

**RECOMMENDED GENERAL PROGRAM PLAN
FOR THE
SMALL RUMINANTS
COLLABORATIVE RESEARCH SUPPORT PROGRAM**

Prepared by
Research Triangle Institute

for
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and the
Joint Research Committee
of the
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I. INTRODUCTION

A. Overview

This report is the major product of the Small Ruminant Collaborative Research Support Program (CRSP) planning effort that began in October 1977. The purpose of this report is to present the Research Triangle Institute recommendations for the small ruminant CRSP. This recommended general research program lists the specific projects that should receive support, the ecological zones and continents where the foreign components of the research should be carried out, the institutions that RTI identified for participation in the program, the principal investigators for each project, and the administrative entity. The program also includes a training component and a budget.

B. Program Orientation

Program orientation of the CRSP is best described by the title of the program. It is a collaborative program with support drawn from all entities participating in the research undertaken: (1) the U.S. universities (and by extension, the states in which the universities are located), (2) institutions in developing countries in which some of the work will be carried out, and (3) the U.S. Foreign Assistance Program, represented by AID. The CRSP will build on existing programs, not duplicate them.

The proposed program is collaborative in that it draws together research scientists from the United States and LDCs to establish a network of projects focused on a common objective: improving productivity and utilization of meat, milk and fiber from small ruminants. The interconnectedness of the projects is crucial. The CRSP is not intended to fund isolated projects. Rather, it is intended to provide support for bringing together and augmenting existing capabilities and ongoing research into a coherent program that will benefit poor people in LDCs. In this respect, AID/Title XII funds will be used as a catalyst to establishing and sustain such a collaborative effort. To accomplish this, the program will cut across institutional boundaries to assemble a team of program participants that represents the best expertise in U.S. institutions.

C. Planning Procedures and Schedule

The general research program is the culmination of a very careful procedure to determine research needs and elicit expressions of interest from the university community. The following steps were carried out by RTI in arriving at the present set of program recommendations:

1. An ad hoc advisory group was convened in October 1977 to assist in identifying key issues, determining research needs, identifying foreign institutions to contact, and mapping the procedures to be followed in the remainder of the planning phase;
2. RTI notified all Title XII eligible institutions in October 1977 that specific expressions of interest would be solicited in December;
3. RTI prepared a report on the state-of-the-art and research

needs in small ruminant production/utilization in LDC's. This report was sent to the eligible universities in December 1977 with instructions for preparing the expressions of interest to participate in the CRSP. The state-of-the-art and research needs were assembled by:

- a. Contacting American Universities for the opinions of their staff members;
 - b. Contacting foreign institutions for their opinions, and
 - c. Review and analysis of the literature by RTI staff and a group of highly qualified consultants.
4. RTI received the expressions of interest in February 1978 and evaluated them by means of a panel of national and international experts;
 5. RTI has formulated the general program plan contained in this report with the assistance of the evaluation panel and expert staff consultants.
 6. The general program plan contained in this report will serve as the basis for the Detailed Program Plan (DPP) that should be prepared and submitted to AID by mid June 1978.

The DPP will consist of project plans prepared by each of the identified principal investigators. In all cases, these plans will be revisions of the original expressions of interest submitted in February. These proposals will contain a brief but explicit technical approach, a staffing plan, and a budget as a minimum. These project plans will be reviewed and revised so that they form an integrated, comprehensive research program.

The principal investigators and participating universities will need to agree to an administrative entity. The Joint Research Committee of BIFAD (the Board for International Food and Agricultural Development) and BIFAD itself will review the DPP. If approved, the DPP will form the basis of negotiations between the universities and AID.

D. Report Organization

The General Program Plan contained in this volume is divided into six sections. The next section, II, is a review of the state-of-the-art concerning small ruminants in the developing countries. It also contains an estimate of the potential benefits from improvements in the productivity of these animals. Section III lists the recommended general research program. Section IV is a discussion of the recommended budget. Section V discusses the administrative entity, or structure, for the research program. Section VI contains procedures for expanding the scope of the program as well as the number of institutions. There also is a brief discussion of the reasons why some institutions that expressed interest were not identified for inclusion in the program.

II. STATE-OF-THE-ART REVIEW

A. Background

This section presents a summary state-of-the-art review on the production potential of small ruminants (sheep and goats) in less developed countries. The information presented here is a summary of information contained in two previous volumes on this subject: Integrated Report: Selected Materials for Preparing Proposals Under Title XII Collaborative Research Support Program on Small Ruminants by the Research Triangle Institute, December 1977, and The Role of Sheep and Goats in Agricultural Development by Winrock International Livestock Research and Training Center, August 1977. The reader is referred to those two publications for an in-depth state-of-the-art analysis of the role of sheep and goats in developing countries. Copies have been sent to the Title XII Representatives of all eligible institutions.

B. Importance of Small Ruminants in LDCs

There are a number of important reasons for applying resources to research aimed at improving the production and utilization of small ruminants in developing countries. Briefly, these may be summarized as:

1. Small ruminants provide a significant proportion of food and economic activity in a number of the very poorest LDCs. The ability of sheep and goats to graze and browse marginal agricultural land has made them a key agricultural activity in much of the low-rainfall areas of the developing world.
2. Small ruminants are particularly well-suited livestock for small holders in LDCs given their low initial cost, ability to scavenge marginal lands and crop residues, their modest requirements for housing and maintenance, their ability to provide meat and milk in small and readily useable quantities, and the fact that they can be readily managed by almost any member of the household.
3. The protein and calcium provided by small ruminant meat and milk is greatly needed by rural smallholder families, many of whom suffer from protein and calcium deficiencies (particularly small children and pregnant and nursing women).
4. There is great room for improvement in productivity in small ruminants in developing countries in both milk and meat production, given current low levels of productivity.
5. Very little research has been done to date on improving productivity and utilization of small ruminants in developing countries. There is ample evidence that work in the major areas of production and utilization can yield significant improvement since very few attempts have been made to transfer expertise in small ruminant production from developed to developing countries.
6. There is evidence of great interest and the capacity to respond

on the part of American universities in undertaking collaborative research in the area of small ruminants. At the same time, there is growing awareness on the part of developing country institutions as well as international donor organizations that collaborative research on improving small ruminant production and utilization would provide great benefits to developing countries.

C. Production Systems

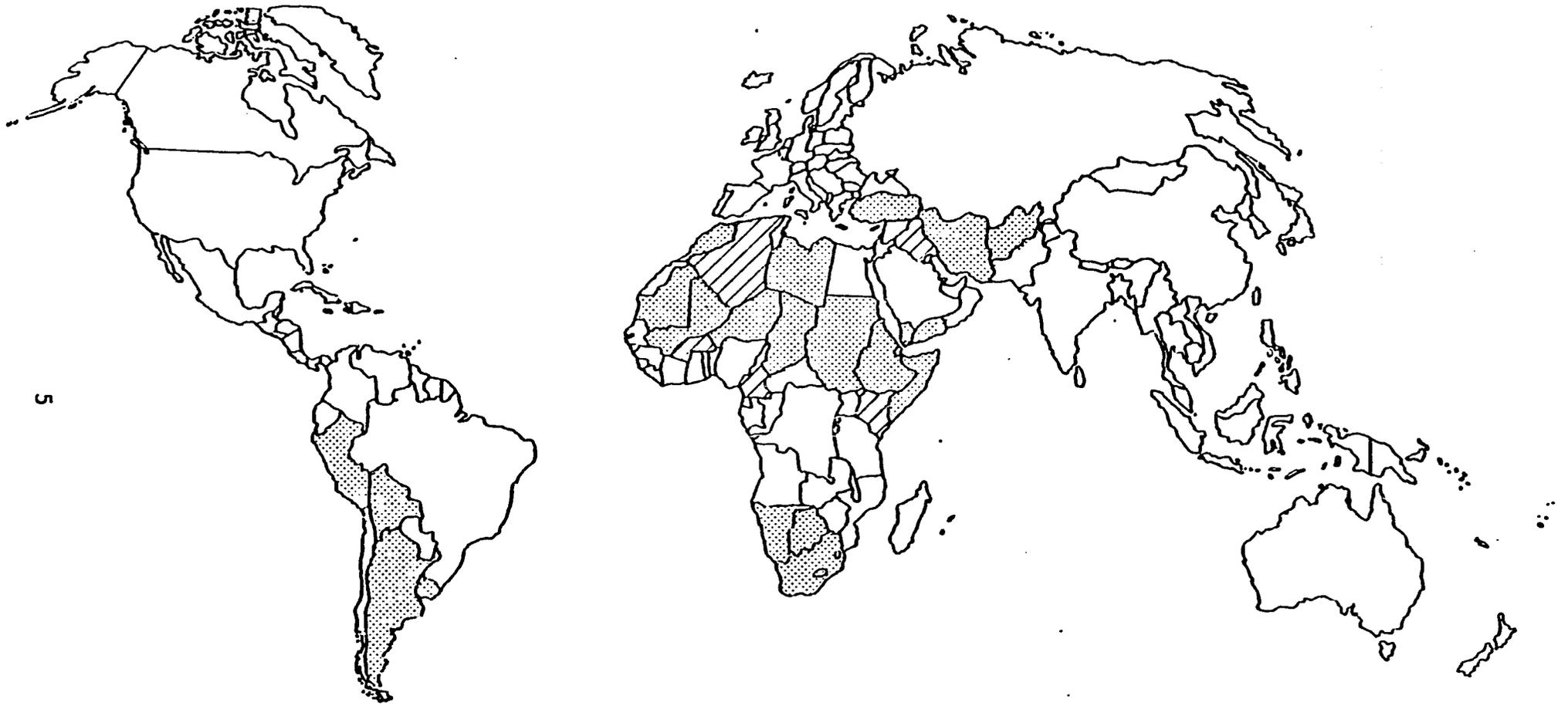
For the reasons listed above, a concerted effort in small ruminant research is timely and appropriate. An examination of the current state-of-the-art reveals that this research should have two main thrusts. The first thrust is in improving production/utilization under what is called the extensive system of small ruminant production. The second thrust is in the area of intensive production techniques.

Extensive systems of production are systems in which the animals graze over relatively large areas. Examples of these systems include nomadic, transhumant, and sedentarized systems. These systems are found in areas of low rainfall where crops normally are not grown or in areas that are too mountainous to cultivate. A smallholder in an extensive system usually owns more animals than does a smallholder in an intensive system because each animal is less productive and because the owners are usually more dependent on the animals for their livelihood.

Intensive systems of production are defined as those consisting of smallholders who own a small number of animals in an area where crops are commonly raised. The smallholder lives in one location and does not move his animals long distances in search of food. The animals may be kept in confinement at all times or they may graze pastures, roadsides, or crop residues. There are probably at least 100 million people around the world who receive a substantial part of their income from animals raised in the intensive system. Furthermore, there is great potential for increasing both the numbers and productivity of small ruminants in the humid areas of the tropics where underutilized forage resources exist in abundance.

Currently, small ruminants are found in greatest numbers in low rainfall areas, those characterized by extensive systems of production (Figure 1). Generally the areas of the developing world where sheep and goats are an important part of the food supply/economy do not have the feed supply potential (vegetation) for supporting increases in numbers of livestock. On the other hand, areas of the developing world with large feed supply potential (the humid tropics) are not areas where sheep and goats now play major roles in the agricultural system. Both types of areas have large potential payoffs from improved productivity. In the areas where sheep and goats are an important part of the economy (extensive production system areas), small improvements in parts of the production system are multiplied by the sheer number of animals producing a large cumulative impact. In areas with large feed resource potential (the intensive production system areas) large increases in the numbers of ruminants are possible, providing a different type of cumulative impact.

In addition to differences in the types of production systems, the re-



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Figure 1. Concentrations of sheep and goats in developing world.

-  Proportion of sheep and goats to people greater than 1.0
-  Proportion of sheep and goats to people between 0.5 and 0.99

search program must also be sensitive to differences in sheep production and goat production systems. At present, sheep are more important than goats in the highland ecozones, in the semi-arid areas of North Africa, the Near East, and northwest Asia. In the sub-Saharan parts of Africa, including the Sahel and East Africa, sheep and goats seem to be equally important in the agricultural systems. On the Indian subcontinent goats are the more important of the two species in the livestock systems. Generally, sheep depend largely on grass and forages for sustained production, while goats can be maintained on browse alone. This means that goats predominate in the most arid regions.

In examining productive potential in the developing countries, three major ecological zones have been identified. These are:

1. Arid/Semiarid Areas
2. Humid/Subhumid Tropics
3. Highland Areas

The Arid/Semiarid and Highland regions are characterized predominately by extensive systems of production, with transhumance being more common than nomadism in the highlands. The Humid/Subhumid regions are characterized by intensive systems of production.

Despite the lack of a large body of research in the area of small ruminant production in developing countries, the major opportunities for improving productivity have been identified in general. In summary, these are:

1. Extensive Systems
 - Improvement of rangelands and grazing management
 - Maintenance of year-round feed supply
 - Improved breeds
 - Increased off-take and herd management
2. Intensive Systems
 - Improved smallholder small flock management
 - Increased utilization of small plot forages, crop residues, and agricultural byproducts
 - Introduction of milk animals into subsistence crop-oriented systems
3. Both Intensive and Extensive Systems
 - Herd/Flock health improvement
 - Production intervention techniques that are compatible with social and cultural norms
 - Development of systems analysis models including cost/benefit analysis techniques for assessing smallholder production alternatives
 - Development of improving marketing systems

These areas constitute the main research topics that the Collaborative Research Support Program in small ruminants should address initially.

D. Potential Benefits From Increased Small Ruminant Productivity

It has been estimated that approximately 100 million people on a part-time basis are involved in the production and utilization of small ruminant products in developing countries (see Integrated Report, Research Triangle Institute). It is anticipated that improvements in production and utilization techniques can potentially benefit the majority of this group, depending on the extent of dissemination and impact of the research results. In addition to identifying the number of people who may be affected by improvements in small ruminant production, it is also useful to examine the amount of increase in productivity that may be obtainable in these systems. This may be done by looking at average productivity for sheep and goats in LDCs and establishing what are some reasonable levels of productivity increase in the foreseeable future. This is most readily done by comparing productivity levels of small ruminant herds in LDCs with those of the developed countries.

Table 1 presents these comparisons in terms of aggregate production of meat and milk per year for sheep and goats. In brief, the table shows that meat productivity (measured as weight of meat slaughtered per head in the herd) for both sheep and goats in LDCs is running about 60 percent of the offtake of sheep and goats in the developed countries. If we use the amount of offtake for the developed countries as a measure of what might be possible under vastly improved circumstances, we see that while some increase in productivity is indeed possible, phenomenal increases (such as a doubling of offtake) is not very likely. On the other hand, in examining milk production, we see that the productivity of milk goats in developing countries is only one-fifth that of milk goat productivity in the developed countries. While this reflects to some extent the fact that goats are kept for both meat and milk in the developing countries, it does show that substantial increases in goat milk production (e.g., doubling or tripling production per animal) is not beyond the realm of possibility. While the aggregate statistics do not show it, the potential for sheep milk production increases is also great. In countries where sheep are kept for milk (e.g., France, Italy, and Greece) sheep milk production is about ten times the worldwide average per animal.

In order to translate the productivity increase potential into more meaningful terms, a chart has been developed which shows the number of people that could receive their entire minimum daily requirement of protein from varying levels of increased productivity of a small ruminant herd in developing countries (Table 2). While the table indicates that productivity increase in meat could provide more protein than a similar increase in milk could, it should be kept in mind that the potential for milk increase, particularly from goats and milk sheep, is probably a great deal higher than that from meat, as discussed above.

Table 3 shows the increase in national income that could be achieved under varying increases in small ruminant productivity. Since the estimated aggregate income from small ruminants is more than 1-1/2 billion dollars for developing countries (see Integrated Report, Research Triangle Institute), the table shows the additional income that may be generated by productivity increases.

Table 1
SHEEP AND GOAT PRODUCTIVITY COMPARISONS

Kilograms/Animal/Year

	1960-65	1976
SHEEP MEAT¹		
Developing Countries	3.5	4.0
Developed Countries	5.9	6.5
GOAT MEAT²		
Developing Countries	3.5	3.7
Developed Countries	3.9	5.7
SHEEP MILK³		
Developing Countries	6.6	8.2
Developed Countries	5.0	6.9
GOAT MILK⁴		
Developing Countries	13.6	14.8
Developed Countries	63.0	79.6

SOURCES: ¹Tables 85 and 81, FAO Yearbook 1976
²Tables 86 and 81, FAO Yearbook 1976
³Tables 91 and 81, FAO Yearbook 1976
⁴Tables 91 and 81, FAO Yearbook 1976

Table 2

NUMBER OF ADDITIONAL PERSONS IN LDCs WHOSE MDR OF PROTEIN¹ CAN BE MET
UNDER DIFFERING RATES OF SHEEP AND GOAT PRODUCTIVITY INCREASES²
(Thousands)

	Increase in Productivity (from 1976)		
	10%	25%	50%
MEAT	4,272	10,680	21,360
MILK	2,543	6,358	12,716

¹Minimum Daily Requirement is an average 35 grams/day of high quality protein (Maurice King, et al., Nutrition for Developing Countries. Oxford Press, 1972).

²Assumes 1% herd size increase per annum based on observed 1965-76 total herd increase (Table 81, FAO Yearbook 1976).

Table 3

ADDITIONAL INCREASE IN LDC NATIONAL INCOME THAT COULD BE EXPECTED
UNDER DIFFERING RATES OF SMALL RUMINANT PRODUCTIVITY INCREASES
(1970 dollars)

	1970	Percent Increase in Productivity		
		10%	25%	50%
Total annual income from small ruminants (\$ million)	1,639	164	410	820

Source: Table 9, Integrated Report, Research Triangle Institute, 1977.

III. RECOMMENDED PROGRAM

A. Requirements

The intention of the Joint Research Committee and Title XII legislation is to establish a collaborative research support program on small ruminants with certain characteristics. The RTI interpretation is that the program should be world-wide in terms of locations and expected effects. The program also should have some balance in terms of the aspects of livestock production and products. Both sheep and goats should be parts of the program. All the major relevant disciplines should be included, social sciences as well as life sciences.

The major disciplines, or problem areas, include:

Range management
Utilization of feed resources
Breeding/genetics
Health
Marketing/economics
Socio-cultural factors
Systems analysis

American universities with expertise in these fields should be included insofar as they express an interest, have the demonstrated capability, and show evidence of developing responsive projects that met the needs of the developing countries as well as the needs of American agriculture. A willingness to contribute in a significant manner to the support of this program is also required.

In response to these requirements, a general program plan for the CRSP in small ruminants has been prepared based principally on (1) project proposals submitted by U.S. universities and (2) an assessment of research needs conducted by Institute staff and consultants.

B. Scope and Rationale of the General Research Plan

The proposed general program plan is based on the principle that the CRSP should be world-wide in its impact, cover the major ecological zones, and include the dominant production systems. The major geographical areas are Africa, Asia, Latin America, and the Near East. The ecological zones are arid/semiarid, humid/subhumid, and highlands. The dominant production systems are intensive and extensive systems, though it is recognized that there are intermediate systems that combine elements of both of these. These three groups could result in a maximum of 24 different combinations of potential project locations. The number may be reduced to 18 by eliminating the Near East because the results of research in the surrounding ecological zones would be applicable throughout the Near East. Furthermore, FAO programs are quite advanced in the Near East and small ruminant productivity exceeds that of the other areas. Table 4 shows the matrix formed by possible combinations of locational factors. A project could be lodged in any cell.

The elements in Table 4 were used to design the research plan found in the next section. The overriding principle is that the results should be

Table 4
 MATRIX LAYOUT OF PROJECT LOCATIONS FOR A
 SMALL RUMINANTS CRSP*

Geographical Area	Ecozones and Production Systems					
	Arid/Semiarid		Humid/Subhumid		Highlands	
	Intensive	Extensive	Intensive	Extensive	Intensive	Extensive
Africa		XX	X			X
Asia		X	XX			X
Latin America		X	XX			XX

*The X's are locations where projects could logically be located, while the XX's are locations that were recommended for projects.

generalizable and applicable in other similar locations. Thus, the most common production system found in an ecozone is recommended for research even though other production systems may be practiced there. For example, an extensive system of producing small ruminants in humid areas of Africa is possible, and in fact does occur, but such a system is not commonly found in the region. The Xs in Table 1 represent the most promising combination of ecozones, production systems, and geographical areas. In the interest of economy only four of these locations are recommended for projects. Findings at these locations should be applicable to similar conditions in other parts of the world; these locations are marked with XXs. These four locations cover all three continental areas, the three ecozones, and both production systems. More will be said about these locations in the next section.

The reasons for not selecting other locations are significant and will be mentioned briefly. An intensive system project was not recommended for Africa because ILCA, the International Livestock Center for Africa, is planning such a project in West Africa, probably in Nigeria. ILCA also has a project in Ethiopia that is concerned with the highland production system in Africa. An extensive production systems project in the arid/semiarid areas of Asia would likely duplicate current research underway in Iran and India. Some highlands research also is underway in India, but there is a need for more. One possibility would be a project in Pakistan supported by PL-480 funds. In any case, the results of the highlands research in Latin America should be transferable. There is research at CIAT, Centro Internacional de Agricultura Tropical, in Latin America dealing with livestock production, primarily cattle, under humid tropical conditions, and FAO-sponsored work in Guatemala on sheep production systems. This experience can be combined with findings from the two extensive systems projects on small ruminants in Africa and Latin America to address many of the problems in this location.

C. Description of the General Program Plan

The general program plan consists of five major projects, the components of these projects, the participating universities, the principal investigators for each component, and the recommended budget for each component. The major projects are:

1. Intensive Systems Latin America
2. Intensive Systems Asia
3. Extensive Systems Africa
4. Extensive Systems Latin American
5. Worldwide Breeding

These project components are based upon the program requirements discussed in the previous section and the expressions of interest provided by the universities. RTI staff and consultants have identified those institutions and individuals whose expertise and interest best match the needs of the ideal program. The following section briefly describes the major project outlines. The subsequent section describes the project components in more detail.

1. Intensive Systems of Production: Latin America and Asia

Intensive systems of production are defined to consist of a smallholder who owns a small number of animals in an area where crops are the

predominant agricultural enterprise. In these systems, there is great potential for increasing both the numbers and productivity of small ruminants in the humid areas of the tropics where underutilized forage resources exist in abundance.

The proposed projects would be located in Asia and Latin America, most likely in areas where the density of population is relatively great. The projects would be identical in terms of the components and institutions involved. Table 5 lists the components, institutions, principal investigators, and budgets. More detailed descriptions of the components are contained in Section III.D below.

Each of the two project locations will consist of separate projects, but with the same PI's and institutions at both locations. Eight institutions will be involved, but two (Tuskegee and Winrock) will be working together on one project; California will have two different projects. The use of the same PI for two different locations should lead to significant economies.

2. Extensive Systems of Production: Africa and Latin America

Extensive systems of production are systems in which the animals graze over relatively large areas. Examples include nomadic, transhumant, and sedentarized systems.

The proposed extensive system projects would be located in Africa and Latin America. The African project would be in an arid/semiarid area where nomadic or transhumant systems are common. The Latin American project would be located in a highland area where a more sedentarized production system is found. Table 6 contains the six program components as well as the institutions, principal investigators, and budgets. Different institutions are used for two of the components because these projects are significantly larger than those of the intensive systems project. A total of seven institutions and eight principal investigators will be required for staffing the extensive system projects. The same PIs are used for the economics, sociology, and systems projects as are proposed for the intensive systems.

3. Worldwide Program

The worldwide program consists of several breeding components which have worldwide application and impact. These projects include the introduction of exotic sheep and goat germplasm into the United States, the establishment of a semen bank, and distribution throughout the world (see Table 7). This project would involve three institutions, though two of them also are involved in the extensive systems project.

D. Program Components

The following section describes the proposed project components in brief. Description of these activities will necessarily be expanded, and probably modified, by the CRSP university participants in developing the final small ruminant CRSP program plan.

Section 1 contains briefs of the projects specific to the intensive systems project. Section 2 contains briefs specific to the extensive systems

Table 5
INTENSIVE SYSTEMS

Program Component	Latin America			Asia		
	Institution	PI	Budget	Institution	PI	Budget
1. Smallholder dairy goat production systems	Tuskegee (WINROCK)	Oliveira (Cooper)	100,000	Tuskegee (WINROCK)	Oliveira (Cooper)	100,000
2. Nutrition: forage production	Ohio State	Van Keuren	75,000	Ohio State	Van Keuren	75,000
3. Nutrition: crop utilization	N. Carolina	Johnson	50,000	N. Carolina	Johnson	50,000
4. Improving genetic resources	California	Bradford	75,000	California	Bradford	75,000
5. Flock health	California	McGowan	100,000	California	McGowan	100,000
6. Marketing/economics	Colorado	Skold	40,000	Colorado	Skold	40,000
7. Sociological factors	Missouri	Nolan	50,000	Missouri	Nolan	50,000
8. Systems analysis	Texas A&M	Cartwright	25,000	Texas A&M	Cartwright	25,000
		TOTAL	\$515,000			\$515,000

Table 6
EXTENSIVE SYSTEMS

Program Component	Africa			Latin America		
	Institution	PI	Budget	Institution	PI	Budget
1. Grazing management including range improvement and dry season feeding	Texas Tech	Burzlaff	200,000	Utah	Malachek	200,000
2. Improving genetic resources	Montana	Blackwell	125,000	Montana	Blackwell	125,000
3. Flock health problems	Idaho	Frank	150,000	Colorado	Kimberling	150,000
4. Marketing/economic analysis	Colorado	Skold	60,000	Colorado	Skold	60,000
5. Sociological factors	Missouri	Nolan	75,000	Missouri	Nolan	75,000
6. Systems analysis	Texas A&M	Cartwright	50,000	Texas A&M	Cartwright	50,000
			660,000			660,000
	TOTAL					

Table 7
WORLDWIDE PROGRAMS

Breeding Component	Institution	PI	Budget
1. Introduction and evaluation of exotic sheep and goat germplasm	Texas A&M	Shelton	200,000
	Utah State	Foote	100,000
2. Develop semen bank of exotic sheep and goat germplasm; distribution of semen	Cal Poly	Nelson	100,000
		TOTAL	400,000

project. Section 3 contains briefs of project components that will be carried out in both intensive and extensive systems projects. Section 4 is a description of the worldwide breeding project.

1. Intensive Systems Project Components

(a) Title: Intensive Dairy Goat Production Systems for Smallholder Farmers and Landless Peasants

Leaders: Dr. Doris M. Oliveira, Tuskegee Institute, and Dr. George Cooper, Winrock International

Locations: 1. Asia
2. Latin America

Rationale: A major portion of the goats in the humid tropics is owned by the target smallholder/landless peasant population in herds of less than five head. Current production systems could probably be defined as "scavenger" systems, with little understood about the components of production. There is an acute need for the development of "total package" confinement/semiconfinement management systems for these producers aimed at improving milk production principally for home consumption.

Approach: The basic approach should be to develop a total management package for three to five head dairy goat production systems, applying to field conditions the best current technology. Training and extension education must be a part of the package. The project should be closely coordinated with other components of the Intensive Production Systems Research program (breeding, health, sociology, etc.).

USAID Budget: \$100,000 each location (\$200,000 total)

(b) Title: Intensive Forage Production Systems for Smallholder Sheep and Goat Producers

Leaders: Dr. R. W. Van Keuren and Dr. Charles Parker, Ohio State University, Wooster, Ohio

Locations: 1. Asia
2. Latin America

Rationale: Improved forage production systems for smallholder mixed crop/livestock production are needed to increase animal productivity through utilizing marginal land, crop interstices and crop rotation programs. While smallholders may not control more than a few hundred square feet of land and own no more than three to five animals, the availability of year-round forage in the humid tropics could supply adequate feed for small ruminant herds if properly developed and utilized.

Approach: The basic approach is to develop forage production systems that can be utilized via grazing, "cut and carry" of fresh forages, or be harvested and stored for later use by smallholder producers. Forages may be the sole nutrient resources or may be used to supplement other feed. The forage research program must be integrated with other nutrition research on crop residues, byproducts, and other supplemental feeds.

USAID Budget: \$75,000 each location (\$150,000 total)

(c) Title: Utilizing Crop Residues in Intensive Sheep and Goat Production Systems for Smallholders

Leaders: Dr. William L. Johnson, North Carolina State University

Locations: 1. Asia
2. Latin America

Rationale: Crop residues and other supplemental feeds range from primary to important secondary feed sources for smallholder producers throughout the tropics. Improving their utilization has the potential of dramatically increasing animal productivity.

Approach: Any "changes" in treatment of crop residues (processing or storing methods, etc.) must be simple and inexpensive for adoption by the target population of smallholders. The research program on crop residues should be closely coordinated with nutrition research with other components of the total research program (breeding, health, etc.).

USAID Budget: \$50,000 each location (\$100,000 total)

2. Extensive System Project Component

Title: Grazing Management Including Range Improvement and Dry Season Feeding

Leaders: Dr. Donald F. Burzlaff, Texas Tech University, and Dr. John C. Malechek, Utah State University

Locations: 1. Africa
2. Latin America

Rationale: In low rainfall areas the protection and improvement of the range resource is the most critical issue since this is the most vulnerable and limiting factor in livestock productivity in these areas. Secondly, means of dealing with large fluctuations in the feed supply from wet to dry seasons need to be developed in order to sustain productivity year round.

Approach: In Africa the objective will be to improve range conditions and small ruminant production by combining grazing management/stocking rate and dry season feeding through use of ungrazed and/or harvested forage and other feeds. Research will include soil-vegetation-climatic relationships on target area rangelands, developing grazing management systems to best fit needs of sedentary tribes and nomadic herders, and identification of seasonal dietary deficiencies. Supplemental feed to meet dietary requirements will be provided by alternatives of leaving standing forage, harvesting hay or silage, and use of crop residues. All of these endeavors need to be geared to improvement of the basic range forage resources so that small ruminants will be insured of adequate feed supplies in years of varying climatic conditions.

In Latin America or another suitable high elevation location, research will be limited to improvement of rangeland productivity through developing grazing systems, species of animals grazed and stocking rate and intensity of grazing. Comparisons will be made of small ruminant productivity under unimproved compared with improved range management conditions. Assessment will be made of present ecosystem factors that limit animal production and offer potential for management resolution. Within existing environmental constraints alternative forages will be evaluated for yields and nutritional qualities, integration and utilization of cropland residues or byproducts will be considered, and range management practices for establishing and maintaining improved forage resources will be investigated.

USAID Budget: \$200,000 each location (\$400,000 total)

3. Project Components Included in Intensive and Extensive Systems Projects

(a) Title: Improving Genetic Resources

Leaders: Dr. Robert L. Blackwell, Montana (Extensive), and Dr. G. Eric Bradford, University of California at Davis (Intensive)

Rationale: Selective breeding of superior native stock and introduction of selected exotic breeds has the potential for greatly improving sheep and goat productivity in developing countries. In addition, the introduction of controlled breeding practices could also greatly improve herd quality and productivity. However, to be effective these projects must be closely integrated with the other ongoing projects in intensive and extensive systems so that maximum gains in improved genetic resources can be preserved through improved overall management.

Approach: (1) In the Intensive Systems Component, focus should be given to improving indigenous dairy goat characteristics with emphasis placed on qualities of concern to the subsistence farmer with three to five goats: length of lactation, disease resistance, adaptability to different feeds, length of productive life, and seasonality.

(2) In the Extensive Systems Component, focus should be given to improving both sheep and goat breeds with emphasis on characteristics of concern in arid/semiarid areas: drought resistance, adaptability to variations in the feed supply, desirable carcass characteristics, and disease resistance.

The two components will be carried out in conjunction with other field projects. Intensive systems breeding should be conducted with the smallholder dairy goat component, while the extensive component should be attached to the grazing management component. Both components should be conducted in connection with the worldwide breeding component which should be able to supply superior germ plasm for crossbreeding.

USAID Budget: \$75,000 each location (\$150,000 total) Intensive Systems
\$125,000 each location (\$250,000 total) Extensive Systems

(b) Title: Herd/Flock Health Improvement

Leader: Dr. Blaine McGowan, University of California at Davis; Dr. Floyd W. Frank, University of Idaho; and Dr. Cleon V. Kimberling, Colorado State University

Rationale: Disease-induced production losses in sheep and goats stem from both sporadic sweeps of epizootics and continuous attrition of diseases common to sheep and goats worldwide. Data from pilot trials in the United States clearly incriminate the latter as the major cause of loss on a long term basis. Pilot herd health programs (HHPs) on selected sheep and goat operations in the United States have increased production by 20 to 50 percent in 2 to 4 years. Similar programs in LDCs could result in a quick and significant production increase and provide invaluable information for the sheep and goat industries in the United States. Expansion and intensification of existing experimental small ruminant HHPs in the United States could enhance both the U.S. and LDC programs.

Approach: Herd/flock health programs constitute a continuous disease and parasite surveillance program combined with the development and application of the most appropriate treatment, control and prevention strategies. As each HHP matures, disease prevention and control dominate disease treatment. The most significant production increase will result from the concomitant impact of HHPs and improved husbandry and management techniques, improved nutrition, and genetic modification. Objectives of the proposed project are (1) to experimentally adapt and modify known successful disease control and prevention systems to small ruminant diseases in the LDCs; (2) to develop and test new strategies where needed; and (3) to incorporate (1) and (2) into continuous herd health programs. Expertise of the project personnel should allow immediate emphasis on diseases affecting fertility and reproduction, diseases of the neonate, and parasitic diseases.

USAID Budget: \$100,000 each location (\$200,000 total) Intensive Systems
\$150,000 each location (\$300,000 total) Extensive Systems

(c) Title: Marketing/Economic Analyses

Leader: Dr. Melvin D. Skold, Colorado State University

Rationale: Improvement of sheep and goat production in the developing countries is a worthwhile undertaking only if its results in economic benefits such as greater consumption of small ruminant products on the farm or sale of these products. These benefits must exceed the costs to the farmer and the local government of producing them, unless there is a policy decision to subsidize farmers. This project will be concerned with analyzing the expected costs and benefits as well as investigating ways to improve the benefits. The most prominent way to increase economic benefits to farmers is through marketing. Marketing of meat animals is particularly important in extensive systems to increase net offtake and reduce grazing pressures. Secondly, this project will provide a general economic analysis function that will be beneficial to planning and evaluation of the overall program and also to the modeling effort in the systems analysis project.

Approach: The marketing effort will include studies of marketing patterns and the marketing problems that small ruminant producers encounter. These studies will be integrated closely with studies of production economics and sociocultural factors that affect marketing. Export markets need to be investigated as well as the local and national markets. Consumer attitudes, tastes, preferences, as well as price and income elasticities in the national market will be examined to the extent necessary. Marketing strategies, institutions, transportation, and distribution channels will be studied in order to recommend improvements.

Project staff also will undertake benefit/cost studies based on information received from the other projects at each site. One of the purposes of these studies will be to evaluate the potential for increasing animal output through improved management, health, nutrition, range resources, and institutional arrangements. Data collected and analyzed as part of this project will be incorporated into the systems analysis project. Project staff will respond to the need for economic analysis in all other parts of the small ruminant program.

USAID Budget: \$40,000 each location (\$80,000 total) Intensive Systems
\$60,000 each location (\$120,000 total) Extensive Systems

(d) Title: Sociological Factors Analyses

Leader: Dr. Michael F. Nolan, University of Missouri

Rationale: Sheep and goat production in developing countries takes place in an institutional and cultural environment that is much different from the United States. Even though sheep and goats may be low status animals relative to cattle, there are various customs and social factors attached to them that have a great influence on the acceptability of recommended changes.

Approach: This project will analyze the social constraints to small ruminant production at each of the project sites and assist in the development of packages of technical assistance based on the research in this and the other projects that make up the total research program. This package will be designed to ensure that the results of the production strategies are beneficial to the small producers.

The analysis will focus on the system of small ruminant production. That is, all components of the system need to be identified and the patterns of activity within the system specified. The village or local level will be the focus of analysis but linkages to the larger society will be explored. Some of the factors to be studied include herd management practices, production strategies, the perception and treatment of risk, the role of women and children, the land tenure system and the effects on production practices, religious and cultural traditions, and prestige factors.

Some of the cultural factors will include consumption patterns, nutritional customs, and related factors. There will be overlaps with the marketing and economics analysis project, but these overlaps should be complementary.

USAID Budget: \$50,000 each location (\$100,000 total) Intensive Systems
\$75,000 each location (\$150,000 total) Extensive Systems

(e) Title: Systems Modeling

Leader: Dr. Thomas C. Cartwright, Texas A & M University

Rationale: Systems modeling is needed for predictive assessment of the results of different combinations of feed and small ruminant resources on turnoff of meat, milk, and wool. Modeling can identify critical constraints to productivity. For example, lack of good quality feed during the mating season may limit the number of young produced and the number of lactating ewes or does.

Approach: The objectives of the modeling include:

- (1) Evaluate sensitivity of critical limiting parameters, including forage, animal resources, disease-parasite status, and management.
- (2) Evaluate efficacy of alternative programs for use of forage, sheep and goat resources.
- (3) Coordinate systems modeling of biological and environmental interaction and intervention with socioeconomic findings.

It is recommended that sheep and goat production systems models similar to the Texas A & M beef cattle model be developed.

USAID Budget: \$25,000 each location (\$50,000 total) Intensive Systems
\$50,000 each location (\$100,000 total) Extensive Systems

4. Worldwide Breeding Project

Title: Worldwide Breeding Genetics: Germ Plasm Acquisition & Distribution

Leaders: Dr. Maurice Shelton, Texas A & M University; Dr. Warren Foote, Utah State University; and Dr. A. E. Nelson, California State Polytechnic University

Rationale: To facilitate breeding research on locally adapted superior LDC breeds and to increase familiarity of U.S. scientists with these breeds, a U.S. herd of these breeds should be established. In addition, once such herds are established, semen from these breeds or improved crosses should be made available for research/upgrading in the United States and abroad.

Approach: Semen from such tropically adapted Awassi, Chios, Dorper, Barbados and other sheep breeds as well as the Jamnapari, Boer, Nubian, and other goat breeds will be a basis for crossbreeding experiments under both extensive and intensive production areas of the tropics. To facilitate this, it is expected that two universities will develop projects for the importation and maintenance of small herds in the pure state as a germ plasm source. From this source, the third university will gather, store, and distribute semen to service the breeding-genetics component of goat and sheep improvements under both extensive and intensive systems.

USAID Budget: \$300,000 introduction and evaluation of breeds
\$100,000 semen bank and distribution system

E. CRSP Training Component

The CRSP is expected to have a training component that will increase significantly the supply of human capital with expertise on small ruminants in developing countries. The CRSP probably will have a life of over 8 years, which will not eliminate the need for additional research on the subject. The people who are trained, however, will have a vested interest in doing additional work on this subject. Thus the training component should not be short-changed.

While training is considered to be an important component of the CRSP, program funds should be utilized for training that is directly integrated with the research and not for nonrelated training. This means that the students/trainees should be involved in the small ruminants research projects so that supporting funds produce a double benefit in both training and research products.

As with the rest of the CRSP, the cost of training should be shared among the American universities, AID, and the foreign institutions. The CRSP will build on existing programs and help to reorient them. The cost of training will be a part of the budget recommended for each project, though these Title XII funds will not meet the total cost of training.

Three types or categories of training are suggested as part of the CRSP. These categories are: (1) Graduate training for students from the developing countries; (2) In-service training for scientists and technicians in the developing countries, and (3) Graduate training for American students. Each category will be described briefly in the following paragraphs.

The first category is M.A. and Ph.D. training for students from the developing countries. This training is very important because they will be the ones who will carry out research in the future. The recommended program would be for the students to take classes in the United States and carry out the thesis and dissertation research in a developing country, preferably at one of the project locations. The students would come from many different countries, as opposed to just those in which the projects would be located. It might be possible for students to take some or all of the classes in their own countries if adequate facilities exist (as in India) and do the research at one of the project locations.

The second category is in-service training at the project locations for technicians and scientists from other developing countries. This training would help to disseminate the results of the current research as well as previous research that had been compiled. Students would come either for short courses (1 to 2 months) or intermediate courses of 3 to 6 months. The longer courses would involve practical applications as well as classwork.

The third category is graduate training for American students. These students would take their classwork in the United States and do research in the developing countries. The results of the training and research would be beneficial both to the LDCs and the U.S. agriculture. A suggested means of financing would be university support of the graduate students while they are taking classes and Title XII support while doing the dissertation.

IV. BUDGET REQUIREMENTS

The budget for the Small Ruminant CRSP consists of three parts: (1) AID/Title XII funds; (2) University funds; and (3) LDC institution funds. The budgets for each project in the program description include only the Title XII funds. These funds will be used for support of research and training at the U.S. institution, travel, per diem and other personnel support, and funds passed through to the collaborating institution. The funds that go to the foreign institution would be used to purchase goods and services not already provided such as additional animals, animal feed, people to take care of them, fencing, additional vehicle costs, and other equipment if needed. Funds would not be used to pay professional personnel, regular support personnel, for buying land or establishing new herds of animals, for buildings, and for standard equipment that a research institution would normally have. The funds are to be used to remove bottlenecks but not to start research institutions or programs.

The collaborating institutions on average would be expected to provide support equal to about one-third of the AID/Title XII funds. All institutions would not have to meet this ratio depending upon circumstances. For example, one institution might perform a "service" project for the program and gain relatively few benefits. In other cases, the research results might be directly applicable to agriculture in the United States so that quite large institutional support would be forthcoming. Of course, there would be few benefits accruing from the management entity so that Title XII funds would support it in its entirety. The collaborating LDC institution would be expected to provide matching support equivalent to approximately one-third of the AID/Title XII funds in the form of professional scientists, technicians, land, buildings, and animals.

The total AID/Title XII budget recommended is as follows:

Intensive systems	
Latin America	\$ 515,000
Asia	515,000
Extensive systems	
Africa	660,000
Latin America	660,000
Worldwide breeding	400,000
Management entity	200,000
TOTAL	<u>\$2,950,000</u>

These figures represent full funding estimates once the program is under way. If it is determined that the estimates are too low or that sufficient funds for all projects are not available, the whole program could be reduced by reducing the number of participating institutions or the number of LDC locations.

A minimum effective program must contain a location in Asia, Africa and

Latin America, with at least one each in intensive and extensive systems. Since each type of system is found in the "Semiarid-Arid," "Humid-Subhumid" and "Highland" areas, a minimum of three locations would be required. A further constraint on reduction is the necessity for including each of the seven major disciplines or problem areas listed under Section II-A, "Requirements."

It is the strong recommendation of the RTI staff and consultants, however, that neither the proposed programs or funding level be reduced.

V. MANAGEMENT ENTITY FOR A SMALL RUMINANTS CRSP

The JRC Guidelines specify that for each CRSP, an administrative "Management Entity" with appropriate legal status, not necessarily a corporation, will be required for administering the resources contributed by A.I.D. and for overseeing the individual projects comprising the program.

While the collaborating institutions will have the responsibility for designing a management structure suitable to their needs and the program requirements, the following section outlines the perceived nature and structure of a Management Entity for a Small Ruminants CRSP.

A. Functions of the Management Entity

- (1) Serve as the legal and fiscal entity to receive and administer AID grant funds, sub-allocating them to the participating U.S. and developing country institutions for their respective projects.
- (2) Provide central program direction and technical management.

B. Requirements of the Management Structure

The management structure should be designed to meet the following requirements:

1. There should be clear lines of authority and fiscal accountability built in.
2. There should be structured periodic review of the program orientation and content by outside, technically competent advisors.
3. There should be a full-time Project Director and Administrative Staff which represents the group of participating universities.
4. The Program Director should be technically qualified in small ruminant research with proven administrative skills.
5. Program content should be determined principally by technical experts (principal investigators) from the participating universities.
6. There must be structured involvement of university administrators in setting policy for university involvement, funding requirements and administrative procedures.

C. Structure of the Management Entity

Figure 2 shows one possible configuration of the CRSP Management structure that would fit the requirements listed above. Figure 3 shows the lines of authority and funding channels of the recommended organization. Section D following describes the management units in detail.

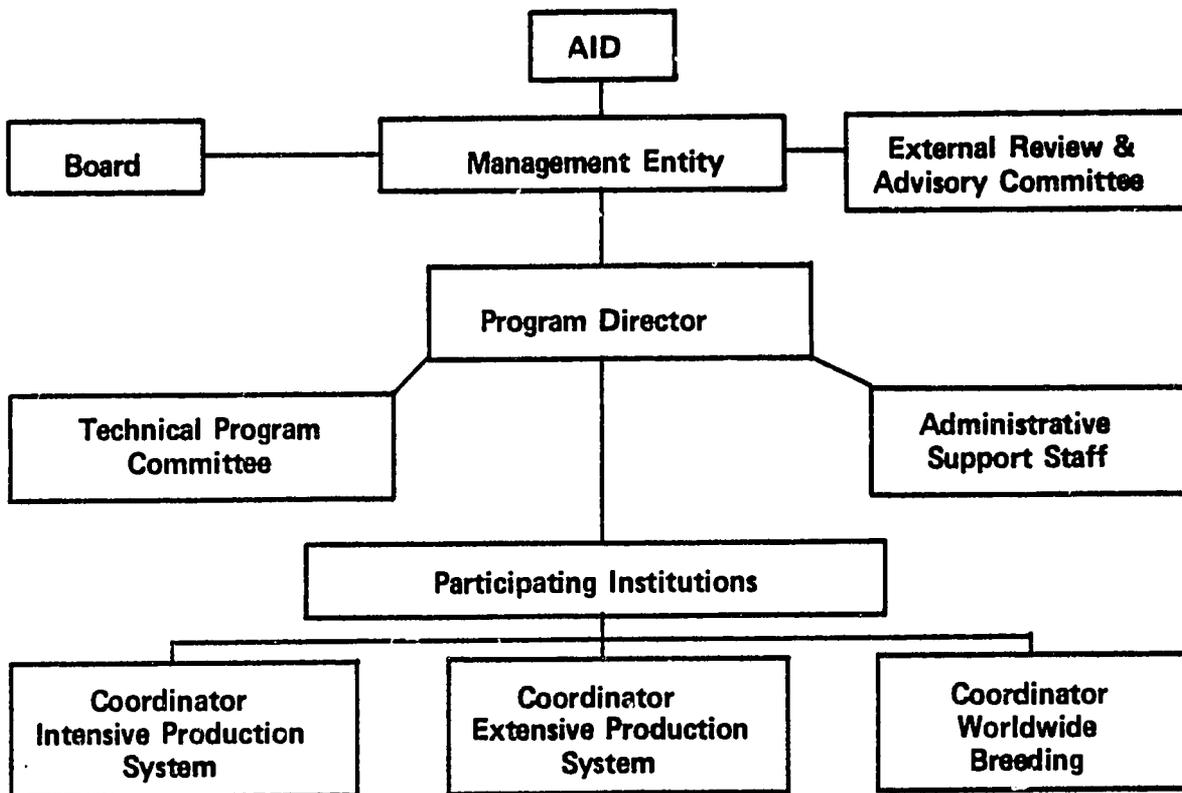


Figure 2. Structure of the management entity.

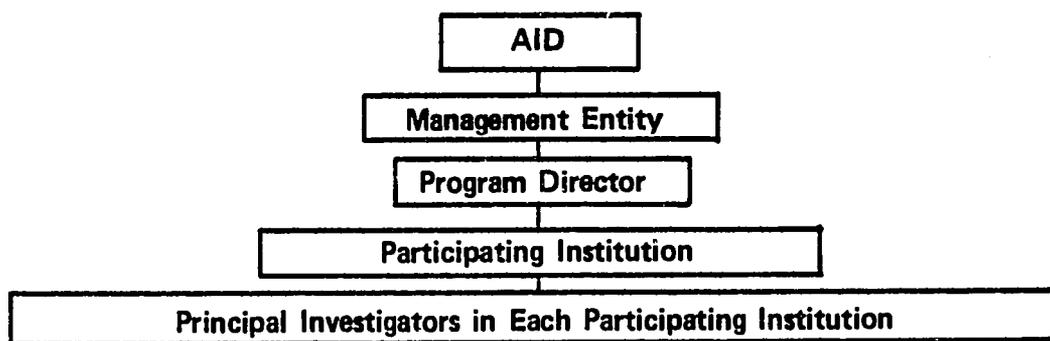


Figure 3. Funding channel and line of responsibility to participating institutions.

D. Functions and Composition of Each Unit in the Management Entity

(a) Management Entity

This entity would receive and administer AID grant funds for the Small Ruminants CRSP, sub-allocating them to the participating U.S. and developing country institutions for their respective projects. This responsibility would be assumed by, and services would be provided in, an administrative unit established within existing programs/offices in the participating university selected. Services would be provided on an actual cost basis. This management entity would implement program policy decisions as determined by the Board of Participating Universities.

(b) Board of Participating Institutions

This board would act as the policy guiding body of the Management Entity for carrying out the Small Ruminants CRSP. It would determine institutional policies and other budgetary support required from the participating institutions for the effective prosecution of the collaborative research support program. It would determine general program policy, taking into consideration the changing technical requirements as identified by the Technical Program Committee, and the views of the External Review and Advisory Committee. These actions would be subject to AID approval. One representative from each participating institution would serve on this Board. Normally these members would be executive officers of the participating institutions responsible for allocation and administration of research budgets, e.g., Experiment Station Directors.

(c) External Review and Advisory Committee

This Committee would act in a program review, evaluation and advisory capacity in behalf of the Management Entity and the Board of Participating Institutions. This Committee would be independent of the Internal Technical Program Committee. It would conduct periodic program reviews, and project reviews as deemed necessary. The reports as prepared by this Committee would be simultaneously submitted to the Management Entity and the Board of Participating Institutions, and to AID.

This committee would be composed of a multidisciplinary group of eminent scientists from the United States, other developed countries, International Research Centers, and developing countries as appropriate. The members of this committee would not be associated with any of the participating institutions, or otherwise have a vested interest in any of the program activities.

(d) Program Director

The Program Director would have executive technical and fiscal management responsibility for the Small Ruminants CRSP. He would respond to the Board of Participating Institutions through the Management Entity. The Program Director would be responsible for seeing that the training component is implemented, but that specific development of training slots and integration of trainees into the research work would be the function of individual PI's. He would not have any prior or current vested interests in the program activities.

However, it would be desirable that the Program Director have a courtesy appointment with the university serving as the management entity.

(e) Administrative Support Staff

The support staff for the Director would include a full-time comptroller, information specialist and secretarial staff as required.

(f) Technical Program Committee

This committee represents the technical team actually carrying out the research projects. The committee should be chosen from the PI's--its exact composition should be determined jointly by the PI's and the Program Director.

(g) Participating Institutions

There would be a direct line of responsibility between a representative of each participating institution and the Program Director. This representative would be held accountable for project activities carried out by personnel of that institution. This follows the flow and accountability of AID funds.

This does not imply that the Program Director would not have direct contact with participating institution personnel in program development, implementation and evaluation. It does indicate, however, that the established institutional administrative channels must be observed in the executive direction of this CRSP.

(h) Coordinators of Sub-Programs

It is envisioned that each of the three major program components on Intensive Systems in Humid Areas, Extensive Systems in Arid Areas and Worldwide Breeding would have a person assigned to coordinate all efforts within that sub-program, and to assist the Program Director in the coordination of the total CRSP. It is anticipated that the coordinators be drawn from the principal investigators in charge of the project components.

E. Information Dissemination Aspect of Management Entity

The staff of the management entity would have the responsibility to disseminate the results of the research as well as the current status of the program. One person on the staff would have the assignment of publicizing the program and its results. One method could be a quarterly or bi-monthly news letter that reported on progress and the status of each of the individual projects. Another or additional approach would be to concentrate on a different discipline or location in each issue. The newsletter could go to American land grant universities as well as to foreign institutions who could benefit from the findings.

The same person could also be responsible for maintaining copies of all working papers and data that have been generated. These data would be useful to the projects concerned with economic analysis and systems analysis and also would serve to insure that research findings were prepared in a useful format and to facilitate the flow of this information to both developed and developing countries.

VI. PROCEDURES FOR MODIFICATION OF THE PROGRAM

A. Participant Identification Procedures

The general program plan contained in this report is RTI's recommendation based on a seven month planning effort. Some of the 23 institutions submitting firm expressions of interest have not been recommended for inclusion in the CRSP. These recommendations are based on very careful deliberations of the 18 person expert review panel assembled by RTI for the express purpose of evaluating individual expressions of interest and molding these into a coherent program.

A total of 60 proposals was received from 23 institutions. Of this number, two were exclusively devoted to administration of the CRSP in small ruminants. The remaining 58 were focused on various substantive disciplines of sheep and goat production/utilization.

All proposals were evaluated by the panel members and numerically rated on the following criteria:

- Appropriateness and significance of topic to LDC smallholders
- Institutional experience in area; logical extension of domestic programs
- Demonstrated capacity to establish LDC institutional linkages
- Soundness of the technical approach; probability and timeliness of payoff
- Expertise and adequacy of proposed staffing.

There were a variety of reasons for recommending that specific project proposals and institutions not be included in the CRSP. The large number of proposals made the deliberations difficult. At the same time, such a large pool of potential projects insured that very high caliber projects be nominated. Table 8 shows the distribution of reasons for not recommending individual projects that were submitted.

B. Program Modification

It is likely that modifications in the program content and mix of participating universities will occur over the life of the CRSP. It is possible that in formulating the Detailed Program Plan over the next few months, new skills or projects not contained in the general program plan will be needed.

The Detailed Research Program that results from the continued planning effort might call for projects or skills not contained in the general program plan described in Section III. At that time it might be necessary to modify the number of institutions or principal investigators that were identified in the general program plan. This initial identification was largely based on the goodness of fit between essential elements of submitted expressions of interest and the needs of the program. Thus it is possible that a newly perceived need in the research program would require new principal investi-

gators. RTI will insure that the resources of institutions that were not identified for the initial program are given due consideration for inclusion in any program revision.

Table 8
 DISTRIBUTION OF MAJOR REASONS FOR NOT INCLUDING
 PROPOSED PROJECTS IN RECOMMENDED CRSP

A.	Low priority topic	12
B.	Duplicates ongoing research	1
C.	Incomplete coverage of topic	10
D.	LDCs not able to use results	1
E.	Covered more effectively in other proposals	7
F.	Inadequate staffing	1
G.	Inadequate technical approval (including lack of focus)	5
H.	Constitutes Service Delivery Program other than research	<u>4</u>
TOTAL		41
