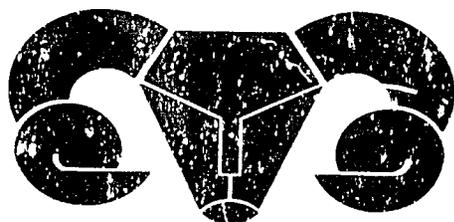


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**Small Ruminant
Collaborative Research
Support Program**

**Summary
Report**

**Program Year Nine
1987-1988**



**Small Ruminant CRSP
University of California
Davis, California 95616**

COLLABORATING ORGANIZATIONS

Federal (U.S.):

United States Agency for International Development
Science and Technology Bureau

Board for International Food and Agricultural Development
Joint Committee on Agricultural Development

Overseas Collaborators:

INDONESIA--Agency for Agricultural Research and Development (AARD)

KENYA--Kenya Agricultural Research Institute

MOROCCO--Institut Agronomique et Veterinaire--Hassan II University
(IAV)

PERU--Instituto Nacional de Investigacion Agraria y
Agroindustrial (INIPA)

Participating Institutions:

University of California, Davis

Colorado State University, Fort Collins

Montana State University, Bozeman

University of Missouri, Columbia

North Carolina State University, Raleigh

Texas A&M University, College Station

Texas Tech University, Lubbock

Utah State University, Logan

Washington State University, Pullman

Winrock International Institute for Agricultural Development,
Morriston, Arkansas

THE SMALL RUMINANT

COLLABORATIVE RESEARCH SUPPORT PROGRAM

(SR-CRSP)

SUMMARY REPORT

PROGRAM YEAR NINE

1987-88

Edited and Compiled by the Management Entity

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Executive Summary

The ninth year of the Small Ruminant Collaborative Research Support Program (SR-CRSP) was highly productive, as measured by research accomplished, publications produced, and participants trained. The first regionalized workshop for the SR-CRSP was held in Bolivia. Conducted, in Spanish, by Peruvian small ruminant scientists, these experts shared their considerable knowledge with farmers, businessmen, government officials, and other scientists from a neighboring country that has similar constraints in small ruminant production.

In all countries, much progress was made toward the development of multidisciplinary technological packages. These packages continue to be validated under farm conditions as a necessary step to the release of improved technology to extension, scientists, and producers. Two hundred and fifty dual-purpose goats (DPG), developed by the SR-CRSP in Kenya, were distributed to farm families to test technical, social, and economic feasibility.

Animal health scientists developed and tested a vaccine for contagious caprine pleuropneumonia in Kenya that can be stored at room temperature and provides protection for more than a year. In Peru, the enterotoxin, Clostridium Perfringens Type A, that is involved in neonatal mortality of alpacas, llamas, and perhaps lambs, was purified. These developments could lead to diagnostic tests and eventually to a vaccine. In Brazil, the research was completed on a vaccine for the goat disease Corneybacterium pseudotuberculosis.

Social science research in Peru has revealed that the time invested in small ruminant production is twice that of crop production, even though livestock are normally considered ancillary to crops. The economists and sociologists in Indonesia launched a large-scale study of the markets and marketing strategies used by farmers and middlemen, following a pilot study on pricing efficiency and marketing margins.

The animal breeders appear to have identified a major gene that controls prolificacy in Javanese sheep. If confirmed, this discovery could increase materially the production of sheep in areas where adequate feed sources are available throughout the year. Breeding scientists have learned that peasants in Peru refuse to castrate males because they claim such animals do not grow as quickly, nor do they put on as much fat, as the uncastrated males.

Nutritionists in Indonesia have learned that growth is promoted in young goats by adding zinc and protein from legume tree foliage to the normal grass diet. Sweet potato vines fed

to DPG kids in Kenya show promise as a partial replacement for dam's milk, resulting in early weaning and more available milk for human consumption.

In Peru, range scientists have found that stocking rates that exceed four to five sheep units per hectare negatively impact sustainable animal production and the health of native vegetation. Improving the plane of nutrition before and during breeding, by using cultivated pasture improved production levels by as much as 25%. In Morocco, the grazing of wheat stubble provided nutrition sufficient to increase the weight of lambs or ewes for about the first month of grazing; after that, protein supplementation was necessary to maintain weight.

Tragically, two SR-CRSP workers, one a Peruvian and one a U.S. citizen, were murdered in the highlands of Peru while collecting field data in a community of peasant families. This loss resulted in the suspension of all field activities, the eventual closing of the office at Huancayo, and the curtailing of other CRSP activity in Peru.

During the year, SR-CRSP scientists from all overseas sites and participating institutions presented a number of professional papers, seminars, and workshops at national and international conferences. Nine papers, covering the historical, technical, management, and training aspects of the program since its inception in 1979 were given by small ruminant scientists at a special symposium on International Animal Agriculture, sponsored by the American Society of Animal Science. The papers are to appear as a series in the 1989 Journal of Animal Science, which receives world-wide distribution. Four small ruminant scientists, three from Peru and one from the U.S, received the first award given by the Peruvian Association of Animal Production for their work in diseases in alpacas.

The projects produced nearly 250 journal articles, technical publications, abstracts, book chapters, theses, and reports during the year. A listing of these can be found, along with a full account of research results, accomplishments, names of participating scientists, and training and communication achievements, in the detailed report of each country. Copies of these may be obtained from the Management Entity.

With a significant reduction in project funds in recent years, fewer students were identified for advanced training. However, during the past year, six students completed M.S. or Ph.D. degrees, and 26 continued their studies with SR-CRSP support in the U.S. or in their native countries. Over 300 students have received degrees in the program since its

inception in 1979.

During the year a major effort was devoted, by a task force from the Technical Committee and the Management Entity, to developing a Strategic Plan for the Small Ruminant CRSP for 1990-2000. The plan was based on the strategic planning conference held at North Carolina State University in January, 1988. The Technical Committee and the Board of Directors approved the plan as an internal working document in January, 1989, and directed its use for preparing the extension of the present grant for the period of October 1, 1990 to September 30, 1995.

Because of its briefness, the annual report for Brazil was included in this summary report and was not prepared as a separate document.

INTRODUCTION

The Concept of the CRSPs

The U.S., as the world's largest generator of surplus food, has provided aid to millions of hunger victims. Abundant harvests in the U.S. have been widely distributed in acute disaster relief programs and on a regular basis to food-deficient nations. However, as the world's populations burgeon, it has become apparent that supplying the hungry world with food through surplus distribution does not permanently alter the cycle of poverty and deprivation in underdeveloped countries. Recent famine in Africa has again demonstrated that the only long-term solution is to improve the capacity of these areas to supply their own food.

To promote this goal, the U.S. Congress passed the International Development and Food Assistance Act of 1975. Included in the act was "Title XII - Famine Prevention and Freedom from Hunger" that states: ". . .in order to prevent famine and establish freedom from hunger, the U.S. should strengthen the capabilities of U.S. land grant. . . universities in program-related agricultural institution development and research,. . .improve their participation in the U.S. government's international efforts to apply more effective agricultural sciences to the goal of increasing world food production, and in general should supply increased and longer-term support to the application of science to solving food and nutrition problems of the developing countries."

The act also specified that the United States Agency for International Development (USAID) administer and fund Title XII with money from its existing budget and authorized the President to create the Board of International Food and Agricultural Development (BIFAD) to initiate implementation of the act. BIFAD appointed the Joint Research Committee (JRC) to oversee the research-related aspects of Title XII. It was their recommendation that Title XII-sponsored research be implemented through Collaborative Research Support Programs (CRSPs). Among their suggested topics were small ruminants.

Fifty-three percent of the world's sheep and ninety-four percent of the world's goats are in the developing countries and are owned primarily by small pastoralists and farmers of very limited means. Despite their low production, these animals contribute significantly to the economy and food supply in these regions and the demand for their products exceeds the supply.

Improving the performance of small ruminants would

directly improve the diet and standard of living of a great many people, because the animals are inherently well suited to the needs of small-holders and the conditions prevailing in the developing countries. For example, they

- have low initial and maintenance costs;
- are able to sustain agriculture through marginal land and crop residues;
- produce milk and meat in small, readily usable quantities;
- produce fiber and skins that sustain cottage industries;
- are easily cared for by any member of the family;
- enhance income, improve cash flow, improve employment opportunities, and reduce risk; and
- provide fertilizer to maintain soil fertility and improve crop production.

Statement of SR-CRSP Goals

The primary goal of the Small Ruminant CRSP is to improve meat, milk, and fiber production from sheep, alpacas, and goats in order to increase the food supply and to raise the income of the smallholder. A major objective of the program is to strengthen the research capacities of overseas and U.S. agricultural institutions. This goal is pursued at the same time as we gain a better understanding of how subsistence-level small ruminant production systems work and learn how to increase the efficiency and sustainability of such systems.

To accomplish these broad objectives, the SR-CRSP is providing leadership for interdisciplinary research programs and furnishing opportunities for the advanced training of scientists interested in small ruminants. This results in increased numbers of professionals with the necessary analytical skills and motivation to engage in an organized effort to alleviate the problems confronting small-ruminant producers. Publishing and disseminating SR-CRSP project results contributes to an enhanced data base for directing future research, designing sound management recommendations, and formulating policy guidelines that mitigate the constraints on small ruminant productivity. Increased attention is being given to the preparation of extension-type material to inform developing country professionals who, in turn, will be expected to adapt this information to their local conditions. The various projects involved in research in the overseas sites play a vital role in the fulfillment of these goals.

The individual projects of the SR-CRSP were designed to help alleviate some of the major problems that severely hinder small ruminant productivity in the developing countries.

Problem Area	Research Area
Inadequate year-round feed supply	Nutrition and feeding
Improper grazing practices	Range management
Poor reproductive performance	Research on reproduction in the male and female
Non-selective breeding	Genetic improvement of local breeds and crossbreeds
Disease-parasitism	Animal health
Sub-optimum utilization of available resources	Management
Cultural constraints and lack of capital	Socio-economic research
Lack of coordination and integration in improvement efforts	Systems research

The Small Ruminant CRSP has been in active operation since the middle of 1979, when the first subcontracts were awarded to participating institutions. The accomplishments of the SR-CRSP during the last nine years fall into three categories: research, training, and public service. A major report that describes these accomplishments is titled "Partners in Research" and was published in lieu of the 1982-1983 annual report. Further progress was documented in the 1983-1984 and 1985-1986 annual reports. The 1986-1987 and 1987-1988 annual reports were assembled by the host country with separate summaries for each country: Brazil, Indonesia, Kenya, Morocco, and Kenya. This summary document contains only a brief report for each country program.

The SR-CRSP scientists, both U.S. and foreign, have generated over 2,000 research reports, papers, abstracts, and oral presentations related to SR-CRSP activity. The

publications generated within this program year, as well as training activities, are included in the country reports. A separate composite listing of all SR-CRSP program publications from 1978-1988 was published in 1987. A compilation of training activities (degree, non-degree, short courses, etc.) is included in the 1986-1987 summary report. Further information is available from the Management Entity office.

Organization of the SR-CRSP

The Management Entity (ME): Seventeen research proposals were selected to embark upon the first CRSP and the University of California, Davis (UCD), was designated the Management Entity. A program director was appointed and three committees, each of which plays a distinct role in the function of the SR-CRSP, were established. The organization structure was modified in program year eight to follow more closely the guidelines established by BIFAD.

The Technical Committee (TC): The TC develops and implements research projects in the U.S. and overseas. It consists of all Principal Investigators as well as one designated host-country collaborating scientist.

The Board of Directors (BD): This consists of seven members elected from the Administrative Council. The Board meets at least once annually to assess the content and the balance of the Program; to examine the adequacy of funding and resources; to review the progress and accomplishments of the Program (including research and training elements, and technical services); to review the general expenditure pattern of the Program; to approve the annual budget plan for the allocation of funds to component projects and work in host country sites; and to approve the addition or deletion of component projects, program elements, and changes in program objectives.

The Administrative Council (AC): The AC is an executive committee primarily concerned with budget review and policy issues. It consists of representatives from the administrations of the participating institutions and each participating host country. Meetings of the Administrative Council are convened from time to time by the Chairman or upon the written request of four or more members of the Council.

The External Evaluation Panel (EEP): This is an advisory committee responsible for reviewing and evaluating CRSP research activities and progress. It consists of a multi-disciplinary group of eminent scientists from institutions not participating in the CRSP.

Overseas Counterparts: Overseas counterparts, at the higher administrative level and at the scientific levels, have regularly attended and participated in the Technical Committee and joint Technical Committee/Board meetings. In some countries there are Program Administrative Committees (PACs) that solicit input about the SR-CRSP from ministry, university, and international agencies. Host Country Representatives have full voting privileges on the Administrative Council and elect one representative to the Board of Directors. In 1987-1988 a host country representative from each country was added to the Technical Committee.

The Budget of the SR-CRSP

Initially the grants were favorable for research, providing a two-year funding horizon and a three-year planning horizon for participants. Unfortunately, this is no longer the situation. Three budget reductions were received for the 1984-1985 and 1985-1986 budget years. As of April, 1988, the ME has received assurance of funding through April 30, 1989, at the same reduced level of the 1986-1987 budget year.

SR-CRSP Overseas Worksites

The group of people toward whom the activities of SR-CRSP are directed is the limited-resource producers in the developing countries, such as the smallholders and nomadic husbandmen. The problems unique to their situation make research overseas not only appropriate, but essential, if meaningful progress is to be made in improving small ruminant productivity under these conditions. Because the overseas research component of the SR-CRSP was considered the cornerstone of the project, great care was taken to select appropriate overseas worksites that met the following criteria:

- The sites are representative of the various ecozones and production systems encountered in the tropics. The applicability of SR-CRSP findings should extend beyond the borders of any nation in which the research was conducted and should be useful in other areas of similar climate and topography.
- The countries in which the sites are located have established agricultural institutions, staffed by scientists, trained personnel, and students with whom the SR-CRSP investigators have an

opportunity to collaborate. These institutions also provide the extension links that are pivotal to the implementation of SR-CRSP findings. The current overseas and collaborating institutions are

Peru: Instituto Nacional de Investigación Agraria y Agroindustrial (INIAA)

Indonesia: Agency for Agricultural Research and Development (AARD)

Morocco: Institut Agronomique et Veterinaire-Hassan II University (IAV)

Kenya: Kenya Agricultural Research Institute, Ministry of Science and Technology

Brazil: Empresa Brasileira de Pesquisa Agropecuaria (EMBRAPA) (Linkage status beginning 1987).

SUMMARY OF PROGRAMS AND THEIR ACCOMPLISHMENTS

(A detailed report of each country is available separately, except for Brazil. The report on Brazil is at the end of this summary.)

INDONESIA

Major Accomplishments

1. Reproductive performance of ewes in the Outreach Pilot Project, as measured by percent of lambs born and percent weaned, increased by 40% and 50% respectively over the previous year's performance. A major part of this improvement is attributed to the application of feeding and management recommendations developed in the SR-CRSP.
2. Thirteen Technological Packages (Tech Packs) are now available and are being tested on farms to assess their economic and social acceptability.
3. Following a small pilot study on pricing efficiency and the marketing of small ruminants in mid-1988, a large-scale study was initiated to gather data concerning livestock markets, slaughter houses, middlemen, and the marketing strategies of small ruminant farms.
4. More information on testing the hypotheses that a major gene controls prolificacy in Javanese sheep was collected during the year. If confirmed, this finding could increase substantially the production in areas where adequate feed resources are available throughout the year.
5. Higher growth rates and reduced amounts of wool (less heat burden) have resulted from cross breeding hair sheep, introduced by SR-CRSP, with local breeds.
6. Positive effects in growth were noted from adding zinc and protein from legume tree foliage to the normal grass diet for growing Kacang goats.
7. Over 50 publications were produced during the year, and one M.S. and two Ph.D.s completed their degrees.

Summary of Program

The SR-CRSP program in Indonesia has followed the farming systems research approach. This is reflected in the development of the research activities over the last nine

years, which can be divided into several stages: baseline data collection (descriptive/diagnostic), technology development (on-station research trials), and on-farm testing. A fourth, and complementary, final stage in a formal farming systems approach is the extension of the tech packs developed to the end users. Although extension is outside the mandate of the SR-CRSP and its host institution in Indonesia (the Research Institute for Animal Production), the program has developed sui generis methodologies that can be used by extension services, from its on-farm technology development research. These methodologies explore, among other aspects,

- new avenues to maximize the receptivity of the farmers to a given technology;
- the magnitude and direction of the interaction between a given technology and type of practical recommendations associated with that technology; and
- dynamic alternatives to improve the information exchange gap that often exists between researchers and the end user of new technologies.

At present, the program is operating its interdisciplinary testing phase, which has received an important boost during 1987-1988. A key element of this testing phase is the Outreach Pilot Project (OPP), where new tech packs are developed and focused on the production problems outlined by the farmers. The tech packs are produced by the disciplines of the different projects (i.e., nutrition, breeding, etc.) through their discussions and collaboration with the farmers. This methodology incorporates traditional knowledge with current information.

In this process, emphasis has been given to shortening the lambing interval, reducing lamb mortality, increasing weaning weights, improving marketing information for farmers, improving feeding management, and designing barns. In the Outreach Pilot Project, it was shown that a combination of shorter lambing intervals, lower lamb mortality rates, and higher proportions of ewes successfully being bred consistently raised the animal's reproductive performance, as reflected by the information contained in Table 1. A major part of this improvement is believed to be due to the application of feeding and management recommendations developed in the SR-CRSP.

Table 1

Reproductive performance traits in small ruminants in the OPP compared to earlier West Java Studies.

Traits ¹	West Java ²		OPP ³
	1982	1986-87	1987-88
% lambs/kids born	126	145	184
% lambs/kids weaned	113	116	166

¹On the basis of ewes available

²Knipscheer et al., 1983

³B. Setiadi, 1988

Correspondingly, a number of tech packs available for on-farm testing include (1) high prolificacy contributed by the Javanese Thin-tailed sheep; (2) hair-sheep cross; (3) improved housing for animals; (4) use of gliricidia, leucaena, and sesbania tree legumes as feed supplement; (5) use of ampas tahu (soybean waste); (6) cassava leaves as a feed supplement; (7) use of ensiled grasses during the dry season; (8) integrated sheep-rubber plantation management systems; (9) care of lambs at birth; (10) several animal health improvement measures; (11) composting system for feces and feed refusals; (12) marketing at optimum weight; and (13) various health care technologies. While high prolificacy and feed supplementation technologies have been developed for the confinement (cut-and-carry) system, the hair sheep and the sheep-under-rubber management practices are technologies geared for grazing systems.

The economics and sociology components are the principal organizers in the on-farm testing and farmer participatory research program. These efforts are conducted in collaboration with the biological components, generally under the umbrella of the OPP in West Java, or the ORP (Outreach Research Project) in Sei Putih, North Sumatra. With increasing emphasis in user-based technology development, assessing the economic and social acceptability of the various tech packs will be a critical area of on-farm research. In addition, the economics program has begun a large-scale pricing efficiency and marketing study on Java, where the vast majority of Indonesia's small ruminants are maintained. This study was designed to gather data concerning livestock markets, slaughter houses, middlemen, and small ruminant farmers' marketing strategies.

Additional on-station work on the above and other technologies is continuing as an integral part of the disciplinary research of the participant. Continuation of this on-station work is necessary for the development of future technologies and the reshaping or adjustment of the existing technologies through farming systems research methodologies.

Research data from the Citadas Station contributed more information on the testing of a hypothesis that postulates that a major gene controls prolificacy in Javanese sheep. If this hypothesis is confirmed consistently, proper levels of prolificacy could be adjusted to different types of environments with regard to feeding constraints. For instance, prolific ewes (producing predominantly twins and occasionally triplets) could increase substantially the productivity of production systems in areas where forage and feed availability are not constrained.

In Sei Putih, North Sumatra, the evaluation of hair sheep in an integrated system of grazing under rubber plantations is in progress. Crosses of local and hair sheep, compared to local sheep stands, have shown higher growth rates and less proportion of wool. This research will continue to assess the comparative advantage of hair sheep in reproduction and in overall production performance. Hair sheep avoid the need for shearing and, since the wool is not sold, represent a significant saving in labor.

Nutritional studies are focusing on the use of agricultural by-products (especially from rubber and oil-palm trees), supplementation studies (the use of legumes, of different energy products, and of minters), and feeding strategy studies. The focus of the nutrition research is shifting slowly to Sei Putih, where rotational grazing studies under young and aged rubber trees are being conducted in conjunction with studies exploring alternatives for improving the quality of forage by introducing and testing new forages and shade-tolerant species.

During 1987-88 the SR-CRSP provided full sponsorship to five graduate students: 2 Ph.D. degrees (breeding and economics), and 3 M.Sc. degrees (breeding, nutrition, and sociology).

Literature Cited

- Knipscheer, H.C., M. Sabiani, A. J. De Boer, and T. D. Soedjana. 1983. The economic role of sheep and goats in Indonesia: A case study of West Java. Bulletin of Indonesian Economic Studies XIX (3): 74-93.

Setiadi, Bambang. 1988. Reproduction Efficiency of Sheep and Goats from OPP Farmers (October 87-September 88), Mimeo, Balai Penelitian Ternak/SR-CRSP, Bogor/Ciawi, Indonesia.

KENYA

Major Accomplishments

1. A baseline survey of 120 households was completed and 250 dual-purpose goats (DPGs) were distributed to farm families to test the technical, social, and economic feasibility of DPG technologies.
2. DNA probes for surveillance and epidemiological studies of Anaplasma were developed. Also, a vaccine was developed and tested for contagious caprine pleuropneumonia (CCP) that can be stored at room temperature and that provides protection for more than a year.
3. DPG breed stabilization and improvement was initiated, thus paving the way for the gene segregation that could lead to genetic immunity to diseases and parasites. Early research indicates that there is genetic resistance to haemonchus infections in DPG.
4. Sweet potato vines fed to DPG kids show promise as a partial replacement for dam's milk. This could result in early weaning and more milk available for human consumption.
5. The testing of leguminous, multi-purpose trees--leucaena, sesbania, and gliricidia--has shown their importance as sources of protein for goats, green manure for crops, and firewood for family use.
6. A completion of more than 30 recommendations for feed production, nutrition, breeding, health care, and management of DPGs, in the form of a tech pack, was published and made available to extension workers.
7. Carcass data from intact males, castrates, and mature does show intact males to have a lower percentage body fat than of castrates and females, the latter having the highest. However, the difference in dressing percentages were not significant among the breeds of males tested.
8. Four workshops were conducted for extension specialists in western Kenya.

9. Three Kenyans were studying for Ph.D. degrees in the U.S.
10. Over 40 publications were published during the year.

Summary of Program

The global research program of the SR-CRSP addresses agricultural systems in which small ruminants are, or can become, an important component. In Kenya, research by SR-CRSP has been focused on a nontraditional role for goats--namely, producing milk and meat on small farms in high agricultural potential regions.

Much of western Kenya is blessed with fertile soils and a bimodal rainfall pattern, which permits two cropping seasons per year. Unfortunately, this high agricultural potential has supported rapid population growth. Traditional agricultural systems no longer meet the needs of families for food and income.

Adding a dual-purpose goat (DPG) can increase the productivity of smallholder systems. For example, DPGs can convert crop residues and browse to milk and meat. Keeping three to five does, instead of a cow, adds a small, but consistent, milk protein supplement to family diets year round. Litters of two to three kids in less than a year substantially increase the off-take of slaughter stock for family consumption or marketing. Because goat meat is a highly desired product, goats have potential as a significant "cash crop."

To meet the needs of smallholders, DPG production systems must be based on low-cost, low-risk technology and be generally complementary to cropping activities. Kenyan and U.S. institutions are collaborating on this. The Kenya Agricultural Research Institute and the Ministries of Agriculture and Livestock Development are the principal host-country institutions. In addition, the SR-CRSP works with scientists from the University of Nairobi, Egerton College, and other Kenyan institutions.

U.S. institutions participating in the SR-CRSP/Kenya include

Texas A & M University	Breeding, systems analysis
Washington State University	Health
University of Missouri	Sociology

The implementation strategy followed by the SR-CRSP in Kenya involves a three-phase process:

Phase 1 (1980-1982). Characterization of social-economic-biological activities of traditional farming systems and on-station component research in breeding health, goat nutrition, and agronomy.

Phase 2 (1983-1985). Monitor limited numbers of DPGs on farms; scientist-managed, on-farm component research (agronomy, goat nutrition, health management); on-farm component research in breeding, health, nutrition, and agronomy; and preliminary cost/benefit and social feasibility analyses.

Phase 3 (1986-1990). Technical, economic, and social evaluation of technology packages and production systems under farmer management. Component research--both on station and farm--continues.

Emphasis has been placed on a farming systems approach to ensure that research results are relevant to the needs and the resources of farmers in western Kenya. In addition, the general principles, and many of the specific technologies for DPGs, can be adapted to farming systems in other parts of the tropics.

Accomplishments during 1987-88 were built upon the results of research in previous years. In general, these accomplishments represent the collaborative efforts of scientists from the multiple disciplines supported by two or more of the projects in Kenya. For example, scientists from sociology, economics, and production systems completed a baseline survey of 120 households in four new clusters. With this baseline established, 250 dual-purpose goats were distributed to farm families to test the technical, social, and economic feasibility of DPG technologies under small farm conditions.

Animal health scientists developed DNA probes for surveillance and epidemiological studies of *Anaplasma*, and they developed and tested a vaccine for contagious caprine pleuropneumonia (CCPP) that can be stored at room temperature and provides protection for more than one year.

The DPG breed stabilization and improvement phase was implemented. This base generation of the four-breed composite

provides an excellent opportunity for segregating the major genes and epistatic combinations associated with genetic immunity to diseases and parasites. Breeding and health scientists collaborated on preliminary research that indicated the existence of genetic resistance to haemonchus infections in DPG.

Feed resources are the major limiting factor to DPG productivity. An important, if somewhat surprising, use for sweet potato vines was evaluated. These vines were proven to be excellent milk replacers, allowing early weaning of DPG kids and making more milk available for human consumption. Multipurpose trees--leucaena, sesbania, and gliricidia--were evaluated and proved to have important value as sources of protein supplement for goats, of green manure for crops, and of firewood for family use.

With special funding, a short-term project was initiated to collect carcass data from 60 goats to assess edible product yields and to quantify carcass characteristics of intact males, castrates of different breeds, and mature does. Results showed that intact males had a lower percentage of fat than castrates, females were highest in percentage of carcass fat, no significant differences occurred in dressing percentages among the males of the different breeds, and body fat percentages of the females tended to validate the TAMU Goat Simulation Model parameter that was based on meager data. Also, the differences between the fat composition of goats and sheep is striking and emphasizes the different nutrition and management required. As numbers of DPGs permit, further studies will be undertaken to assess meat off-take; this will be an important factor contributing to the value of the goat to the small holder.

SR-CRSP scientists published "Dual-Purpose Goat Technology Package for Smallholders in Kenya," a compilation of more than 30 documented recommendations for management feed production, nutrition, breeding, health care, and management of dual-purpose goats. This publication is written in a style usable by extension workers for transferring technologies to small farmers.

The training of Kenyan scientists has a high priority. During 1987-88, three Kenyans were studying for Ph.D. degrees with support from health, sociology, and economics projects. Non-degree training included four workshops conducted for extension specialists in western Kenya. SR-CRSP scientists from Kenya were invited speakers for international conferences in Brazil, France, U.S.A., Ethiopia, and Zimbabwe.

MOROCCO

Major Accomplishments

1. Given the low dietary usage of Stipa by both sheep and goats because of its poor palatability, the animals competed for the scarce grasses of other species and rare forbs, placing them under extremely heavy grazing pressure.
2. Studies were initiated to understand the dynamics of the Artemisia community, in order to comprehend the impact of grazing and plowing on the sustainability of this major plant ecosystem of Morocco and adjoining areas of the Middle East.
3. Seventy-two farms in the Artemisia Stipa ecosystem were selected for a production survey in late 1987 in areas where sheep are the dominant species of small ruminants. Approximately 80% of the farms were engaged in both livestock and crop production. Most of the sheep are marketed as lambs at six months of age, usually between March and July.
4. As a substantiation of earlier findings, the grazing of wheat stubble provided nutrition sufficient to increase the weight of lambs or ewes for about the first month of grazing; after that, protein supplementation was necessary to maintain weight.
5. Concentrate supplementation of ewes during the last month of gestation prevented low birth weights and poor postnatal lamb weight gains.
6. The D'Man breed of sheep transmits its superior prolificacy in an essential additive manner that provides for the possibility of producing groups of sheep with mean litter sizes at any desired level between 1.1 and 2.2 lambs. This finding will enable producers with more intensive production/management systems to increase their off-take through a planned breeding program.
7. The project produced nineteen journal publications or chapters in books, five abstracts, six theses, and ten miscellaneous reports.

Summary of Program

Work continued in three projects during 1987-88: Range Nutrition, Genetics, and Reproduction. Field research in Sociology, the fourth component of the Morocco CRSP, ended in

1986, but some publications from this work continued in 1987-88.

A set of Stipa tenacissima (alfa grass) pastures, fenced for study in the fall of 1987-88, are producing some very interesting results. This is the major plant component in large areas of eastern Morocco ranges and is extensively grazed. However, annual production was found to be only a fairly small fraction of the standing crop of this species, which is apparently of very low palatability to sheep. It was virtually uneaten at low and moderate stocking intensities, and was only 12 to 21% of the diet of sheep or goats under heavy stocking intensities. This means that competition for the scarce grasses of other species and rare forbs in the Stipa community are normally under extremely heavy grazing pressure.

A study of Artemesia herba-alba, a dominant shrub species of arid range lands of Morocco, is also being carried out. An important part of this study is the evaluation of recovery (or non-recovery) of the natural plant community following plowing (for cultivation), which unfortunately is being done increasingly in these very marginal lands.

A third range study is the characterization of human populations, agricultural practices, and relative emphasis on crops and livestock, based on a sample of 72 farms of the Artemesia/Stipa ecosystem. Approximately 80% of the farms engage in both crop and livestock production, with similar emphasis on the two activities across the entire sample but considerable variation in emphasis within farms. Among livestock, sheep were much more important than cattle or goats.

Stubble-grazing studies on soft-wheat stubble supported preliminary conclusions from earlier work: that stubble provides nutrition permitting gains in weight of lambs or ewes for about the first month of grazing, but that supplementation is necessary thereafter to prevent weight loss. Concentrate supplementation of ewes was necessary in late pregnancy to prevent low birth weights and poor postnatal lamb weight gains.

Inclusion of 20% carob pulp in lamb diets had a positive effect on weight gain and feed consumption, whereas levels of 30 and 50% depressed both. Substituting carob pulp for barley reduced diet digestibility.

Analyses of data from D'Man, Sardi, F₁, F₂, and backcross groups of ewes shows that the superior prolificacy of the D'Man breed is inherited in an essentially additive manner.

This, plus the similarity and performance of F₁'s and F₂'s, indicates that groups of any mean prolificacy level desired over the range of the two parent breeds (i.e., 1.1 to 1.2 for Sardi, 2.0 to 2.4 for D'Man, depending on the level of nutrition) can be produced by varying the proportion of inheritance of these two breeds in a cross from 0 to 1. With regard to other traits, there appears to be favorable heterosis in fertility and in growth rate, and possibly in age at puberty. Work has been initiated on development of a 50%D, 50%S synthetic breed that should have suitable production potential for the better feeding and management conditions of the country, and be useful as sires in matings with non-prolific breed ewes to give some increase in prolificacy and productivity over the latter in somewhat more extensive conditions. In the driest areas, the pure non-prolific sheep breeds are likely to be the best adapted and the most suitable.

The projects have produced nineteen journal publications or book chapters, five abstracts, six theses, and ten other reports in the past year.

PERU

Major Accomplishments

1. Three workshops in Spanish conducted primarily by Peruvian scientists were held in Bolivia and at two locations in Peru, with 300 participants in attendance. These efforts represented the first attempt to regionalize the program at any overseas location.
2. Field data collection in the peasant communities in the highlands progressed well until the tragic killing of two SR-CRSP fieldworkers in June, 1988. As a result, field activities were suspended, but analysis of the data continues, with the prospect of nine interdisciplinary publications emanating from the data.
3. Organization and initial development of the technology package got underway.
4. The enterotoxin, Clostridium perfringens Type A, which is involved in neonatal mortality of alpacas, llamas, and perhaps lambs, was purified by the veterinarian scientists. These developments could lead to field diagnostic tests and eventually to a vaccine.
5. Several native plants were examined for their efficacy in treating endo- and ecto-parasites. Varying degrees

of effectiveness were demonstrated and some show considerable promise as "home remedies."

6. Crop and animal production are so closely linked in the highlands that they cannot be considered independent economic enterprises. Also, the time invested in small ruminant production is twice that of crop production even though livestock are normally considered ancillary to crops.
7. Research on breeding revealed the reasons peasants refuse to castrate males (quicker growth) and the selection criteria for rams used for breeding. In addition, research is elucidating the contribution of male and females to production traits, thereby providing guidelines useful to extension specialists as they work with producers.
8. Grazing land research has demonstrated that stocking rates are the primary influence on animal performance traits, such as fleece weights, staple length, and lamb crops. Stocking rates that exceed four to five sheep units per hectare negatively impact sustainable animal production and the health of native vegetation. Improving the plane of nutrition before and during breeding by using cultivated pasture improved production levels by as much as 25%.
9. Significant findings emanating from special short-term projects include the following:
 - a) The ovulatory hormones, LH and GNRH, show promise for inducing super ovulation in camelids.
 - b) Female alpacas may be bred at one year of age rather than the traditional three years of age by strategic use of cultivated forages.
 - c) Losses from poisonous plants can be attributed to photo sensitization and astragalus poisoning. Nine genera were pointed out as serious floral agents identified as causing losses in small ruminants.
10. The projects produced forty-one journal publications, thirty-three technical publications, thirty-three abstracts, and two chapters in books. Twenty-four presentations were made at scientific meetings, symposia, and workshops in Peru and in the U.S. Four workshops were given in Peru and one in Bolivia. Three Peruvians and one U.S. scientist received the first award given by Peruvian Association for Animal Production for their work on diseases in alpacas.

11. Two students completed their M.Sc. degree in the U.S., and one his ingeniero degree in Peru; three are continuing their studies for the M.Sc. in the U.S., two their Ph.D. in the U.S., and three their graduate degrees in Peru, all with full or partial support from the SR-CRSP.

Summary of Program

During the past year, 1987-88, the Small Ruminant Collaborative Research Support Program has had a landmark year in the tremendous progress made in all interdisciplinary ventures. These include (1) SR-CRSP sponsored workshops in LaPaz, Bolivia (150 participants), arequipa (60 participants), and Lima, Peru (88 participants); (2) the Integrated Research in Peasant Communities; and (3) the initial development of the Peru Technological Package (Peru Tech Pack). These unique and highly visible team-oriented efforts will make lasting impressions on the peoples of the Andes, both in Peru and Bolivia. Peruvian and U.S. scientists were the first in the CRSP to begin building information bridges to neighboring countries that have not received direct benefits from having a CRSP project. We believe strongly that this was the ultimate goal of the USAID designers of the CRSP's. But even while our spirits soared over our interdisciplinary accomplishments, our hearts were deeply touched and saddened at the tragic loss of our beloved colleagues, Constantine Gregory and Gustavo Rojas.

Another major step forward was the Management Entity's decision to fund "Special Projects" research. These short-term projects produced valuable results relative to "Embryo Transfer in South American Camelids," "Standardizing Methods for Determining Passive Immunity in Small Ruminants," "Early Maturation of Female Alpacas," and "Development of a Complete List of Poisonous Plants Which Affect Animal Production in the High Andes." Significant findings include (1) the preliminary indication that ovulatory hormones (LH, GnRH) have promise for superovulation in camelids, (2) female alpacas may be bred at one year of age rather than the customary three years of age by strategic use of cultivated forages, and (3) losses from poisonous plants center on photosensitization and Astragalus poisoning. (Only nine genera were identified as serious floral agents in small ruminant losses: Astragalus, Trifolium, Utica, Polylepis, Elodea, Lupinus, Pennisetum, Ephedra, and Conium.)

Under the umbrella of team-oriented research and outreach, each discipline effectively produced results that are significant. For example, the health project at Colorado State University purified a Clostridium perfringens Type A enterotoxin, a serious agent in the neonatal mortality of

small ruminants. In addition, several native plants were examined for the efficacy in treating parasites such as the sheep ked (Melophagus ovinas), liver flukes, and gastrointestinal nematodes. Respectively, these effective plants were "utashayli," artichoke, and "paico."

The University of Missouri Sociology project had the primary coordination role in the Integrated Research in Peasant Communities and the development of the Peru Technology Package. Their study of the genealogy of knowledge transfer and their monograph on ethnoveterinary developments will be landmark works.

The Economics Project at Winrock International Institute for Agricultural Development has been heavily involved in studies on the micro- and macro-economics affecting peasants and peasant communities. Interesting contributory findings include the fact that animal and crop production are so closely linked that they cannot be considered independent economic enterprises of the small-holder. Moreover, the time invested in small ruminant production is twice that of crop production, even though livestock are normally considered ancillary to crops.

Montana State University's Breeding Project has had many accomplishments aside from the normal flow of prestigious publications in world-renowned outlets. Scientists have learned why peasants refuse to castrate males and how they select rams for breeding purposes. Furthermore, they are developing an understanding as to the contribution of males and females into production traits of Andean sheep. Such knowledge will enable extension specialists to alter decisions made by producers.

Because native forage (rangelands) and introduced plants are the nutritional base for animal production, Texas Tech University and their Peruvian co-investigators are delving into topics like mixed-species (complementary) grazing, proper stocking rates, and the nutrient status of free-grazing small ruminants. Stocking rate has had the primary influence on animal performance traits, such as fleece weights, staple lengths, and lamb crops. Furthermore, stocking rates that exceed four to five sheep units per hectare will have severely deleterious effects on sustainable animal production and the health of native vegetation. Sheep were successfully flushed with cultivated pastures and raised production levels by as much as 25%.

Collectively, the SR-CRSP in Peru has been one of the most productive projects of all the CRSP worksites. Indeed, this is a tribute to our Peruvian colleagues who have worked tirelessly and courageously in the face of extreme hardships

and terrorism.

We offer our sincere thanks to these brave women and men. Without them our efforts would have been futile.

BRAZIL

Effective October 1, 1987, SR-CRSP work in Brazil was placed on "linkage" status. In that mode, a low level of professional contacts and relationships between Brazilian and U.S. scientists was maintained. Supplies and equipment repair parts not available in Brazil were supplied by the Utah Range Project, the only project currently maintaining fiscal relations with EMBRAPA/Brazil.

A Brazilian M.S. student, Maria Auxiladora Vasconcelos, who began her SR-CRSP supported work in 1986, continued to pursue her research at CNPC under the supervision of Dr. Ederlon Oliveria.

Additionally, Dr. Harvey Olander, the principal investigator for the former California Health Project, maintained active professional contact with EMBRAPA researchers who had earlier collaborated on that project. The major objective of these contacts was completion of research on a vaccine for the goat disease Corneybacterium pseudotuberculosis. This work was on-going at the time the Brazil program was placed on linkage status, and Dr. Olander's continued involvement has provided the impetus for the project to be brought to a meaningful end.

Work continued on finalizing two "Tech Pack" publications summarizing SR-CRSP involvement in Brazil. One, edited by Drs. William Johnson and Ederlon Oliveria, deals with meat goat production in the tropics, and the other, edited by Drs. Maurice Shelton and Elsie Figueriedo, focuses on tropical hair sheep. Release of these books is anticipated in early 1989.

SMALL RUMINANT CRSP
 USAID GRANT NO. DAN-1329-G-SS-4093-00
 APPROVED PROGRAM BUDGETS

Institution	Discipline	Year 6 84/85	Year 7 85/86	Year 8 86/87	Year 9 87/88	Year 10 88/89	Total
California	Breeding	\$242,034.00	\$226,100.00	\$165,900.00	\$160,000.00	\$210,000.00	\$1,004,034.00
California	Health	\$170,000.00	\$150,750.00	\$73,100.00	\$0.00	\$0.00	\$393,850.00
Colorado State	Health	\$170,000.00	\$153,450.00	\$126,400.00	\$160,000.00	\$160,000.00	\$769,850.00
Missouri	Sociology	\$307,800.00	\$295,700.00	\$173,400.00	\$210,000.00	\$210,000.00	\$1,196,900.00
Montana State	Breeding	\$145,000.00	\$144,000.00	\$126,400.00	\$100,000.00	\$125,000.00	\$640,400.00
North Carolina	Nutrition	\$235,178.00	\$240,488.00	\$165,900.00	\$160,000.00	\$179,500.00	\$981,066.00
Texas A&M	Management	\$185,000.00	\$121,500.00	\$67,200.00	\$114,000.00	\$0.00	\$487,700.00
Texas A&M	Systems	\$185,000.00	\$187,026.00	\$142,200.00	\$11,000.00	\$140,000.00	\$665,226.00
Texas Tech	Range	\$297,000.00	\$239,850.00	\$126,400.00	\$160,000.00	\$150,000.00	\$973,250.00
Utah State	Physiology	\$195,000.00	\$161,030.00	\$21,900.00	\$0.00	\$0.00	\$377,930.00
Utah State	Range	\$190,000.00	\$168,750.00	\$126,400.00	\$120,000.00	\$118,505.00	\$723,655.00
Washington	Health	\$170,000.00	\$165,150.00	\$126,400.00	\$160,000.00	\$160,000.00	\$781,550.00
Winrock Int'l	Economics	\$235,000.00	\$258,829.00	\$165,900.00	\$210,000.00	\$180,000.00	\$1,049,729.00
Winrock Int'l	Management	\$232,000.00	\$234,900.00	\$169,900.00	\$180,000.00	\$210,000.00	\$1,026,800.00
Subtotal:		\$2,959,012.00	\$2,747,523.00	\$1,777,400.00	\$1,745,000.00	\$1,843,005.00	\$11,071,940.00
Management Entity*		\$450,000.00	\$432,000.00	\$300,200.00	\$450,000.00	\$440,000.00	\$2,072,200.00
Contingency Funds		\$89,200.00	\$27,412.00	\$55,600.00	\$220,000.00	\$183,295.00	\$575,507.00
Overseas Sites		\$501,788.00	\$393,065.00	\$316,000.00	\$300,000.00	\$333,700.00	\$1,844,553.00
Linkages		\$0.00	\$0.00	\$0.00	\$93,000.00	\$0.00	\$93,000.00
Subtotal:		\$1,040,988.00	\$852,477.00	\$671,800.00	\$1,063,000.00	\$956,995.00	\$4,585,260.00
Total:		\$4,000,000.00	\$3,600,000.00	\$2,449,200.00	\$2,808,000.00	\$2,800,000.00	\$15,657,200.00

* Allocations include funding for External Evaluation Panel, Board Meetings, Technical Committee, and other Meetings.

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 UPDATED THROUGH: February 27, 1989

SMALL RUMINANT CRSP
 USAID GRANT NO. DAN-1328-G-SS-4093-00
 MATCHING CONTRIBUTIONS FROM U.S. INSTITUTIONS

Institution	Discipline	Year 6 84/85	Year 7 85/86	Year 8 86/87	Year 9 87/88	Total
California	Breeding	\$106,748.75	\$117,007.00	\$104,646.00	\$96,529.00	\$424,930.75
California	Health	\$60,184.00	\$40,921.00	\$45,289.00	\$0.00	\$146,394.00
Colorado state	Health	\$56,667.00	\$53,833.00	\$53,334.00	\$53,333.00	\$217,167.00
Missouri	Sociology	\$95,388.54	\$94,190.49	\$53,386.56	\$62,848.05	\$305,813.64
Montana State	Breeding	\$331,265.00	\$262,557.00	\$184,001.30	\$221,920.86	\$999,744.16
North Carolina	Nutrition	\$87,462.00	\$80,549.04	\$64,731.00	\$71,184.27	\$303,926.31
Texas A&M	Breeding/Management	\$66,474.41	\$67,573.65	\$77,098.72	\$0.00	\$211,146.78
Texas A&M	Breeding/Systems	\$59,755.04	\$64,026.43	\$46,311.50	\$56,144.27	\$226,237.24
Texas Tech	Range	\$114,381.91	\$110,950.00	\$59,125.79	\$83,694.40	\$368,152.10
Utah State	Reproduction	\$90,408.40	\$128,057.46	\$6,998.17	\$0.00	\$225,464.03
Utah State	Range	\$103,929.97	\$116,204.92	\$122,213.49	\$82,321.87	\$424,670.25
Washington	Health	\$89,817.59	\$85,610.80	\$129,872.17	\$67,314.96	\$372,615.52
Winrock Int'l	Economics	\$78,111.67	\$73,975.07	\$68,262.09	\$77,543.00	\$297,891.83
Winrock Int'l	Management	\$58,364.49	\$73,428.47	\$79,461.02	\$85,773.51	\$297,027.49
Total:		\$1,398,958.77	\$1,368,884.33	\$1,094,730.81	\$958,607.19	\$4,821,181.10

* Budgeted Amount.

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 UPDATED THROUGH: February 27, 1989

SMALL RUMINANT CRSP
 USAID GRANT NO. DAN-1328-G-SS-4093-00
 EXPENDITURES BY PROGRAM

Institution	Discipline	Year Six 1984/85	Year Seven 1985/86	Year Eight 1986/87	Year Nine* 1987/88	TOTAL
California	Breeding	\$192,562.10	\$258,979.52	\$216,229.92	\$196,166.79	\$863,938.33
California	Health	\$119,308.75	\$142,139.33	\$132,401.92	\$0.00	\$393,850.00
Colorado	Health	\$159,902.05	\$157,787.88	\$131,447.80	\$168,782.58	\$617,920.31
Missouri	Sociology	\$270,247.05	\$307,072.42	\$204,442.54	\$240,246.71	\$1,022,008.72
Montana	Breeding	\$145,000.00	\$144,000.00	\$126,400.00	\$104,717.98	\$520,117.98
North Carolina	Nutrition	\$235,178.00	\$244,088.00	\$165,900.00	\$205,718.10	\$850,884.10
Texas A & M	Breeding/Mgmt	\$158,827.67	\$144,451.44	\$65,380.21	\$0.00	\$368,659.32
Texas A & M	Breeding/Systems	\$143,489.80	\$155,836.79	\$175,909.65	\$207,788.84	\$683,025.08
Texas Tech	Range	\$282,151.09	\$246,138.86	\$113,615.10	\$187,549.88	\$829,454.93
Utah State	Range	\$180,566.51	\$178,183.00	\$126,400.00	\$104,699.92	\$589,849.43
Utah State	Physiology	\$195,000.00	\$156,755.09	\$21,900.00	\$0.00	\$373,655.09
Washington	Health	\$158,632.69	\$176,310.01	\$123,722.15	\$168,985.00	\$626,949.85
Winrock Intl	Economics	\$235,000.00	\$258,584.43	\$198,365.81	\$234,960.01	\$926,910.25
Winrock Intl	Management	\$200,019.76	\$228,936.79	\$207,610.00	\$265,509.31	\$882,075.86
Subtotals		\$2,675,885.47	\$2,799,263.56	\$2,009,025.10	\$2,065,125.12	\$9,549,299.25

Host Countries						
Brazil		\$125,202.15	\$108,969.41	\$59,974.67	\$0.00	\$294,046.23
Indonesia		\$95,001.04	\$70,454.82	\$25,735.50	\$72,204.58	\$263,395.94
Kenya		\$73,777.56	\$55,922.68	\$40,597.29	\$72.36	\$170,369.89
Morocco		\$39,681.21	\$47,894.74	\$69,230.01	\$12,448.94	\$169,254.90
Peru		\$129,422.10	\$121,942.83	\$59,778.00	\$99,470.95	\$410,613.88
Subtotals		\$463,084.06	\$405,184.48	\$255,215.47	\$184,196.83	\$1,307,680.84

Management Entity**		\$376,306.95	\$415,263.66	\$438,094.62	\$447,003.99	\$1,676,669.22
Miscellaneous Expenses		\$0.00	\$11,541.71	\$0.00	\$0.00	\$11,541.71

TOTALS		\$3,515,276.48	\$3,631,253.41	\$2,702,335.19	\$2,696,325.94	\$12,545,191.02
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* These are preliminary final figures for Missouri.

** Expenditures include those for the External Evaluation Panel, Board and Technical Committee, Bolivia Workshop, and Strategic meetings and Conferences.

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Created: 30 Nov 88 jws C:

Updated: February 27, 1989

1987-1988 ANNUAL REPORT*

Project Title: Range Research for Increasing Small Ruminant Production in Brazil (Linkages Project)

U. S. Institution: Utah State University

Host Country Institution: EMBRAPA / CNPC

Personnel: Principal Investigator:
John C. Malechek

Brazil

Dr. Ederlon Ribeiro de Oliveira, Co-Investigator	EMBRAPA
Dr. Elsio Figueiredo, Co-Investigator	EMBRAPA
Dr. Expedito Lopes, Co-Investigator	EMBRAPA
Dr. Roberto C. M. Mesquita, Co-Investigator	EMBRAPA
Dr. Joao Ambrosio Araujo, Co-Investigator	EMBRAPA

USA

Dr. Fred Provenza	USU
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RESEARCH RESULTS

Dr. Ederlon Oliveria continued studies initiated in 1986-87, focused on determining nutritional requirements and intake by sheep and goats on caatinga rangeland. This work supports an M.S. student, Maria Auxiliadora Vasconclo. Minor purchases for lab chemicals and operating supplies unobtainable in Brazil were made on the Linkages Project to support this work.

Due to Malechek's year-long absence (sabbatical leave), no international travel was undertaken.

Mr. Scott Kronberg, Ph.D. graduate student at USU who began his work under the USU/Brazil Range Project, returned to USU in September, 1987. He has spent the past year completing coursework and laboratory analyses and plans completion of his Ph.D. program in January, 1989. He continues to receive assistantship support from the SR-CRSP.

* Included here because of its brief nature.

TRAINING REPORT
 Utah Range Project, SR-CRSP
 October, 1988

<u>Student's Name</u>	<u>Degree Sought</u>	<u>Institution</u>	<u>Planned Completion Date</u>	<u>Major Advisor</u>
Amanual Gobena	Ph.D.	Utah State Univ.	completed	F Provenza
Scott Kronberg	Ph.D.	Utah State Univ.	June 1989	J Malechek
Maria Auxilidora Vasconcelos	M.S.	Fed. Rural Univ.	Sept. 1989	E Oliveira

PUBLICATIONS

Refereed Journal

- Burritt, E. A., J. C. Malechek, and D. F. Provenza. 1987. Changes in tannin, total phenolics, crude protein and in vitro digestibility of browse due to mastication and insalivation by cattle. *J. Range Manage.* 40:409-411.
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- Kirmse, R. D., F. D. Provenza, and J. C. Malechek. 1987. Clearcutting Brazilian caatinga: Assessment of a traditional forest grazing management practice. *Agroforestry Systems:* 45:429-441.
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- Pfister, J. A., D. Hansen, and J. C. Malechek. 1987. Small ruminants: Surgical establishment and maintenance of esophageal fistulae. *Small Ruminant Research*, in press.
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Manuscripts in Press

Schacht, W. H., J. R. Kawas and J. C. Malechek. 1987. Effect of supplemental nitrogen and energy on dry season weight gains of goats in the semiarid tropics. J. Anim. Sci.:accepted.

Schacht, W. H. and J. C. Malechek. 1987. Nutrition of goats as influenced by thinning and clearing of deciduous woodland in northeastern Brazil. J. Anim. Sci.:accepted.

Schacht, W. H. and J. C. Malechek. 1987. Dietary selection by goats as influenced by thinning and clearing of deciduous woodland in northeastern Brazil. J. Range Manage:accepted.

Ph.D. Dissertations

Gobena, A. 1988. Effect of fertilization on woody plant chemistry: The role in diet selection by goats. Ph.D. Dissertation. Utah State Univ., Logan. 98.

COUNTRY	<u>SR-CRSP DISCIPLINE</u>	<u>PRINCIPAL INVESTIGATOR</u>	<u>COLLABORATING SCIENTIST</u>
Indonesia:	Animal Nutrition	K. Pond	B. Haryanto
	Economics	H. Knipscheer	T. Soadjana
	Breeding	E. Bradford	B. Gunawan
	Sociology	M. Nolan J. Gilles	K. Suradisastra
Kenya:	Breeding/ Systems Analysis	T. Cartwright	C. Ahyua B. Mwandotto
	Animal Health	T. McGuire	S. Chema S. Waghela
	Economics	H. Knipscheer	F. Nyaribo
	Production Systems Feed Resources Nutrition Management	H. Fitzhugh	K. Otieno M. Mathuva M. Simba
	Sociology	M. Nolan J. Gilles	A.N. Mbabu
Morocco:	Genetics	E. Bradford	A. Lahlou-Kassi
	Nutrition	K. Pond	F. Guessous
	Range	J. Malechek	H. Narjisse
	Sociology	M. Nolan J. Gilles	A. Hammoudi
Peru:	Animal Health	J. DeMartini	E. Ameghino
	Breeding	P. Burfening	J. Chavez
	Economics	H. Knipscheer	D. Martinez
	Range Management Sociology	F. Bryant M. Nolan K. Jamtgaard C. McCorkle	A. Florez M. Abuhadba M. Estafonero

SR-CRSP ADMINISTRATIVE COUNCIL

Robert C. Albin*	Texas Tech University
Antonio Chavez#	INIAA - Peru
Samson Chema#*	MALD - Kenya
Elmer Clark	Utah State University
James Henson	Washington State University
Larbi Firdawcy#	AIV-Hassan II-Morocco
Charles Lassiter*	N. Carolina State Univ.
Arthur Linton*	Montana State University
Allen G. Marr*	University of California
Carl Menzies*	Texas A&M University
Jan Nari#	CRIAS-Indonesia
Gordon Niswender	Colorado State University
Ned S. Raun*	Winrock International

* Member of Board of Directors

Host Country Representative

EXTERNAL EVALUATION PANEL

S. Gordon Campbell	Cornell University
Saul Fernandez-Baca	Peru
William Flinn	Ohio State University
Gerald Thomas, Chair	New Mexico State University

MANAGEMENT ENTITY STAFF

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