Institutional and Communication Factors Affecting Small Farmer Participation in and Success of Rural Group Credit Programs

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Summary

This is a five-year project designed to explore critical institutional and communication problems associated with success or failure of group credit programs for small farmers in Latin America. The focus of the project is on the pattern and extent of participation of small farmer groups in the credit process. Specifically examined will be the effect of prior group functioning before the credit project on the success of the credit venture; the degree to which group credit systems result in increased local control over credit procedures and availability; the interactions between group credit society members, technical assistance agents and lending institutions as they predict project success or failure; effects of group credit participation for minifundistas (less than 5 hectares); extent to which organization for group credit tends to lead to more active farmer participation in other matters of concern in agriculture or the community.

Phase One of the project would document and analyze existing data on group credit systems throughout Latin America, and then lead to a detailed examination of the history and functioning of 24 projects. Goal of this phase would be the development of key institutional, communication, and economic factors associated with group credit success.

Phase Two of the project would create one or more pilot projects to test the criteria developed in phase one of the project. Trained staff would be introduced into test areas to facilitate and evaluate the test approach. A final evaluation in Year Five of the project would measure changes in terms of participation, productivity, viability of the program economically, and farmer reaction. The final result would be the recommendation of a group credit system for Latin American small farm agricultural development.

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Phase one of the project would document and analyze existing data on group credit systems in Latin America, and then lead to a detailed examination of the history and operations of 25 projects. Goal of this phase would be the development of institutional, communications, and economic factors associated with group credit success.

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Introduction

Analysis of agricultural credit programs in Costa Rica and Latin America in the past two decades reveals several common characteristics which tend to exclude small farmers from the credit process:

1) Banks, which are often the major source of agricultural credit -- sometimes at subsidized rates -- tend to apply procedures and criteria toward loans that minimize their risks and costs.* By requiring that farmers hold title to their lands which can be used for collateral, by specifying a minimum farm size, or by tying loans exclusively to considerations of ability to repay, banks have tended to systematically exclude small farmers (i.e. those with less than 5 hectares) from the credit process. In addition, since most banks find that dealing with agricultural clients is more costly per loan than other types of loans because on-site visits are required in rural areas, banks tend to try to minimize costs in two major ways. First, they tend to reduce the total number of loans issued, and thus to increase the average loan amount. Second, they tend to deal with the same clients year after year, which avoids the necessity of reinspecting land or titles. These two tendencies have the <u>effect</u> -- whether intentional or not -- of excluding small farmers. An additional factor concerns the location of lending institutions. In many cases, it is difficult for individual small farmers to travel to locations where they may obtain credit, especially since many trips are often required to secure a loan.

* See A.I.D. Spring Review of Small Farmer Credit, Vol. II, February, 1973, No. SR102 "Small Farmer Credit in Costa Rica," AID Department of State, Washington, D.C. and Heliodoro Diaz and Herman Felstehausen, "Communication and Institutional Change in Mexican Agricultural Development," Land Tenure Center Paper No. 98, University of Wisconsin, Madison, 1974.

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2) Funds are often targeted toward development of export crops. In Costa Rica, for example, a major portion of funding has been used to support credit for coffee, sugar cane, cacao, bananas and the cattle industry.* Additional support is now being given to assist the development of pineapple and macadamia nuts for export. These projects obviously are important and have merit, but most are not of direct benefit to small farmers (except coffee), and often use up limited allocations of credit for agriculture.

3) Despite the focus on agricultural credit, the percentage of total farmers receiving credit has remained small. The 1973 AID Spring Review of Small Farmer Credit reported that fewer than 30% of Colombia's farmers receive institutional credit, in Nicaragua only 20%, Mexico about 15%, Brazil less than 15%, Honduras 10%, Paraguay 6%, Bolivia 5%, Panama 4%, and Guatemala 2%. When specific credit programs are examined, the results indicate that even programs which specifically attempt to reach small farmers tend to gradually reduce the number of clients served as years go by, and to increase the amount of credit extended to those fewer persons.

4) Attempts by organizations other than banks to extend credit have not been notably successful. Reform agencies often lack trained credit personnel and consistent funding to provide long-term credit service. In Colombia, INCORA's supervised credit program began by serving a substantial number of new small farmers. However, it is now reducing its activities to concentrate on the few campesinos it has already settled on parcelization and irrigation projects.

To summarize, the typical rural agricultural credit program: has been administered by a banking institution which has as its goal minimization of risk and cost rather than numbers of clients serviced; has offered minimum cost

* Robert Cross Vogel and Caludio Gonzalez Vega, Agricultural Credit in Costa Rica, AID/ACM Contract No. AID-515-171-T, Associated Colleges of the Midwest, Central American Field Program, July, 1969.

or subsidized credit to a small group of credit "repeaters" who obtain funds time after time; has emphasized credit for export crops rather than subsistence crops; has set limits for loans such as possessing clear title to lands or a minimum farm size which tend to exclude small farmers as potential clients.

The objective of the present proposal is the creation of a credit program with the following characteristics:

1) It focuses on the small farmer specifically, and makes numbers of such farmers served a major criterion for judging project success;

2) The program should charge interest rates sufficient to insure the future viability of the program. That is, subsidized rates which tend to require continuous government support over time would be avoided, since failure of government programs to provide adequate funding at subsidized rates over time has been a major reason for program failure in the past.

3) The program should emphasize prompt repayment of outstanding loans, and should include effective sanctions for non-payers.

Why Focus on the Small Farmer?

It is often said that small farmers cannot be a productive target for agricultural credit. Reasons advanced often describe individual characteristics of small farmers who are "not modernized" as compared to larger landowners who are. An analysis of problems of farmers in Colombia* suggested that it was difficult to change behavior of large groups of farmers because:

Farmers lack education
Farmers lack management knowledge
Farmers lack personal savings
Farmers lack political influence and group expression

* Herman Felstehausen, "Providing Information for Resolving Farm and Community Problems," Land Tenure Center Paper No. 61, University of Wisconsin, Madison, 1969.

Farmers lack land resources
Farmers choose inappropriate physical inputs
Farmers apply inappropriate technology
Farmers have traditional social values
Farmers have negative attitudes toward business and management
Farmers have ignorant habits

Thus, even if small farmers were as easy to convince as large farmers, change agents would want to focus more on large landholders to get maximum effect from their recommendations in terms of production.

The suggestion from the above would tend to make one believe that small farmers would be less productive than larger farmers. However, as Kanel* and others have shown, small farmers as a group tend to make more productive use of their lands now than do larger farmers on a per hectare basis. This fact might indicate that these farmers would be even more receptive to credit and assistance in reaching even higher production levels.

Instead of focusing on the problem of credit as an individual farmer problem, it may be more productive to examine it as an infrastructural problem. The inability of small farmers to get adequate credit should not be viewed independently of their inability to get adequate fertilizer and seed, good roads for getting crops to market, an adequate educational system, good health care, etc. The common thread tying these things together is the importance of group action in solving these problems. If a farmer wanted a road to haul his produce to market, he could attempt to construct one himself on his land, with the hope that each other farmer on adjoining land would do the same. But this would be unlikely to lead to a serviceable road. Group decision and action would be much more likely to result in successful completion of a road project.

* D. Kanel, "The Economic Case for Land Reform: Employment, Income Distribution and Productivity," in Peter Dorner (ed) Land Reform in Latin America: Issues and Cases, Land Economics Monograph No. 3, Madison, Wis. 1971 (pp. 52-53).

The same seems to be true of credit. A single small farmer dealing with the credit bureaucracy and requirements imposed by banks is unlikely to obtain credit. However, numerous credit experiments with small farmers have shown that group efforts to obtain credit have often been successful not only in obtaining credit, but in providing a mechanism for bringing about additional change in the community.

Group Credit for Small Farmers

One promising solution to the problem of getting small farmers adequate credit has been to organize groups, societies, associations, or other organizations to facilitate the credit process. These organizations are of several major types, but each has advantages for the government or lending institution. Two types are:

A) An organization, such as Juntas Rurales in Costa Rica, which consists of local farmers who screen and approve loans issued by banks. Loans are granted to individual farmers whose titles or other collateral meet the bank's requirements, and who additionally are seen by members of the Junta as being morally suitable as loan recipients. An inspection of lands under consideration is usually a requirement of such an organization. The major advantage for the bank is that knowledgeable local people are screening the loans to ensure repayment. A common major problem for banks is that they lack trained personnel to inspect farms and make judgments about soil quality, productivity, etc. The local committees ensure that these factors are adequately considered. A major disadvantage of this type of group involvement is that generally local farmers do not have a say in the criteria used by the bank to determine who will receive loans. This often means that ability to repay and security of title may be more important than the effect on productivity.

B) Organizations which apply for and receive group loans, which may then be divided among individual farmers. This system, which was used extensively in the Puebla Project in Mexico, formed credit societies consisting of up to

Judas

Group C:

9 farmers. The farmers themselves determined the membership of their group. They then elected one person to be their representative, and that person dealt with the bank or lending institution. The bank then issues a loan to the group, and collects repayment from the group. It is the responsibility of the members to police the loans from each individual, and make up the difference if default occurs. The major advantage here for the banks is the ability to cut down on paperwork and increase the average loan amount. This enables farm loans to compete in efficiency with other loans made by the bank. A second advantage is the element of group pressure for repayment. In Puebla, group loans of this type had a 92% rate of on-time repayment, compared to 60% for other loans to non-grouped farmers.

Advantages to farmers of this type of organization include access to credit that was not previously available, ability to pressure the banks for changes in procedure more effectively because of status as large lenders, and spread effects of organization into other areas of common farmer concern, such as procurement of fertilizer and other inputs, construction of water systems, etc.

Another major advantage of group activity has been in the information exchanges which take place in the process of discussions about credit and other projects. The meetings provide a forum for exchange of the latest agricultural innovations, discussion of market prices, etc. Many of these group credit projects have been tied to extension information activities, since agents can reach larger numbers of farmers at a time. In Puebla, the extension effort was a key planned part of the overall organizational process, and credit was viewed as the means by which new seed and fertilizer practices could be applied.

An Institutional and Communication Study

Simply creating groups of farmers has not led consistently to successful credit programs in Latin America. In fact, programs which have set up new groups exclusively to receive credit have often failed.* The proposed research would investigate a sample of the many group credit schemes with a focus on the institutional or communication factors which may be responsible for the success or failure of the credit program. Key elements to be analyzed include:

1) It is often said that groups which are most likely to succeed in obtaining and repaying credit, and which are most likely to use credit productively, are those which have been functioning for some time. They may not have focused on credit before, but they have worked out rules and procedures for group activity. They may or may not be related by kinship ties. What are the organizational characteristics of the groups that cause them to succeed? What is it about their past activities or association that makes them function better than newly created organizations?

2) One of the criticisms of the existing banking credit system is that small farmers do not have any control over the design and functioning of the system. Usually this means that the risk is on the farmer, and the bank itself does not suffer if the loans do not result in enough increase in productivity to pay them off. To what extent does group credit lead to changes in this system? Several instances in the Puebla project were documented in which credit society members appealed what they felt were unfair bank practices. In one case, they successfully appealed to the Governor of their province, who directed the bank to "re-examine" its system. How often is this

* See Roger Soles, "Successful Rural Credit Projects in Latin America: Criteria, Characteristics and Analysis," remarks presented at the VI Seminario Internacional de Financimiento Cooperativo, Panama, Nov. 1976.

the case? Is it a predictable effect of certain kinds of group credit systems? In general, does group credit increase local control over the credit process?

3) A major variable in any credit system is the extent to which technical agricultural information is introduced with the credit to encourage a specific type of productivity increase. In Puebla, field days, demonstration plots, community discussions, planning sessions and even assistance at the banks with the loan process was provided by trained communicators. How much technical assistance is necessary to ensure success, and should it be provided by the banking system or the extension system (or some other system)? To what extent is a communication facilitator needed between the group credit representatives and the banks?

4) If technical assistance and group credit organizational factors are held constant, what are the effects of assistance on productivity for small farmers?

5) Group credit offers small farmers a mechanism for greater community participation in decision-making because farmers gather together to discuss common problems and needs. What spin-off effects have been observed from these group credit enterprises? Have they led to group sharing of agricultural inputs or machinery? Have they led to consideration of other community or agricultural problems? If so, how effectively have these been addressed? To what extent should these spin-offs be weighed in to determine the benefit of a group credit program?

6) Overall, what seem to be the characteristics of the group credit system which most likely lead to success in terms of effectively obtaining and using credit, and in terms of productivity and participation in solving other community problems? Phase One of the project would involve data-gathering and analysis of group credit projects in Latin America. As a result of this

analysis, about two dozen group credit projects representing contrasting approaches would be selected for more detailed study. For each case, a history of the groups involved in the credit system and their relationship with each other would be one focus of analysis. In many cases, existing data on productivity and uses of inputs may already be available, allowing more exclusive focus on the institutional and communication aspects of the groups.

For each case, a step-by-step analysis of the credit process would be constructed, with a focus on problems encountered and how these were resolved (if they were). Other communication activities of the credit group, society, organization, etc. would also be documented, as would measures of satisfaction with the process.

Phase Two of the project would test the key organizational and communication conclusions of the project by applying them in a pilot test situation. This could be accomplished by modification of an existing credit program in some Latin American country, or by a pilot program in a new area. This would involve a longitudinal step-by-step analysis of the group credit program as it unfolded with focus on the key elements identified in Phase One.

The result of the research would be a general package of recommendations for countries interested in utilizing a group credit approach to agriculture. It would estimate costs of supporting services necessary for successful implementation of the program as well as time and manpower needs.

Proposed Tentative Budget for Project. Includes 5 year project with 2 year Phase One review of group credit projects in Latin America, plus detailed analysis of 24 selected projects throughout Latin America. Phase Two includes 3 year pilot project to test success criteria developed as a part of Phase One.

Total salaries/overhead/office space, etc.	$2,686,000
Travel/per diem for interviewers and consultants	385,900
Equipment, supplies, analysis and computer time	200,000
Administration of interviewer training program	10,000
Administration of pilot community training program	50,000
Line of credit for pilot program (50% A.I.D./50% local country)	2,000,000
TOTAL	$5,331,900
Total A.I.D. share	$4,331,900

Family and Community Postharvest Grain Project

Family and Community Postharvest Grain Project

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January 2, 1980

The main intent of this project proposal is to portray the broad picture of postharvest grain losses in Central American and preliminary suggested solutions to alleviate those losses. The specific projects and particularly the estimated costs and other inputs for those projects will need to be modified when more complete local conditions and situations are known.

It is commonly estimated that postharvest grain losses in tropical countries will range between 30 and 40% of the total production. These losses basically occur because of two situations that are prevalent.

(1) The crops are allowed to stand in the fields for extended periods of time to field dry to satisfactory levels. During this time much of the grain is destroyed by rodents, insects, birds and biological deterioration.

(2) When the grain is harvested it is of generally poor physical condition and, consequently, continues to biologically deteriorate and be consumed by insects.

The obvious solution is to harvest the grain at an acceptable higher moisture content that will minimize the grain damage and losses in the field. To accomplish this goal, practical, economical, and acceptable methods must be developed and evaluated to satisfactorily preserve the grain that has been harvested at the higher moisture content at both the family and community level.

After the appropriate methods for preserving the grain have been selected, the technology must be disseminated to the farmer by using proven extension teaching methods such as developing demonstration facilities for other farmers to observe.

In-country agencies personnel, such as Extension workers and Peace Corps volunteers can be trained to be valuable teachers of the technology.

It is conservatively estimated that improved techniques for harvesting and preserving grain crops could easily double a Central American farmer's income. The crop could be stored and marketed over a longer period of time rather than being forced to be sold during the market glut at harvest time when the prices are at their lowest. In addition, after the majority of grain producers accepted the improved technology, the consumers would also benefit. The

extremely high prices for grain that commonly occurs just before harvest commences (when there is little acceptable grain for human food) will be minimized. In conclusion, improved technology in harvesting, preservation and storage of grain will reduce both the extreme highs and lows of the flow and the price fluctuation of grain in the market. *Both the Central American farmers and consumers will benefit.*

The target country for this proposed project should be in Central America. The developed procedures and the results should be included in the other AID programs in Central America and all countries, particularly in the Americas, as soon as feasible to do so.

Although there are several specific and separate segments of the proposed project, the necessary surveys, developments, and evaluations should proceed concurrently to expedite disseminating the proven technology to benefit the farmers as soon as possible. Following is a partial list of the activities proposed for this project:

Postharvest Losses - The common postharvest losses need to be known for the major grain crops grown in the different sections of the target Central American country, if this information is not now known. Although all grain crops will benefit, this information will assist in determining which crops need major emphases. It is speculated that maize and rice would generally have the higher postharvest losses and such crops as frijoles and wheat would have the lower losses. Would a survey establish these assumptions as fact? Are there other major grain crops that also have high postharvest losses?

Optimum Time to Harvest - A survey or evaluation needs to be conducted to ascertain the optimum moisture content for harvesting to both minimize field losses and also the cost for preserving the crops.

Moisture Testing - Moisture testing equipment is not common on farm or at the community level in developing countries and it is expensive - probably too expensive for most to afford. What techniques are used by the local people to determine when the different grains are safe for storage? Are the techniques acceptable? Could the techniques be modified to make them more reliable? Can the acceptable techniques for moisture testing be readily taught to the farmer? Gathering these types of information is essential for the project.

Weather Condition - In order to judge viable grain preserving techniques, the average and extremes in the weather for different sections of the target country must be known. The kinds of information that are needed are: temperature,

relative humidities, rainfall, wind velocity and direction, and such solar information as percent of cloudless days and if possible solar radiation. This weather data is needed for the periods when the various grains sould be harvested at optimum moisture content to minimize postharvest losses.

Small Grain Dryers for Families - For centuries grain producers have used the sun for grain drying. Improved techniques to continue to utilize solar energy that will minimize the risks that are common with unexpected rainfall, that discourage farmers from using this technique, need to be developed. In addition, methods that utilize conductive heat grain drying that uses neither electricity nor petroleum should be investigated. Any of these developments should use as much locally available construction material as possible and they should be simple to construct.

Grain Storage for Families - As a part of a well developed and proven maize storage and research project conducted by the IITA (International Institute for Tropical Agriculture) in Nigeria, West Africa, the storage of maize dried to a safe moisture content in tight or sealed barrels has proven most satisfactory. Malthion powder or dust to kill any insect activity that is in the dry grain, is scattered throughout the small grain mass. This practice should be evaluated for all dried grain under Central American conditions.

Maize Drying and Storage for Families - It appears logical that the system for harvesting maize at a high moisture content to be dried for safe storage developed at IITA can be adapted for Central America. The procedure is:

(1) The maize is harvested in the ear between 25 and 30% moisture content.

(2) The husks are removed from the ears of maize.

(3) The husk free ears of maize are stored in a crib that is 1 m wide, approximately 1 m high, and as long as is necessary for the amount of maize to be stored.

(4) A roof approximately 2 m wide covers the crib.

(5) The removable floor (to conveniently unload the crib) is constructed 1 m above the ground.

(6) The main structural poles have conical metal caps constructed around them, just below the crib floor to prevent rodents from entering the crib.

(7) The crib is located in an area that has good access to winds for drying the maize.

(8) As soon as the maize has dried to a moisture content that is low enough for safe storage as grain (approximately 12% moisture content), the maize is removed from the crib and shelled.

(9) The shelled maize is then placed in tight or sealed barrles with malthion added as described above.

This method of maize storage is presently also being evaluated in a project sponsored by Iowa Partners for Progress in the Yucatan, Mexico.

Drying and Storage for Communities - It is proposed that one appropriate dryer for all grains, that would be adaptable for communities, might be a small homemade batch-type dryer. The approximate dimensions would be about 2 m x 2 m x 1 m deep. Since a dryer of this type would need to dry grain rapidly, a fan powered with electricity (if available), an internal combustion engine, or a tractor pto would be necessary. Drying temperatures of 120°F (49°C) to 160°F (71°C) would be needed. Since petroleum based fuels are not readily available and are very expensive in Central America, heating equipment to directly burn crop residues or wood should be developed. Another possibility to supplement the energy needed for heat, that should be investigated, is the use of solar energy.

Although it is speculated that in the most socially acceptable method for storage of the grain dried to a safe storage moisture content would be by individual farmers in tight containers as previously described. Other small, locally built storage units should also be investigated. It is suggested that small, pyramid shaped storage structures, built with masonry bricks, might provide an excellent storage environment for dry grains.

Other Grains Preservation Ideas - There are other possible grain preservation techniques that should at least be considered. They include fermented grain storage, storage with grain preservatives, such as propionic acid, perhaps food canning techniques, and even grain roasting. None of these should be accepted with a great amount of enthusiasm at this stage because experts and/or literature in food technology might indicate that all or some might be an unacceptable preservation method for human consumption. In addition, if any were acceptable, they might be impractical from either an economic standpoint or acceptability by consumers.

The successful completion of the Family and Community Postharvest Grain Project will draw upon expertise of numerous staff members at Iowa State University. Dr. Stephen J. Marley and Dr. Carl J. Bern have expertise in the areas of alternative energy sources such as crop residue burning and utilization of solar energy. Dr. Earl Hammond, and others in the Department of Food Technology, have the knowledge to judge the feasibility of some of the other grain preservation ideas suggested for consideration. The ultimate goal of widespread dissemination of proven, improved techniques for grain storage to farmers is compatible with the project to

evaluate extension methods proposed by Dr. John Tait and Dr. Eric Abbott.

A realistic goal for the successful completion of the Family and Community Postharvest Grain Project is five years. The project would include, not only the development and evaluation of practical grain handling, drying, and storage methods, but also the procedure for widespread dissemination of this technology to the target Central American country farmers.

Although it is presumptive to accurately estimate the cost of the project because of inadequate facts about the availability of laboratories, shop facilities, interested local scientists for in-country leadership, etc., for this proposed project, following is a preliminary cost estimate:

Salaries of two ingenieros agrónomos	$ 60,000
Salaries for other workers and technicians	$ 20,000
Cost for in-country travel (assuming vehicles are available)	$ 15,000
Materials to construct dryers and storage units	$ 25,000
U.S. technician travel	$ 15,000
Salary and expenses for U.S. technician in-country	$ 72,000
	$207,000

DEVELOPING TRAINING PROGRAMS FOR AGRICULTURAL AND RURAL DEVELOPMENT IN CENTRAL AMERICA

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SUMMARY

The major focus of this five year project is the development and implementation of training programs for rural development workers in three Central American countries. This project has four objectives: (a) conducting an assessment of the current communications systems for utilizing rural development information, (b) conducting an assessment of the training needs of rural development workers, (c) developing and implementing training programs for rural developing workers to enhance the development of their professional skills in rural development, and (d) evaluating the effectiveness of the training programs for rural development workers and making recommendations for future rural development training programs in Central America.

Rural development teams, consisting of five or six members, would be selected in each of the three countries to provide leadership in implementing the training program for rural development workers within that country. In addition to contributing to the planning of the rural development worker workshops, these teams would also become involved in teaching some segments of the training content.

Within each country, a geographical area would be selected for implementation of a rural development worker training program. Approximately 40 rural development workers would be trained within this area. The rural development worker training program would be conducted over a one year period.

The training content for the workshops will be designed to provide opportunities for rural development workers to develop their competencies for furthering rural development at the community level. Some possible content areas include developing skills to (1) identify local problems, (2) identifying and involving local leadership, (3) training rural leaders, (4) identifying local level resources, (5) organizing rural development action programs, (6) involving local citizens, (7) establishing planning committees, (8) communicating with local people, (9) organizing action groups, (10) coordinating local groups and (11) evaluating outcomes. The program content would also be developed into applied publications for use by rural development workers.

In addition to developing the rural development training capacity within the three countries and providing opportunities for approximately 120 rural development workers to develop their skills for carrying out rural development, four project reports would be developed. The final report would make recommendations for (1) the development of communications systems for disseminating information and (2) the development of future rural development training programs in Central America.

DEVELOPING TRAINING PROGRAMS FOR AGRICULTURAL AND RURAL DEVELOPMENT IN CENTRAL AMERICA

Introduction

Most integrated rural development programs have increasing agricultural production and family income as major goals. Achieving these goals involves many political, economic, educational, social, and technological decisions. Among these decisions is the problem of how to disseminate appropriate technology, information, and assistance to individuals, families and organizations in the rural sector.

In Central America, many governments have undertaken programs involving both financial and human resources in an effort to improve agricultural production and family income in the rural sector. At the regional level (multi-national), organizational structures have emerged which have established goals for increasing agricultural production and family income. Through these national, regional, and international rural development programs, an increasing knowledge base is being generated which may be applied to rural development at the local community level. Yet, this knowledge base can not be fully utilized unless effective communications systems are developed between national, regional, and international rural development organizations and the local villages and communities throughout the rural sector of Central America.

As an increasing body of knowledge develops related to such topics as higher yielding crop varieties, improved postharvest grain handling methods, improved diets, establishing farm credit cooperatives, providing local health care services, and newer educational opportunities, decision-makers at the national and regional level throughout Central America are concerned with the communication of this knowledge so that it can be effectively utilized by local villages and communities. One of the links which continues to be developed between these national and regional organizations and the local level is the rural development worker employed by the national government and regional organizations. The rural development worker becomes a major link for communicating new information to the local village and community. In addition, the rural development worker provides a major link through which local needs might be communicated to the national and regional level.

provide some of these opportunities is the major focus of this proposal. Through developing the skills and competencies of rural development workers, it is believed that a more effective system for utilizing research and educational information can be developed in Central America.

Objectives

It is proposed that a five year project be undertaken to develop and implement rural development training programs in three selected countries in Central America. This proposal focuses on four major objectives. These objectives are:

a) conducting an assessment of the current communications systems for utilizing rural development information within the three selected countries,

b) conducting an assessment of the training needs of rural development workers within the three selected countries,

c) developing and implementing training programs for rural development workers within the three selected countries to enhance the development of their professional skills and competencies in rural development, and

d) evaluating the effectiveness of the training programs for rural development workers and making recommendations for future rural development training programs in Central America.

The next four sections will elaborate on each of the four objectives stated above.

Assessing the Current Communications System

The first phase of this project would assess the current communications system for utilizing development information within the three selected countries. Before designing the training program for rural development workers, it would be desireable to gain an understanding of how rural development work is conducted within each of the three countries.

During this phase, information would be collected regarding: (1) the nation's philosophy and programs for rural development, (2) the organizational structures from the national level to the local village and community level for delivering rural development programs, (3) the resources available for conducting local rural development programs, (4) the communication linkages between the national level and the local level, and (5) an assessment of current and future rural development training plans.

An important aspect of this phase would be to determine how the present systems are communicating and utilizing research data and information. Are there subject matter specialists (e.g., animal scientists, agronomists, nutritionists, health care workers, etc.) which prepare and communicate information to local rural development workers? How is new information regarding rural development disseminated to rural development workers and the local community? What training programs have been provided for local rural development workers? What has been the content of these training programs? Answers to these questions would be useful in providing background information for the development of the training program.

Another major aspect of the first phase would be to determine the target audience of rural development workers to receive training in later stages of the project. It is suggested that the target audience for the training include rural development workers at different levels, i.e. national, area and local, with a major emphasis being placed on the training of rural development workers who are at the local village and community level.

This first phase of the project would involve legitimizing the project with national leaders of rural development programs in each of the three selected countries and collecting information to provide background data regarding the above questions. Data collected in the first phase would be obtained through personnel interviews with leaders of rural development programs at the national level. It is suggested that ten interviews be obtained in each country or a total of 30 interviews. After assessing the information and finalizing the target audience for the training, the second phase of the project would be initiated.

Assessing the Training Needs of Rural Development Workers

After the target audience has been selected for the training, each rural development worker selected would be invited to participate in the training program. At this time, each rural development worker would be asked to provide information which would be used for developing the training program. A questionnaire would be developed to collect data such as the following:

a) role assignments and areas of work,

b) resources available for carrying out rural development,

[illegible] of this phase would [illegible] specialists (e.g., [illegible] other workers, etc.) [illegible] rural development [illegible]

[illegible] overriding issues [illegible] reports.

[illegible] in appraising the [illegible] larger audience for the [illegible] different levels [illegible] placed on the training of [illegible] at community level [illegible] emphasizing the content [illegible] each of the three [illegible] background data [illegible] these would [illegible] development [illegible] interview [illegible] not for the training, the second [illegible]

[illegible] the Training Needs of Rural Development Workers [illegible]

[illegible] has been selected for the [illegible] each [illegible] would be invited to participate [illegible] each rural development work [illegible] which would be used to develop the [illegible] could be developed to collect data [illegible]

c) target audiences being served at the local level,

d) linkages to area, national, and regional institutions concerned with rural development programs,

e) linkages to the resources of the local village and community

f) sources of information used in rural development,

g) attitudes toward rural development,

h) past involvement in rural development training programs and future training needs,

i) personal and social characteristics

Forty rural development workers would be selected in each country. A total of 120 would be selected for the program in the three countries selected for the project.

Alternative methods would be explored for collecting the data from the 120 rural development workers selected for the program. If feasible the information would be collected through a mail questionnaire. If this alternative is not feasible, the data would be collected through personal interviews.

The major purpose in completing this phase is to gain an understanding of the audience to be trained. This data will be used in determining the content and the strategy for designing the rural development workshop in which they will participate. After analyzing and interpreting the information collected from the first two phases, the information provided would be used in designing the rural development training workshops.

Developing and Implementing Training Programs

The third and fourth phases of the project would involve the development of the training program and the implementation of the training workshops in each of the three selected countries. Since the development of the training content and the workshop format is dependent in part on the information gathered through the first two phases, only a general format for the third and fourth phases are described here. Also, knowledge gained from other training models and programs used in Central America or in other developing countries would be used in developing and implementing this training program.

1. Developing the Training Program

A small rural development team would be selected in each country to provide leadership and assistance in developing the training program. In addition to providing planning inputs, this team would be expected to assist in conducting some aspects of the training workshops. Another aspect would be to develop the competneices of this team to organize and conduct other training programs beyond those conducted as a part of this proposal. Involving a small rural development team at the national level would enhance the capacity for building future rural development training programs.

The proposed rural development team might consist of five or six individuals who have responsibilities for various aspects of rural development. This core group might consist of an administrator, a training officer, a communications expert, an agricultural specialist and one or two research workers concerned with the communication and utilization of research findings. Additional individuals may be identified which could be included in the core group. This identified group would provide leadership and assistance in working with the project staff in developing the training workshop programs.

The overall objective for the training workshops is to provide opportunities for rural development workers to develop their competencies for furthering rural development at the community level. The assessment of the training needs from the second phase will assist the project staff and rural development team in determining the specific objectives for the workshops. Based on country needs, the workshops in the three countries are likely to have some aspects that are quite similar but other aspects that are quite different. At this stage, some specific objectives for the workshops might be:

a) creating awareness of resources available for carrying out rural development programs at the local level,

b) developing skills for communicating rural development information to individuals, families, and organizations at the local level,

c) developing process skills for mobilizing local, national and regional resources for carrying out rural development programs at the local level,

d) enhancing the developing of linkages between the local community and rural development organizations and structures outside the local community, and

e) developing rural development projects for implementation.

[illegible]

[illegible]

[illegible] from the second phase will assist the [illegible] specific objectives [illegible]

a) [illegible] development [illegible]

b) [illegible] information [illegible] individuals, [illegible] entities, and organisations at the local level;

c) [illegible] for mobilising local, national and [illegible] carrying out rural development [illegible] at the local level;

d) enhancing the development of linkages between the local community and rural development organisations and [illegible] outside the local community; and

e) developing rural development projects for implementation.

Each of the above objectives is briefly discussed below to give an overview of some of the content which might be included with each objective.

a) creating awareness of resources available for carrying out rural development programs at the local level.

The members of the rural development team would develop this segment of the training program to create greater awareness of resources available at the national and regional level for rural development. This part would include increasing the knowledge level about available information for local rural development programs. It might also outline some of the rural development research projects which will be generating information which can be used at the local level. Also, this segment might deal with the communication channels through which they may receive new information being generated through research projects.

b) developing skills for communicating rural development information to individuals, families and organizations at the local level.

For each workshop, the team members would select one or two priority problem areas. For these priority areas, some new research findings would be presented by a research member of the team. Following the presentation of the information, various methods for communicating the information would be presented and discussed, e.g. demonstrations, neighborhood talks, farm and home visits, radio, organizations, etc In workshops, the participants would develop plans for disseminating the information. After the workshops, they would be encouraged to carry out their plans. The major purpose to be achieved would be the development of skills for communicating information.

c) developing process skills for mobilizing local resources in carrying out rural development programs at the local level.

A major segment of the training program would focus on developing skills to mobilize and involve local people and resources in rural development programs. Some possible content areas are:

1) Identifying major problems
2) Identifying and involving the local leadership
3) Training local leaders
4) Identifying local level resources

4) [illegible]
3) [illegible]
2) [illegible]
1) [illegible]

5) Organizing rural development action programs
6) Involving local citizens
7) Establishing planning committees
8) Communicating with the local people
9) Organizing action groups
10) Coordinating local groups
11) Evaluating outcomes

The objective would be to provide the participants with practical techniques which they could apply to local rural development programs. The training would involve the participants in activities where they would practice using the techniques. Projects might be designed which they could carry out in their local communities.

d) enhancing the development of linkages between the local community and rural development organizations and structures outside the local community.

With the involvement of the rural development team in the workshop, linkages would be further developed between the two groups. Ways would be explored with the rural development team and the participants in the workshop on how to further strengthen relationships to meet local needs.

e) developing rural development projects for implementation.

This objective might be achieved by having the participants develop an activity for carrying out a rural development action program. One example might be developing a family or community project to reduce postharvest grain losses. Research findings and alternative methods from the project proposed by Dr. Larry Van Fossen would be one example of a project which participants might develop and implement. Another example might be the development of a rural group credit program based on findings from the project proposed by Dr. Eric A. Abbott. Other ideas of concern to the participants might be used to develop plans for carrying out a project. The project selected for development should be one that they plan to carry out with the local community.*

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*For a discussion of these proposed projects, see Larry Van Fossen's proposal entitled "Family and Community Postharvest Grain Project" and Eric A. Abbott's proposal entitled "Institutional and Communication Factors Affecting Small Farmer Participation in and Success of Rural Group Credit Programs." IICA-ISU Continuing Seminar, San Jose, Costa Rica. February 1980.

In addition to the above suggested content areas, other areas suggested by both the assessment in phase 2 and the rural development teams would be considered.

2. Implementing the Training Program

The training program would be implemented in two phases. The first phase would focus on the training for the rural development teams, while the second phase would involve training the rural development workers in each of the three countries. Each phase is outlined below

a) Rural Development Team Workshops

After completing the first two phases of the project, a training workshop, possibly two weeks in length, would be held for the rural development teams selected in each of the three countries. One objective for this workshop would be to focus on the needs for rural development training programs and the role which they may play in the rural sector.

At this workshop, the findings from the assessment of the current communications system and the assessment of the training needs for rural development workers would be presented and discussed. These data would be used by the project staff and the rural development teams in developing the training objectives and the program content for the rural development worker training workshops to be presented in each of the three countries.

The final objective of this workshop would be to develop the objectives and the content areas for the rural development worker workshops. Assignments for the development of the content areas would be divided among the project staff, consultants and the rural development teams. Each rural development team would be expected to develop and teach some of the training content for the respective country. The project staff and consultants would also develop and teach a major segment of the training content. The methods for carrying out the training program would also be determined during this workshop.

This first rural development team workshop would be planned for a two week period. Fifteen to 18 participants from the three countries plus the project staff would participate in this workshop. A location central to the three selected countries would be chosen for this training workshop.

Approximately six months after the first workshop, a second rural development team workshop would be held with each of the three teams in the respective country. The objective for these three workshops would be to present and evaluate the program content which has been developed and finalize the mechanics for carrying out the rural development worker training workshops. Approximately one week would be allocated for each of these workshops. Each workshop would be presented at a location within the respective country.

A final workshop for the rural development teams would be held approximately six months after the completion of the rural development worker workshops. The objectives for this workshop would be to evaluate the project, including both the rural development team and rural development worker aspects of the training program. Implications of the training program for future training programs in Central America will also be articulated.

b) Rural Development Worker Training Workshops

The rural development worker training workshops would be conducted in each of the three countries selected for the project. It is suggested that an area or region within each country be selected as the target area from which rural development workers would be selected for the training programs. Approximately 40 rural development workers would be selected in each country for the workshop program. Several factors might determine the geographic area from which these workers would be selected such as the time and distance for the rural development workers to travel to the workshop location, the costs involved and other factors.

The proposed content areas for the rural development training workshops have been outlined above. Other areas that evolve through analyzing the data in the first two phases and the contributions of the rural development teams would also be considered in planning the content for the training program.

The program content will be presented by the project staff, the rural development teams and other consultants which might be used for selected segments of the program. Another major aspect of the training would be involving the participants in applied projects to utilize the information presented and the knowledge gained. Such a program would have a balance between staff and participant inputs into the workshop.

Several methods might be considered for delivering the program content. One method is to design a series of training workshops over a one year period. With this format, the participants might participate in several short workshops at different intervals during the year. Such a format would provide the participants with the opportunity to apply the information presented during the training sessions to local community problems. This would also allow the participants to provide feedback on the use of the information and how it had an impact on affecting local rural development projects.

It is proposed that the training be provided over a one year time period. The training would be held within the geographic areas selected for the project or as near as feasible to where the rural development workers carry out their roles. After one year's participation in the program, the rural development workers would be involved in evaluating the projects to determine its effectiveness in achieving the project goals.

Evaluating the Training Program

The final phase of this project would evaluate the effectiveness of the training programs for both the rural development team members and the rural development workers to achieve the program's objectives. The evaluation would consist of three aspects. First, the rural development workers in each country who participated in the training program would evaluate the training program. In addition to evaluating the program at its conclusion, the rural development workers would be asked to evaluate the program at six month and 12 month intervals after the training program has been completed. This evaluation would attempt to determine the impact of the program in affecting behavior after the workshop has been completed.

The second aspect would focus on an evaluation by the rural development teams. In addition to their assessment of the rural development worker training program, they would assess the impact the program had on developing the capacity to deliver training programs within their country. This evaluation would also focus on future plans for rural development training.

The final aspect would include the project staff's evaluations. Based on the implementation of the project and the evaluations from the rural development workers and the rural development teams, the project staff would

make recommendations for future rural development training programs within the three countries and other parts of Central America.

Project Reports and Publications

The major reports and publications evolving from this project would include the following:

a) a report assessing the current communications system for utilizing rural development information within the three selected countries,

b) a report assessing the training needs of rural development workers within the three selected countries,

c) a number of applied publications on strategies for conducting rural development programs for use by rural development workers in Central America,

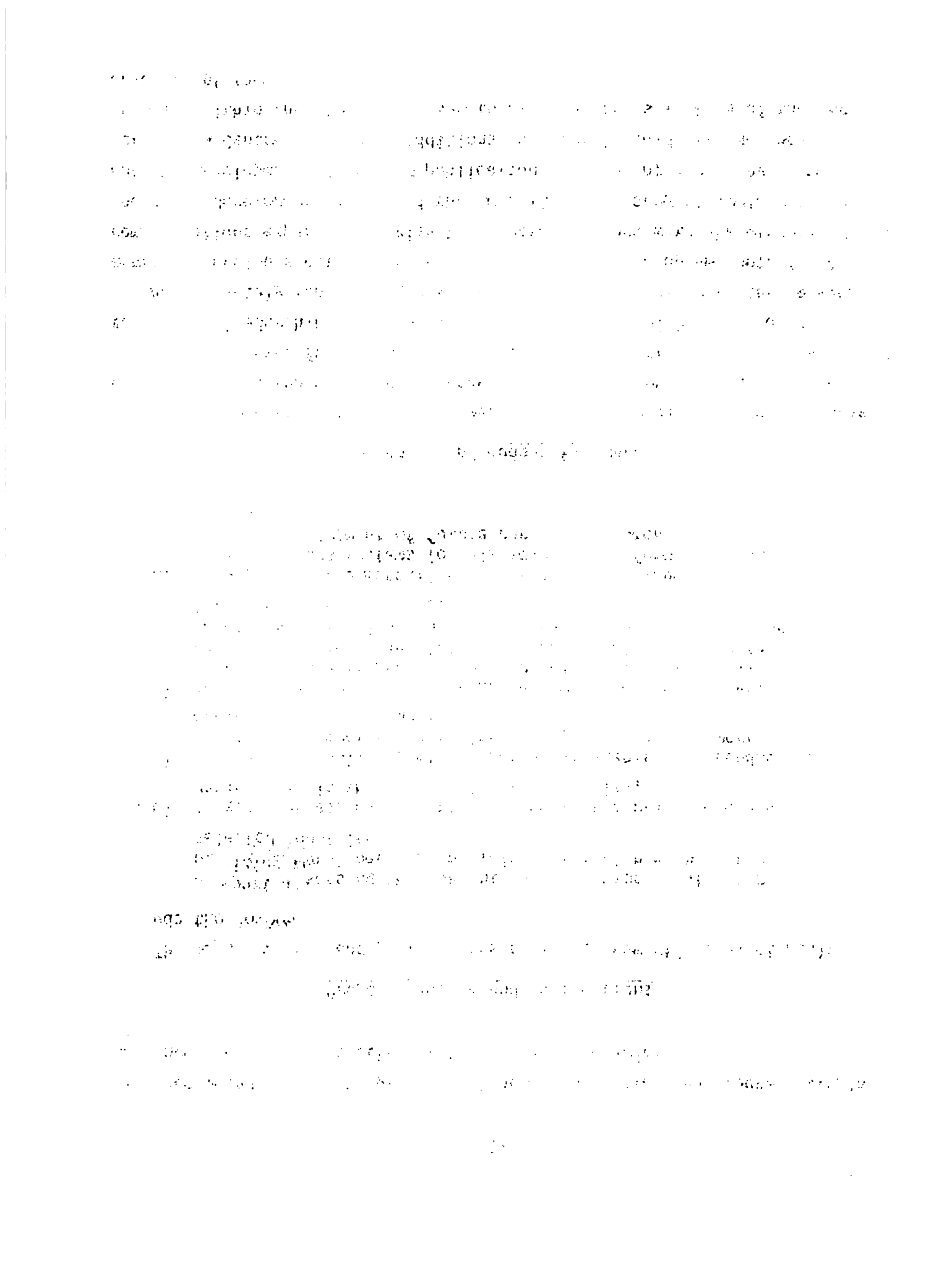
d) an evaluation report assessing the impact of the project on (1) the development of rural development worker skills at the local level and (2) the capacity building of rural development training programs at the national level in the three selected countries, and

e) a report on recommendations for (1) the development of communications systems for disseminating information and (2) the development of future rural development training programs.

Personnel and Budget Estimate

It is proposed that this five year project be co-directed by two individuals, one from the U.S. and the other from Latin America. In addition, a project director from within each of the three countries would be selected to provide leadership and direction for the project within the country.

Approximately ten consultants would be selected for short term assignments to develop specified segments of the training program content. A communications expert would also be selected to work with the project staff, the rural development teams and the consultants on project implementation and the development of applied publications for use by rural development workers in Central America. Additional personnel would include those selected within the three countries to participate as members of the rural development team.



The estimated budget for this five year project is approximately $5,000,000. The direct cost to AID for the five year period would be approximately $2,500,000, while the cost to the three participating Central American countries would be approximately $2,500,000. A more detailed budget will be provided during the IICA-ISU Continuing Seminar on February 25-28, 1980.

PROJECT IDENTIFICATION DOCUMENT

National Cooperative Soil Survey of Costa Rica[1]

A recent USAID Report (February 1977) states that the land and climate of Costa Rica permits the cultivation of a wide variety of crops. However for certain important categories such as field crops, the suitable areas are limited. Also, colonization is taking place in remote areas spontaneously and under government direction. Large areas of the country that presently are still covered by virgin hardwood forests will be bare by the end of the century if current cutting rates continue. Poor policies, pasture expansion, and little public control are cited as contributing to this problem. Removal of the forest cover leads to soil erosion and the destruction of watersheds. The USAID report defines the most critical problem facing the agricultural sector as deforestation and the attendant destruction of soil and water resources. If this process is not halted there will be little resource base left upon which to build future agricultural development. A specific policy and program recommendation listed in the USAID report is "improved land and resource information systems to provide the accurate and timely information necessary to formulate above policies and programs." The proposed project defines the means to develop a National Cooperative Soil Survey Program for Costa Rica so that the land natural resource base can be inventoried, studied, and evaluated to aid in future policy and planning decisions involving land use.

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[1]Prepared by T.E. Fenton, Professor of Agronomy, Iowa State University, Ames, Iowa 50011. December 1979.

Description of Proposed Project

The purpose of this project is to initiate and eventually complete a detailed soil survey of Costa Rica. The project consists of the following phases:

1. Establishment of a cooperative soil survey program in Costa Rica and development of its administrative structure.

   The cooperative agreement would include the Vice-Ministry of Agriculture for Natural Resources and OPSA, the University of Costa Rica, and the states or provinces. Iowa State University will provide technical and administrative assistance. Partial funding will be requested from sources outside Costa Rica with the remaining funds to be provided by the Republic of Costa Rica.

2. Training of Costa Rican soil scientists.

   Training of soils scientists will be a joint effort between the University of Costa Rica and Iowa State University. Minimum requirements for a soil scientist include a degree in Soils or in a closely related area with emphasis on Soils and a special training program to be developed as a part of this project.

3. Acquisition of base map imagery.

   Imagery will be acquired as needed at a scale commensurate with soil and landscape patterns.

4. Statistical sample mapping, mapping unit legend preparation and establishment of correlation procedures.

   The mapping legend will be developed by mapping a two-percent sample, randomly selected, over the entire country. Drafts of soil series will be prepared and refined as mapping progresses. Correlation procedures will be established and preliminary legends established for each survey area.

5. Field mapping of soils concurrent with supporting laboratory field studies.

   Field mapping of survey areas by soil survey parties composed of a party leader and one or two additional soil scientists. Field and laboratory studies of soils and landscapes that are needed to better understand and classify the soils will be in progress prior to and concurrent with the field mapping. Field experiments relating to crop and management system and erosion hazard by soil units will also be in progress.

[illegible]

[illegible]

[illegible]

2. [illegible]

[illegible]

3. [illegible]

[illegible]

4. [illegible]

[illegible]

5. [illegible]

[illegible]

6. Compilation and publication of soil maps and soil reports.

   The above phases will be completed as mapping is finished in each survey area.

7. Development of educational programs concerning soils and land use.

   Contrasting soil characteristics will be emphasized by soil monolith displays. Soil characteristics and interpretations, land use, and soil and water conservation will be integrated in this phase of the program.

8. Soil survey field and laboratory data will be integrated into a national land and resource information system.

   It is proposed that the compilation of soil maps for publication be done in computer format so that the data is readily available for storage, retrieval, manipulation, and integration with other data bases.

The area of Costa Rica is approximately 5 million hectares. Of this area, 3.1 million hectares were classified as farmland in 1973. The additional 2 million hectares are mostly forest land. Cost of the field work will depend in large part on the detail mapped. It is anticipated that sloping forest land would be mapped in less detail than the farmland. The use of the farmland in 1973 is shown in Table 1.

Table 1. Farmland in Costa Rica - 1973.

Use	Hectares	Percent
Cropland	490,459	15.7
Pasture	1,558,053	49.9
Woodland	716,518	22.9
Other	357,423	11.5
Total Farmland	3,122,454	100.0%

It is estimated that approximately ten years would be required to complete the field mapping portion of this project with trained soil scientists. This estimation is based on the assumption that a staff of

thirty field soil scientists would each map approximately 16,000 hectares per year. Technical and administrative guidance will be provided by a central staff from the cooperating agencies. It is recommended that Iowa State University provide a full-time soil scientist for the first five years of the program and, in addition, as needed, a professor of soil genesis and classification. The last five years, Iowa State University personnel would be available on a consulting basis. The Iowa State University scientist would be paid from the requested funds. Financial support for other phases of the program will be negotiated between the granting agency outside Costa Rica and the cooperating agencies.

The soil survey will provide detailed soil information about kinds of soil and the location of the soil on the landscape. Soil characteristics that are used to define different kinds of soils include texture, slope, drainage, degree of erosion, acidity, stoniness, and fertility. Soils can be interpreted to aid decision makers in problem areas that range from limitations for selected crops to developmental and economic decisions regarding land use.

Financial Requirements and Plans

It is estimated that the field mapping portion of the project will cost twelve million (1980) dollars. This cost plus the other costs associated with the program will be shared by the granting agency and the cooperating agencies. It is anticipated that the University of Costa Rica and the Ministry of Agriculture would make available their staff and facilities already devoted to this kind of work.

Development of the Report

It is anticipated that preliminary meetings would be held with the potential cooperating agencies in this proposed project to determine the resources they presently have available in this area.

Identification and Development of Central American Energy Resources

Proposal submitted by Stephen J. Marley
Professor of Agricultural Engineering
Iowa State University

January 1980

Introduction

Energy is important in developing both the agricultural and industrial sectors of the economy or a region. In production agriculture, energy is required for land clearing, tillage, control of weeds and unwanted vegetation, planting, harvesting, crop preservation, and irrigation. Energy is required for transportation of production inputs and agricultural products. Examples of industrial energy uses related to agriculture are manufacture of agricultural tools and implements, and manufacture of fertilizers.

In traditional agriculture, much of the energy input for crop culture is provided by human or animal power. In many cases this may be appropriate technology, but where other sources of power are available, humans do not compete well as an energy source. A man can work at a sustained rate of only 75 watts; he can perform 0.75 kW-hrs of work in a 10-hr day. The same amount of energy can be obtained by burning 0.4 liters of petroleum in an internal combustion engine, or by operating a 250 watt (1/3 hp) electric motor for 3 hours.

Potential Energy Sources

In common with most of the world, Central America lacks domestic petroleum. It is highly desirable to expand the energy resources and to replace to whatever degree is feasible, imported oil with domestically produced energy. Several energy sources might be developed:

Identification and Development of
Central American Energy Resources

Proposal submitted by Dr. [illegible]
Professor of Agricultural Engineering;
Iowa State University

[illegible]

Introduction

Energy is important in developing both the agricultural and industrial sectors of the economy of a nation. In non-traditional agriculture, energy is consumed for land clearing, tillage, control of weeds and unwanted vegetation, planting, harvesting, crop preservation, and irrigation. Energy is required for transportation of production inputs and agricultural products. Examples of industrial energy use related to agriculture are manufacture of agricultural tools and implements, and manufacture of fertilizers.

In traditional agriculture, most of the energy input for crop culture is provided by human or animal power. In many cases this may be appropriate technology, but where other sources of power are available, humans do not compare well as an energy source. A man can work at a sustained rate of about 75 [illegible] of work in a 10-hr day. The same amount of energy can be obtained by burning 0.4 liters of petroleum in an internal [illegible] a 250 watt (1/3 hp) electric motor for [illegible] hours.

Potential Energy Sources

In common with most of the world, Central America lacks domestic petroleum. It is highly desirable to expand the energy resources and to replace to whatever degree is feasible, imported oil with domestically produced energy. Several energy sources which might be developed:

1. Wood and forest residues
2. Primary crop products, crop by-products, and crop residues
3. Water for hydro-electric power
4. Wind
5. Animal manure
6. Solar

Possible Methods of Utilization

1. Direct burning of wood or crop biomass in stoves or furnaces ranging up to those used in small power plants.
2. Conversion of crops, by-products, or residues to alcohol.
3. Installation of hydro-electric power plants.
4. Installation of windmills for mechanical power or for electric power generation.
5. Digestion of manure to produce methane gas.
6. Installation of solar collectors.

Project Focus

The first task would be to identify the most feasible energy sources, considering availability, energy quality, and the economics and technology needed to utilize the energy source. All energy forms are not equally valuable. Energy for heating can be obtained relatively easily by burning combustible materials, or from solar collectors. Energy in the form of a liquid fuel or as electricity is more valuable because of its transportability and its ability to be easily converted to mechanical power to drive vehicles or other machinery.

Since there is concern about the depletion of forests, it may be desirable to decrease wood usage. Forest resources should be inventoried,

1. Wood and forest residues
2. Primary crop products, crop by-products, and crop residues
3. Water for hydro-electric power
4. Wind
5. Animal manure
6. Solar

Possible Alternative Technology

1. Direct combustion of wood or crop biomass in stoves or furnaces ranging up to those used in small power plants.
2. Conversion of crops, by-products, or residues to alcohol.
3. Installation of hydro-electric power plants.
4. Installation of windmills for mechanical power or for electric power generation.
5. Digestion of manure to produce methane gas.
6. Installation of solar collectors.

Evaluation

The first task would be to identify the most feasible energy sources, considering availability, energy policy, and the economics and technology needed to utilize the energy source. All energy forms are not equally valuable. Energy for heating can be obtained relatively easily by burning combustible materials, or from solar collectors. Energy in the form of a liquid fuel or electricity is more valuable because of its transportability and its ability to be easily converted to mechanical power to drive vehicles or other machinery.

Since there is concern about the depletion of forests, it may be desirable to decrease wood usage; forest resources should be investigated.

and use of wood for fuel would have to follow sound forest management practices. Crops produce substantial amounts of residues that might be used for burning. This resource also should be inventoried, and the effects of its use as a fuel on soil conservation and fertility must be considered.

Solar energy is abundant, but not very concentrated, and seems to offer few applications except for crop drying, water heating, and space heating in some areas.

Methane produced by digestion of animal manure represents an energy source that can be used for heating or to operate stationary internal combustion engines. However, collection of the manure is feasible only where the animals are kept in confinement, so there are probably only a few instances where methane production could be significant.

Alcohol, water, and wind energy seem to offer the best possibilities for development of energy sources.

Alcohol is a liquid fuel. It is portable and can be used in internal combustion engines. Liquid fuels are the fuels in shortest supply.

Central America produces sugar cane; a crop that is an excellent candidate for alcohol production. The plant juice can be fermented to alcohol instead of being refined to sugar, or the molasses, which is a by-product of sugar processing, can be fermented to alcohol. Alcohol production requires substantial energy input in the form of heat for distilling the alcohol. This heat energy can be supplied by burning the bagasse (fibrous cane residue) remaining after the plant juice is removed. At present bagasse is used in processing sugar cane.

Other Central American crops might also be used for producing alcohol. Any starch source, such as waste or cull bananas, can be a feedstock for alcohol. Grains such as corn or wheat could be used for alcohol if they were in oversupply.

The potential for electric power generation from water power should be investigated. Consideration should be given to both large and small scale power plants. Small plants are advantageous because they are dispersed and the power is available locally without the need for long transmission lines. They can be installed without the need for large dams and with minimum environmental impact. Larger plants may have important flood control and irrigation benefits.

The potential for wind power also merits investigation. Wind power can be used directly for applications such as pumping water, and for electric power generation. Relatively small units are probably most feasible. Small units are quite portable, can be installed in remote areas, and are less vulnerable to storm damage than are larger windmills.

Procedure

A. For Alcohol

1. Determine the potential production of crops for alcohol and the potential alcohol yield.
2. Determine the feasibility (required investment, cost of alcohol production, need for and availability of labor) of alcohol production.
3. Determine the optimum type, size, and location of alcohol plants.
4. Build and operate a pilot plant to identify potential problems and to demonstrate feasibility.

For Water Power

1. Determine the potential for and feasibility of hydro-electric power generation.
2. Select a suitable site and install a pilot plant to identify problems and demonstrate feasibility.

C. For Wind Power

1. Determine the potential for and feasibility of wind energy for mechanical power and electricity generation.
2. Select a suitable site and install a pilot plant to identify problems and demonstrate feasibility.

Project Scope, Cost, and Duration

Scope and cost depend upon whether one, two or all three of the alcohol, water, or wind power components of the proposal are pursued. Project cost also greatly depends upon the size of pilot plants built. These decisions would have to be made in conjunction with cooperating and funding agencies. Realistic project duration would be five years from time of funding.

Cooperating Agencies

Central American governmental agencies

USAID

Iowa State University

C. For [illegible]

1. [illegible] the potential [illegible] feasibility [illegible] energy for mechanical power and electricity generation.

2. [illegible] install [illegible] plant [illegible] quantity [illegible]

[illegible]

<u>Scope [illegible]</u>

Scope and [illegible] depend [illegible] two or all [illegible] the alcohol, [illegible] or with [illegible] component [illegible] proposal are pursued [illegible] project cost [illegible] upon the [illegible] pilot plants built [illegible] decisions [illegible] to be made at [illegible] cooperating and funding agencies. [illegible] project [illegible] would be five years from time of funding.

[illegible]

[illegible]

[illegible]

PROPOSAL FOR DEVELOPMENT OF HORTICULTURAL TEACHING, RESEARCH AND EXTENSION PROGRAMS IN COSTA RICA

Presented by:
Charles V. Hall, Head
Department of Horticulture
Iowa State University
Ames, IA 50011

JUSTIFICATION:

Future development of food production, harvesting, handling and storage technology by small farmers and large scale commercial producers will depend largely on technological methods developed within the country. In addition, industries involved with developing native and introduced plant species as ornamentals for use in Costa Rica and for export depend on sophisticated technology. The future living standards of small farmers and all citizens as consumers of horticultural food crops will be affected by the levels of technology available, its use and transmission to students who will become future agricultural and business leaders.

Therefore, the purpose of this proposal is to develop educational programs for training the following future leaders:

A. Teaching and Research Staff in the areas of:

1. Vegetable production, improvement, handling, transportation, and storage.
2. Fruit production, improvement, handling, transportation, and storage.
3. Systems for development, production, shipment, and use of ornamentals.

PROPOSAL FOR DEVELOPMENT OF

HORTICULTURAL TEACHING, RESEARCH

AND EXTENSION PROGRAMS IN COSTA RICA

Prepared by
Charles V. Hall, Head
Department of Horticulture
Iowa State University
Ames IA 50011

JUSTIFICATION:

AGRICULTURE development of food production, harvesting, handling and [illegible] by small farmers and large scale commercial [illegible] storage [illegible] many [illegible] with produce [illegible] involved with developing native [illegible] plant species as ornamentals for use in Costa Rica [illegible] and [illegible] based on sophisticated technology. The future living [illegible] and for [illegible] farmers and all citizens as consumers of high [illegible] standards will be [illegible] by the [illegible] of technology available [illegible] rural food [illegible] students who will become future agricultural [illegible], its use [illegible] leaders.

Therefore, [illegible] and business [illegible] of this proposal is to develop educational programs for [illegible] the following future leaders:

Teaching [illegible] Staff in the areas of:

1. Vegetable production, improvement, handling, transportation, and storage.

2. Fruit production, improvement, handling, transportation, and storage.

3. Systems for development, production, shipment, and use of ornamentals:

B. Extension Staff and Programs:

1. Horticultural management specialists.
2. Field staff for implementation of new technology.
3. Staff for coordination of testing and demonstration programs for small farmers and business.
4. Training of technical agri-business representatives.

C. The final proposal should contain the following supporting data which will be developed jointly by the personnel of the University of Costa Rica, CATIE and Iowa State University.

1. Crop species currently produced including distribution, volume, season, and ultimate use.
2. Population statistics to include small farm producers, commercial producers, supporting agri-industries, and consumers.
3. Identification of major production, handling, storage, and transportation problems.

II. OBJECTIVES:

A. To provide advanced horticultural training for Costa Rica University faculty as teachers, researchers, and extension specialists.

B. To develop undergraduate horticultural programs to include:

1. Courses in principles, plant propagation, plant improvement, and seed technology; vegetable production, harvesting, handling and storage; ornamental plant identification and culture; tropical greenhouse production; and others related to horticultural crops.
2. Identify necessary supporting courses in soils, pest management, economics, business, food technology, and basic sciences.
3. Integrate the above into a curriculum.
4. Develop and implement graduate level courses in cooperation with CATIE

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2. Field staff for implementation of new technology.

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3. Integrate the above into a curriculum.

4. Develop and implement graduate level courses in cooperation with

5. Develop reciprocal exchange programs for faculty, graduate, and undergraduate students.

C. To define research projects and extension programs to:

1. Seek solutions to current production, harvesting, handling, transportation, and storage problems of fruits and vegetables.

2. To develop greenhouse methods for solution of tropical crop production and management problems (food and ornamental crops).

3. To develop strategies for future advancement of the small farmers, horticultural industries, and for improvement of standards of living for the disadvantaged.

III. PROCEDURES:

A. Staff or Faculty Training - Initially, selected staff members from the University of Costa Rica and CATIE will be supported for taking advanced courses at Iowa State University. Such programs are now in existence.

Marcos Moreira from the University of Costa Rica was at Iowa State University observing vegetable and small fruit extension and production research programs in May and June, 1979. He will return in 1981 for a graduate degree program supported by an assistantship from ISU.

Guillermo Sancho from the UCR will observe fruit production research at ISU during the summer of 1980. The proposed program would enable participation of other staff, graduate students, and undergraduates from both institutions in exchange programs.

B. Graduate student research projects would be done in Costa Rica and at Iowa State University. Research projects would be designed for development of new technology for Costa Rica, training of program participants, and development of research and extension

5. Develop reciprocal exchange programs for faculty, graduate, and undergraduate students.

C. To define research projects and extension programs to:

1. Seek solutions to current production, harvesting, handling, transportation, and storage problems of fruits and vegetables.

2. To develop greenhouse methods for solution of tropical crop production and management problems (food and ornamental crops).

3. To develop strategies for future advancement of the small farmer, including rural industries, and for improvement of nutritional quality for the disadvantaged.

III. PROGRAMS

A. Staff or faculty training - Initially, selected staff members from the University of Costa Rica and CATIE will be supported for training in short terms at Iowa State University. Such programs are now in progress.

[illegible] from the University of Costa Rica was at Iowa State University observing vegetable and small fruit extension and research programs in May and June, 1979. He will return in 1981 for a graduate degree program supported by an assistantship from ISU.

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B. Graduate student research projects would be done in Costa Rica and at Iowa State University. Research projects would be designed for development of new technology for Costa Rica, training of program participants, and development of research and extension

C. Library resources and suitable educational support programs for horticulture are to be developed at the University of Costa Rica and CATIE as necessary.

D. Spanish-English language capability of both Iowa State and Costa Rican participants will be enhanced. This will provide for improved educational and cultural exchange programs in the future.

E. Plans will be developed for integration of future commercial production in irrigated areas of Costa Rica with those of current small farmers in order to prevent competition to small farmers and permit maximum production capabilities for the Guanacaste, Cañas region.

IV. COOPERATING AGENCIES

A. University of Costa Rica

B. CATIE

C. Iowa State University

V. BUDGET AND FINANCIAL SUPPORT

A. Personnel:

1. University of Costa Rica

a. Faculty

b. Graduate student support

c. Undergraduate scholarships

2. CATIE

a. Faculty

b. Graduate student support

3. Iowa State University

a. Faculty

b. Graduate student support

C. Library [illegible] for
Horticulture [illegible] with
and CATIE [illegible]

D. [illegible]
[illegible]
[illegible] future.

E. Class [illegible] III [illegible]
product [illegible] of [illegible]
small farmers [illegible]
and not [illegible],
[illegible]

IV. [illegible]

A. [illegible] of [illegible]

B. CATIE

C. Iowa State University

V. BUDGET [illegible]

A. [illegible]

1. [illegible]

a. [illegible]

b. [illegible]

c. [illegible]

2. CATIE

a. [illegible]

b. Graduate [illegible]

3. Iowa State University

a. Faculty

b. Graduate student support

B. Operational Costs: each agency

1. Cost of living support

2. Travel

3. Supplies

4. Rental fees

C. Equipment, facilities, library books, and materials

D. Indirect costs

Project Identification Document

1. Summary of the problem to be addressed and the proposed response to the problem:

Some edible products of Central America are said to be poorly used because of lack of processing. If their use could be increased, importation of food possibly could be reduced and foreign exchange saved.

1) We propose to identify the products that have the greatest promise in meeting these objectives and to identify and characterize potential customers of the proposed processed products. After the products that might be made are identified, the technology for making them may need to be developed or adapted to conditions in Central America. The product may need to be made on a small scale and test marketed. For products that are acceptable, manufacturing facilities should be build or current facilities expanded. Personnel to manage the plant and maintain quality should be identifed or trained.

2) To achieve these goals we will need to survey the products that are produced and which are being poorly used. (Some thought obviously has been given to this matter already, but it is not clear to the author how complete or reliable the data may be.) We will need to know when and where these products are produced. How much is produced, and can the amount that is currently available could be expanded? What currently is the fate of this product, and what will probably happen if it is diverted to new uses? Who owns the product, and is it for sale? What will it cost? Are there problems of the uniformity or quality of the product? Are there problems of transportation and gathering of the product?

The characteristics of the people who might buy the processed products should be considered carefully. The kind of information required will depend on the nature of the proposed processed product. If it is a standard item that the potential customers are used to eating, we need only consider how to get them to eat more (availability, price, promotion, quality?) and what items in their current diet are likely to be displaced. If the processed product is an unfamiliar one, we will need to discover what properties it should have to gain easy acceptance and how it can best be promoted. It is probable that several consumer surveys will be required.

The amount of technological development needed also will depend on the nature of the proposed product. In some instances processes and machinery for their execution will be readily available. In other instances processes and equipment will need to be adapted to special conditions in Central America. In other instances considerable product development and research may be required. If the processed product is one unfamiliar to the consumers, it is important to produce it on a small scale for market testing before going on to full scale production.

If acceptable products can be produced, the facilities in which they can be made must be considered. Who will provide the capital needed? Where should the plants be located? How many plants? What scale? Can managers with the necessary skills be found or will they need to be trained? What quality standards should be maintained for the product and who will carry out these tests?

Resources required: One local employee to do surveys and related work----$6,000/year.
Consultants from Iowa State 7 trips and 2 months on location per year----$15,000.
Consumer surveys and statistical analyses----$15,000.

According to the data available, this amount over 1-2 years should suffice to identify potential products. After this, the cost of developing the product would vary so much with the nature of the processed product that no meaningful estimate can be made.

3) Major assumptions: That suitable crops exist and that there are no insuperable barriers to their development.

4) Personnel from the host country must be available for the project. It is important that much of the project be carried out by someone familiar with local customs.

5) Alternatives are to continue to spend foreign exchange for foodstuffs, or to put developmental efforts into products that can be sold abroad to generate foreign exchange.

6) The benefits of the project should be diffused throughout the whole economy.

7) The project if successful in one country would probably be applicable in other countries.

E. G. Hammond
Food Technology
Iowa State University

Fred Hopkins

FOREST RESOURCE ANALYSIS

in

CENTRAL AMERICA AND PANAMA

First Draft

In Central America and Panama, available information indicates that the region as a whole is at a critical point with respect to the development and use of forest resources. Continuation of current trends could result in exhaustion of forest resources in two to four decades with severe adverse effects on the welfare of citizens of these nations. On the other hand, the condition and extent of the residual forest resource is such that, with appropriate modification of policy and management practice, the net benefit derived from the forest resource could be greatly enhanced. The proposed project is concerned with identifying opportunities for increasing the net countribution of forest resources toward the well being of the people of the Central American countries and Panama.

It is not the contention of this proposal that forest resources warrant highest priority among development approaches, but rather that a consideration of forest resources must be integrated into programs designed to foster economic development. Measures to implement programs for the development of forest resources must be designed in a manner consistent with the social, political and economic context of each nation. However, substantial advantages are to be realized through a regional approach to the problem.

Forest Resource Analysis

This proposal is for what is essentially an anaylsis of the forest resource of Central America and Panama. It entails a definition of the problem and the development of specific measures of programs to alleviate the problem. In essence, the problem with respect to forest resources is the discrepancy between a goal perceived in terms of the optimal productivity of the forest resource and the level of anticipated benefits if current trends, policies and practices continue. In view of the time element inherent in forest production, planning horizons are distant. The year 2020 may be an appropriate target, but intervening points in time are significant as bench marks in reaching the goal.

To illustrate in very crude terms, production of industrial timber products in 1974 for the Central American Common Market was approximately 3.6 million m^3/yr. Without adjustments in forest resource policy and management practice, production by the year 2020 could be 1.2 billion m^3 or lower. Consequences in terms of employment, income and availability of essential materials are obvious. On the other hand, analysis could reveal that a reasonable goal for timber production in the region would be 18.0 million m^3/yr. While these figures are ficticious, the magnitude of the discrepancy, 18.0 million vs 1.2 million, is not unrealistic. The goal would reflect policies which would foster more rational management of the forest resource. It implies the application of resources to the foreatry sector which could be so utilized more productively than elsewhere.

Certainly the goal is more complex than that suggested above. It

would incorporate a composite of the various benefits to be derived from the forest resource. Such factors as erosion control and watershed protection are critically significant in parts of the region. Other ecological gains may prove to be equally important. Such outputs as fish and wildlife, recreational opportunities and aesthetic values may warrant lower priority, but should be recognized in defining a goal for forest production. The goal would also be developed in terms of employment and income, values generated and impact on balance of trade.

Forest resource analysis entails not only a definition of the problem but also an identification of measures which would help to alleviate the problem. This may be largely implicit in the definition of the problem itself or it may be quite explicit and detailed as to recommendations for action. Alternative proposals may be put forth with an indication of the probable consequences of each.

Characteristics of Forest Production

Before proceeding it may be useful to point out a few characteristics of forest production which relate to the planning process. One of these, often overlooked, is the fact that forestry tends to be capital intensive. Timber growing stock itself is the principal form of capital required and represents the major variable cost of forest production. The opportunity cost of holding forest capital is the greatest obstacle to forest conservation. Because of this characteristic, ownership of the forest resource is particularly significant in planning for the development of the resource. Society may play a somewhat greater role than is required in most other

forms of production.

A second characteristic which bears comment is that the harvesting and processing of forest products tends to be labor intensive as compared with most other forms of production. Thus, strengthening of the forest products industries will favor employment with consequent multiplier effects.

Description of the Forest Resource

Planning in the form of resource analysis requires information as to the extent, character and productive potential of the forest resource. A good deal of information concerning the forest resources of Central America and Panama is currently available. The inventory component of this project would thus be concerned with acquiring what additional data is essential for planning purposes. An inventory system which provided consistency and comparability of data among countries within the region would be advantageous.

While good data is certainly desirable for purposes of developing forest resource policies and management programs, it should be noted that a high degree of precision is not imperative. This is particularly true in the early stages of the development process. The value of added accuracy and detail must be weighed against the additional cost of gaining such precision. The data base can and will be improved as the development process evolves.

A third point to be made with respect to descriptive information on the forest resource is that positive action need not be deferred until the data base is complete. The most rudimentary information currently avail-

able may clearly indicate the nature and direction of measures to be taken. Programs may be refined as better information becomes available.

Description of the forest resource or forest inventory would include the following:

1. Mapping

    a. major forest types or associations
    b. deforested areas
    c. delineated forest areas; forest reserves, parks, etc.
    d. predominant ownership patterns
    e. infrastructure

2. Area

    a. forest area by major forest types or associations
    b. depleted or deforested area
    c. ownership: public; industrial; non-industrial private

3. Volume of Timber Growing Stock

    a. within major forest associations
    b. species
        1.) commercially significant (high value) species
        2.) species groups for less significant and non-commercial species

4. Yield

    a. timber yield in m^3/yr for commercially significant species
    b. good (though not necessarily "best available technology") management practice assumed

In some countries, maps currently available may be adequate for purposes of this project. Additional mapping or detail may be developed through use of satelite and/or aerial photography. Consistent procedures, nomenclature and format within the region would be advantageous.

Data concerning timber volume, yield and ownership would be acquired through application of sampling techniques. Surveys would be carefully designed with due consideration for cost effectiveness.

Forest Resource Management

Serious loss of productivity is a consequence of mismanagement of the forest resource. Such loss may range from reduced yield due to altered stand composition to total long-term loss of productivity because of rapid deterioration of the site. On the other hand, opportunities are present for management which will substantially raise the flow of timber and other benefits derived.

Deficiencies in the application of forest management practices may be attributed to any or a combination of a variety of factors:

1. Inadequate scientific basis for appropriate management under various forest conditions.

2. Lack of incentive for more intensive forest management whether due to the decision maker's perception of benefits or a low level of return.

3. Inadequate knowledge of effective forest management techniques.

4. Insufficient control over the management and use of forest resources.

While the ecological basis for the management of tropical and subtropical forest associations in the region may be limited, knowledge is available to permit more effective management than is being applied. There is a need to extend available knowledge to forest operations. Silvicultural research is beyond the scope of this proposal. However, the project will

are [illegible] voids [illegible]

through systematic [illegible] would be carefully

designed [illegible]

Forest [illegible] Management

Low [illegible] productivity [illegible] of the

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serve to demonstrate the need for expanded investigation into tropical forest biology and management.

One obstacle to more intensive management is the fact that only a small portion of the species present, and thus of total volume, are commercially significant. Developments in the processing of timber will permit recovery of a higher proportion of total volume. Increased returns at the forest level will tend to make investments in cultural practices which will raise productivity more feasible.

Efforts to improve the effectiveness of management should be directed initially toward the most productive forest situations. These present the opportunities for the greatest gain through more intensive management and often will reflect the greatest loss as a result of mis-management.

Land Use

Implicit in the above is the broader question of optimal use of land. The general objective is to allocate land to that use which will be most productive. Soil surveys will add appreciably to the basis for a land use capability classification.

Some forest land in the region will undoubtedly be more productive in agricultural production and conversion to such use will be beneficial. Other forest land, however, cannot support agricultural production for more than a short period of time. Conversion may be contrary to the best interest not only of the community at large but also of the individual families directly involved. Development of effective mechanisms to foster the most productive use of land will prove beneficial.

Within a land use classification system, various functions of forest cover are significant. In some areas of the region, the protective function of forest cover is critical. Forests serve to alleviate soil erosion and siltation of streams and reservoirs, to stabilize stream flow and reduce flooding, and to improve water quality. Areas where the protective role of forest cover is highly significant should be delineated and management practices on such land modified.

Forest land suitable primarily for timber production would be recognized in a land classification system. Such land would be distinguished from that which lent itself to conversion to agricultural production or other uses.

Some forest land is essentially unproductive for forestry or other purposes. Efforts to develop such land entails a misallocation of resources. Such loss may be minimized by identification of unproductive areas in classification.

Forest Products Industry

To a large extent, realization of gains realized through the forestry sector depend on developments in the forest products industry. Substantial opportunities are present for raising income and employment and for improving trade balances within the region. The project would be concerned with raising output and productivity in the forest products industry. Domestic, regional and world markets would be considered. A survey of the forest products industry would be designed to indicate the most productive opportunities for further development.

Among the problem areas to be considered are:

1. improved recovery ratios
2. location of processing operations
3. market development
4. seasoning
5. preservative treatment
6. standardization
7. energy

A relatively small proportion of timber available on an area harvested is recovered in final products. A major portion of the total volume is in species not utilized commercially or are unacceptable because of size or form. This leads to deterioration of stands in terms of composition and greatly increases cost per unit volume harvested. Product recovery is also low with respect to the volume of trees cut. Loss of wood material is high both in harvesting and processing. Development of products and processing techniques which raise the recovery ratio will tend to increase returns and reduce costs as well as facilitate management of forest areas.

Manufacture of wood products involves appreciable weight loss. Location of wood processing operations close to sources of raw material supply will generally bring about cost savings. Integration of manufacturing operations will, in many instances, extend the range of timber species, sizes and qualities which can be utilized advantageously.

Domestic, regional and world markets present opportunities for the introduction of new wood products and conventional products of species not

currently accepted. New technologies improve the prospect for the production of pulp and paper products, thus for reducing a substantial trade deficit in this category. Conditions in Europe and North America would appear to favor expansion of export markets for lumber, plywood and other products. Further development of such markets would require further emphasis on seasoning and standardization to meet market requirements.

The energy crisis has implications for the forest products industry in Central America and Panama. The use of wood waste to generate power, not only for wood processing plants but also for other industries and municipalities is becoming feasible. Industrial development in the forestry sector will, in general, tend to favor more rational management of the forest resource. It is critical, however, that increase in the rate of resource use be closely coordinated with and contingent upon more intensive management of the forest resource. Industrial consumption of timber must be balanced with the productivity of the forest resource base.

Institutional Factors

A number of institutional factors bear significantly on forest resource development in individual countries and in the region as a whole. Among these are:

1. The land tenure and legal context
2. Public agencies concerned with forest resources
3. The role of binational and international institutions
4. Education, including technical and profesaional education

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[illegible] products into [illegible] concrete [illegible] other industries [illegible] development in the forestry [illegible] management of the [illegible] increase in the rate of [illegible]

[illegible] significantly on forest resource [illegible] as a whole. Among them are:

1. [illegible]
2. [illegible] industries connected with forest resources
3. [illegible] of bilateral and international [illegible] arrangements
4. [illegible] including technical and professional [illegible]

5. Research organizations

6. Trade associations

In some countries, well established land tenure institutions may be in conflict with more recently developed policies of natural resource conservation. For example, individuals may have the traditional right, supported by law, to enter undeveloped forest land, clear it, plant crops and thereby establish claim to the land. This may not be the most desirable use of the land. Other institutional circumstances may impede the conservation of forest resources. Public agencies concerned with forest resources play a major role with respect to the implementation of forest policies. They also contribute significantly toward the formulation of policy. In some instances, public foresty agencies may be less than fully effective because of deficiencies in organization or function, insufficient personnel or inadequate budgets. Increments in appropriations, with conscientious execution, may be repaid many times through more effective management and use of the forest resource.

Various binational and international institutions have already played a significant part in forest resource development in the region. Further technical and financial assistance may be provided if productive projects in the forest sector are designed.

Education is another area which warrants consideration. Forestry education at the technician or professional level is offered at several institutions of higher education in the region. However, the number of qualified people falls well short of that required to implement policies of

In [illegible]

in conflict [illegible] of natural resources [illegible] conservation [illegible] traditional rights [illegible] potent[illegible] at [illegible] plant [illegible] and thereby [illegible] not be the most desirable use of the [illegible] impede the conser[illegible] vation [illegible] with forest resources play [illegible] lems [illegible] policies. They [illegible] policy. In some [illegible] effective [illegible] personnel [illegible] inadequate [illegible] scientious execution [illegible] effective management and use of the forest resources.

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Education is another area which warrants consideration. Forestry education at the technician or professional level is offered at several institutions of higher education in the region. However, the number of qual[illegible] [illegible] falls well short of that required to implement policies of

rational forest resource management. Strengthening and possibly some consolidation of existing forestry education programs should prove productive. Some opportunities may be present for a division of labor or specialization among countries in the educational effort. Increased emphasis on conservation at the primary and secondary levels will help to increase public awareness of natural resource problems and support for conservation programs.

A good deal of research into problems relevant to the management and use of forest resources has been accomplished in Central America and Panama. Judicious intensification of the research effort in critical problem areas will be highly productive. An almost universal difficulty with respect to research arises in the failure to apply findings. The effectiveness of research efforts will be greatly enhanced by strengthening mechanisms for transmitting research results to those in policy-making or decision-making positions.

The contribution of the forest products industry would be enhanced by the development of a strong trade association which would function at both the national and regional levels. Such an association would provide a wide range of services to firms within the industry. Among these would be promotion and market development; technical assistance to producers; information and education; product development and improved processing techniques; standardization and other functions.

The proposed project would place major emphasis on institutional factors bearing on the management and use of forest resources. Existing in-

stitutions would be analyzed to provide information as to what they are and how they function. Problems arising from the institutional context would be identified as would be opportunities for strengthening the institutional basis for more rational management of forest resources. Proposals for modification of institutional elements would be developed.

The forest resources of Central America and Panama are being depleted at a rapid rate. While predictions of exhaustion within three to five decades may be extreme, there is no question but that continuation of current trends will have a severe adverse effect on the well-being of the people of the region within the next generation. On the other hand, the present condition of the resource is such that, with modest investment and adjustment in policy and management practice over the next decade will significantly increase the flow of net benefits derived from the forest resource of the region.

The objective of the proposed project is to serve as a calylist in reversing current trends and to generate momentum in the direction of achieving a higher and continuing contribution from the forest resource of the region.

FECHA DE DEVOLUCION			