 yrs old	120		
Female Calves 1 yr old	60	398	57
<hr/>			
Mature Bulls 3 yrs old	177		
Immature Bulls 1-3 yrs old	65		
Male Calves 1 yr old	60	302	43
<hr/>			
All Cattle	700		

Source: As Table 2

TABLE 4

Percentage Cash Income Derived from Livestock Husbandry and
Net Cash Income per Capita on Surveyed Farms

Class of farm	% Farm cash income derived from livestock husbandry	Net cash income per capita (KShs)
1	57.4	626 ⁽¹⁾
2	59.8	387
3	78.5	429
4	65.8	596
All Farms	65.4	509

Note: (1) Class 1 farmers often earn cash wages outside the farm.

Source: As Table 2

ANALYTICAL FRAMEWORK
FOR
PLANNING, EVALUATING AND IMPLEMENTING
FARMING SYSTEMS

Planning, evaluating, and implementing overall plans with individual farm family units can be a relatively simple and workable process if undertaken in a systematic, logical, and step-by-step procedure as outlined below:

- Step 1 INVENTORY RESOURCES. Prepare a complete inventory of farm and family resources -- physical, human, and financial -- starting with layout maps of the farm units to show physical layout features.

- Step 2 CLARIFY FAMILY GOALS AND NEEDS. Plans must be in accord with the unique, specified goals of the individual family.

- Step 3 IDENTIFY PROBLEMS. Itemize constraints which hinder achievement of family goals, in order of urgency and severity.

- Step 4 ANALYZE ALTERNATIVE FARMING SYSTEMS. First, evaluate the "present" farming system, using physical and economic standards and measures. Then, analyze alternative systems (considered feasible and acceptable), using the same standards and measures.

- Step 5 SELECT A PLAN. Choose the plan which seems most promising for achieving family goals and needs for long-run development.

- Step 6 - IMPLEMENT THE PLAN. Set priorities for step-by-step development of the chosen plan over a period of years, starting with the innovations and changes which have the fastest "pay off" in saving labour, assuring the family food supply, improving land resources, increasing production and income, or other goals most important to the family, following the guide, or blueprint, in the farm plan.
- Step 7 ASSIGN RESPONSIBILITIES. Decide who in the family will accept responsibility for management decisions, labour, etc., for each phase of developing and operating the selected plan over time.
- Step 8 EVALUATE PROGRESS. Analyze each year's records to measure progress toward achieving goals projected for the farming system and to guide year-to-year adjustments.
- Step 9 ESTABLISH CONTROLS. Keep annual changes in line with long-term plans to assure progress toward a better balanced system, setting judicious priorities for investing capital, utilizing labour, adopting new technologies, etc.
- Step 10 ADJUST. Keep plan flexible for adopting new technologies, including better varieties, improved tillage implements and methods, and more productive livestock management, which enhance performance of the new farming system.

MISSION'S COMMENTS ON THE PROPOSED
UNDP/FAO PROJECT

1. The Mission supports:

- (a) The abolition of the post of the soil and water conservation engineer, provided that the research aspects of this major discipline will be handled by the soil physicist attached to the USAID/USDA Project, and its developmental aspects by the senior technical advisor/soil conservationist provided for in the proposed new UNDP/FAO Project KEN/81/012--Preparatory Assistance in Soil and Water Conservation (Embu/Machakos). This discipline should be implemented by the provision of an associate expert in soil and water conservation to be stationed at Katumani, who will work under the direct guidance of the senior technical advisor/soil conservationist. If these conditions are not met then the post of the soil and water conservation engineer should be retained.
- (b) The creation of the post of plant breeder in sorghum and millet, an area which requires further work in view of the importance of these two cereal crops to the arid areas.
- (c) The creation of only one agronomist post (at a fairly senior level).
- (d) The creation of the seed production specialist but not of the associate expert in this field.
- (e) The retention of associate expert in farming systems and the creation of a new associate expert in agronomy.

2. The Mission does not support:

- (a) The creation of the position of plant breeder (other cereals and root crops). The sorghum and millet breeder has already been recommended and endorsed by the mission. The other major cereal in the project area is maize and this will be covered by the senior maize breeder of the USAID/USDA project who is expected to arrive shortly.
- (b) The abolition of the post of animal production/nutritionist; this post should be retained.
- (c) The creation of a new post in dairy production. The possibilities for a dairy industry in the dryland areas are still unsure, and whatever experimental work is needed can be handled by the animal production/nutritionist.
- (d) The change in the title of farming system specialist to that of production agronomist. There is no logical basis for such a change.

3. The mission welcomes the establishment of an extension liaison officer to be appointed by the Government of Kenya and stationed at Katumani Station. This officer should also be responsible for the development support communication aspect of the project. The mission also endorses the proposed training programme but wishes to recommend a shift in emphasis from academic studies to short-term training. This is because of the very heavy emphasis on academic training by the USAID/USDA project.

4. The mission strongly recommends the creation of a post of senior dryland farming specialist as technical advisor to the National Coordinator and to act as team leader at Katumani. The cost of this post could be shared equally between the UNDP/FAO and the USAID/USDA projects.

5. The mission believes that the number of national counterparts as proposed in the new Project Document is highly unrealistic. It consists of 30 research officers, 16 technical officers and 61 technical assistants. It would be impossible for the Government of Kenya to locate and recruit so many research and technical officers. The mission recommends this number be reduced to conform with the availability of counterpart staff in the Ministries of Agriculture and Livestock Development.

6. The mission has serious doubts about the institutional arrangements proposed for the execution of the UNDP/FAO project. The FAO staff can not be technically responsible to the Director of Agriculture (MOA) who is located in Nairobi and who has many other important functions. This responsibility, which calls for daily attention, can only be effectively exercised by the National Coordinator. Similarly, the national staff at Katumani can not possibly perform their duties effectively if they are, on the one hand, administratively controlled by the Director of the Katumani Station (including the authority to incur expenditures) and, on the other hand, responsible to the National Coordinator for day-to-day matters. As recommended earlier by the mission, these two functions need to be combined in the post of the National Coordinator.

7. In the terms of reference of every UNDP/FAO expert a line should be added to indicate the nature of the activities which should be carried out jointly with the staff of USAID/USDA team as well as with experts of other donor-assisted projects where similar activities are conducted. In addition, the specific responsibilities and contributions of each expert to the unit farm and the verification and pre-extension trials should be clearly spelled out.