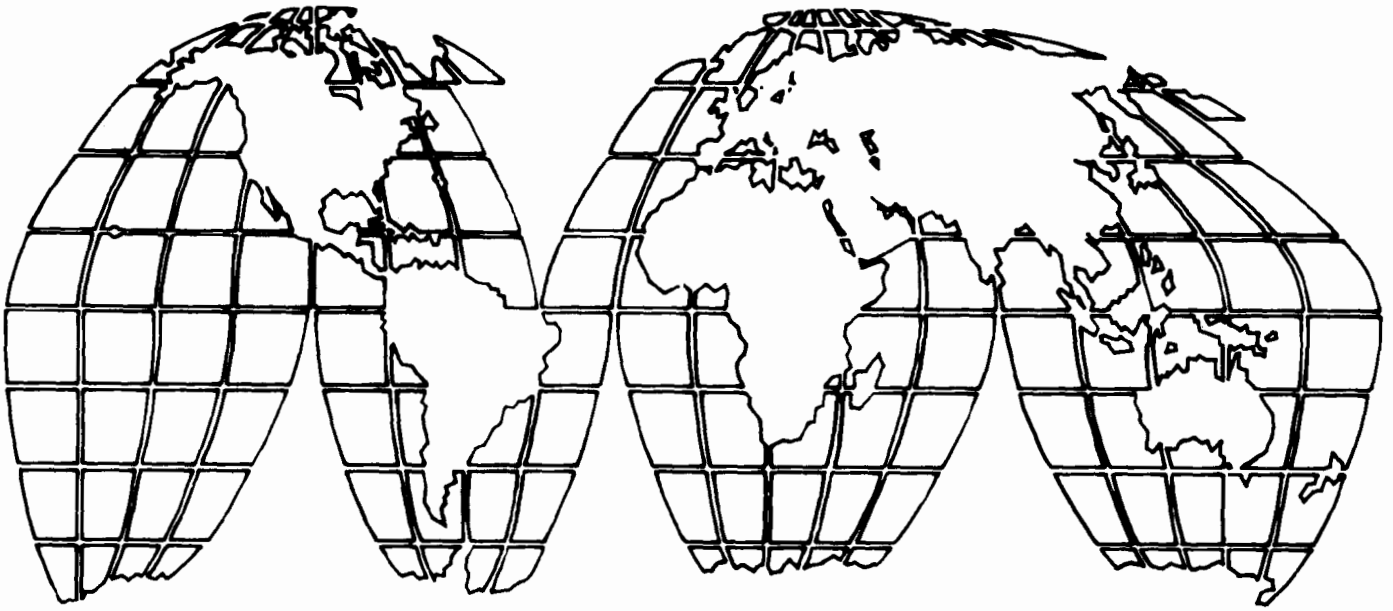
A.I.D. Project Impact Evaluation Report No. 54

PERU: Improved Water and Land Use in the Sierra



December 1984

U.S. Agency for International Development (AID)

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PERU: IMPROVED WATER AND LAND USE IN THE SIERRA

A.I.D. PROJECT IMPACT EVALUATION NO. 54

by

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FOREWORD

In October 1979, the Administrator of the Agency for International Development initiated an Agency-wide ex-post evaluation system focusing on the impact of AID-funded projects. These impact evaluations are concentrated in particular substantive areas as determined by A.I.D.'s most senior executives. The evaluations are to be performed largely by Agency personnel and result in a series of studies which, by virtue of their comparability in scope, will ensure cumulative findings of use to the Agency and the larger development community. This study of the impact of the Improved Water and Land Use in the Sierra project in Peru was conducted in March of 1983 as part of this effort. A final evaluation report summarizes and analyzes the results of all the studies in this sector and relates them to program, policy and design requirements.

PROJECT DATA SHEET

Project Title: Improved Water and Land Use in the Sierra

A.I.D. Project Number: 527-0156

A.I.D. Loan Number: 527-T-059

Borrower: Government of Peru

Loan Amount: $11,000,000

Loan Agreement Signed September 26, 1976

Government of Peru Contribution: $10,000,000

Total Project Costs: $21,000,000

Loan Terms: 40 years repayment from the date of first disbursement, including a grace period of 10 years. Interest rate of 2 percent during grace period and 3 percent thereafter on the outstanding balance of principal and on any due and unpaid interest.

Terminal Date of Disbursement: July 15, 1983

Purpose: To improve water and land use in the Sierra through: (a) an increase in productive land area; (b) an increase in crop yields; (c) expansion of cropping alternatives; (d) an increase in the efficiency of water use; (e) reduction in soil loss from erosion; and, (f) the strengthening of GOP technical capacity at the regional level.

Expected Outputs: 14,900 hectares newly irrigated; 13,000 hectares under improved irrigation; 650 kilometers of new canals; 500 kilometers of improved canals; 1,200 hectares afforested; $4 million of investments in land development financed under sub-loans.

GLOSSARY

BAP - (Banco Agrario del Peru) Agrarian Bank.

CESPAC - (Centro de Servicios de Pedagogia Audiovisual para la Capacitation) Center for Audiovisual Pedagogic Services - government agency charged with providing audio-visual production and distribution services to government-sponsored activities.

CIPAS - Agricultural and Livestock Investigation Centers - decentralized units of INIPA; administer field extension services and carry out research on a regionalized basis.

CORDE - (Corporacion Departamental de Desarollo) Departmental Development Corporation; there is a CORDE in each of Peru's 18 departments; they are responsible for general development activities within the departments, both in urban and rural areas.

DGA - (Direccion General de Aguas) General Directorate of Waters, Ministry of Agriculture.

DGE - (Direccion General Ejecutiva) General Executive Directorate; organism responsible for supervising the implementation of Plan MERIS within the Ministry of Agriculture.

ENCI - (Empresa Nacional de Comercializacion de Insumos) National Enterprise for Marketing of Inputs; state enterprise responsible for the distribution and commercialization of seeds and fertilizers throughout the country.

FONGAL - (Fomento Nacional de Ganado Lacteo) National Milk Cattle Development; government-sponsored organization of cattle and dairy farmers, combining aspects of a semi-autonomous tate body and a producers' cooperative.

GOP - Government of Peru.

INAF - (Instituto Nacional de Ampliacion de la Frontera Agricola) National Institute for Agricultural Zone Development; one of four semi-autonomous agencies within the Ministry of Agriculture which independently administers project funds from outside donors; INAF has oversight over Plan MERIS.

INFOR - (Instituto Nacional de Forestal y Caza) National Forestry and Fauna Institute; a component of the General Directorate of Forests and Fauna, Ministry of Agriculture.

INIPA - National Institute for Agriculture Research and Extension; principal GOP organ providing research and extension services in the agricultural sector.

IRPA - Institute for Agrarian Reform and Agricultural Extension; organization made responsible for both agrarian reform and national extension services after 1968.

MOA - Ministry of Agriculture.

PEPMI - (Proyecto Especial de Pequenas y Medianas Irrigaciones) Special Project for Small and Medium Irrigations; responsible, within INAF, for projects dealing with small- and medium-scale irrigation.

UNA - National Agricultural University.

SUMMARY

The Improved Water and Land Use in the Sierra Project (called Plan MERIS, after its Spanish acronym) was evaluated during March 1983 by a team of AID staff, assisted by USAID staff, Government of Peru (GOP) personnel and a short-term Peruvian contractor. The evaluation took place over a three-week period and involved research and meetings in Lima and field visits to project sites in the Cajamarca and Mantaro valleys, where Plan MERIS is being implemented. During the field trips, the team met with Plan MERIS personnel at the region and project level, as well as with Agrarian Bank representatives and personnel from related government agencies.

Plan MERIS was designed as a five-year effort. Improved water and land use in the Sierra was to be achieved through an increase in productive land areas, crop yields and the efficiency of water use, expanding cropping alternatives and reducing soil erosion. The project was to be targeted to small farm families, typically farming less than two hectares of land. To achieve its objectives, Plan MERIS encompassed several components, among them: (a) construction of irrigation and drainage works for up to 27 sub-projects; (b) a special fund in the Agrarian Bank for sub-lending to participating farmers for investments in on-farm land development; (c) a complementary afforestation and reforestation program; and, (d) strengthening of personnel and institutional capacity through technical assistance and training. The project implicitly left agricultural extension and development activities to the GOP. Total project costs were set at $21 million, comprising an $11 million loan by AID and a $10 million contribution by the GOP.

The project has not been implemented as planned, in spite of a two-year extension to the original five-year project life. Delays in implementation can be traced to: (a) the transfer of project responsibility within the GOP at project initiation, causing a delay in staffing of the regional offices; (b) slower than anticipated completion of sub-project feasibility studies; and, (c) GOP delays in approving the purchase of construction machinery, equipment and materials. As a result, 17 sub-projects will have been constructed, rather than the 27 initially envisioned. Also, project beneficiaries have been reduced from an anticipated 21,737 farm families to some 11,261. And, total irrigated hectares have been reduced from a projected 27,900 to an estimated 13,443.

Similarly, disbursement of the credit component has been much slower than anticipated, reaching less than one percent of the beneficiaries. The major weakness in project implementation, however, has been in the agricultural technical assistance component, due to a scarcity of GOP resources and personnel. As a result, technical assistance is not reaching

the marginal small farmers; instead, as with the credit component, technical assistance is being provided primarily to larger landowners.

FINDINGS AND LESSONS LEARNED

In spite of project shortfalls, more water is now available on a reliable basis to farmers in completed sub-projects for crop and pasture irrigation. As a result, some significant long-term production and economic benefits are likely to derive from this project, at least for the owners of larger holdings. While small farmers also benefit from the availability of water, because of the above-mentioned shortfalls they are likely to reap fewer benefits from the project. A significant benefit accruing to all farmers, however, is a decrease in the risk of catastrophic failure associated with a lack of rainfall.

While the project's physical works appear to be well-designed and construction costs per hectare are relatively low, the credit component was poorly designed, given the intended target group. Thus, although this type of irrigation project has the potential for reaching significant numbers of beneficiaries and extensions of land, a special effort must be made to reach small farmers with creative forms of financial assistance.

The national water tariff structure currently in effect in Peru is unlikely to produce the revenues necessary to make water system maintenance self-financing. Additional resources from the government's general budget are, thus, likely to be necessary to adequately maintain the systems.

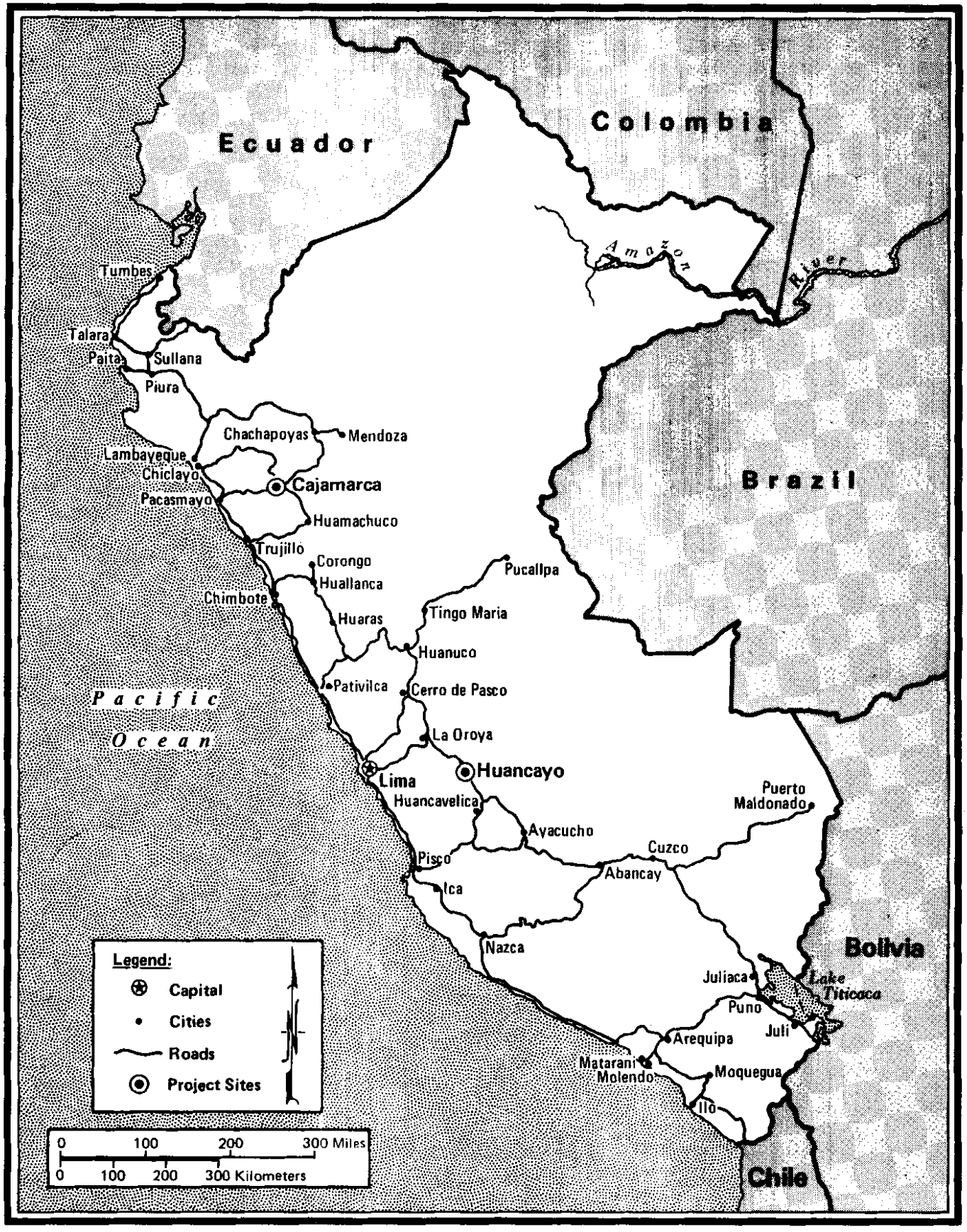
Where a host-country government is in financial straits, as are many of the AID-assisted countries currently, counterpart activities are likely to suffer from a lack of resources. If, as in Peru, an agricultural development effort suffers from a lack of adequate personnel and resources, AID should consider financing the costs of agricultural extension.

Beneficiary involvement from the early stages of project design and implementation is an additional key to success. This involvement is also critical to survival of the irrigation system, through periodic maintenance and improvements, as well as to the success of ancillary project efforts.

Irrigation projects always seem to cost more, and take longer to complete, than anticipated. Given this experience, the design of such projects should allow for longer disbursement periods. Or, missions should be allowed to fund several follow-on projects of the same type, each within a shorter disbursement period, until a body of experience develops with which to interest larger donors in this type of project.

On the whole, the Plan MERIS-type scheme is extremely well suited to the small-farmer agriculture systems prevailing in much of the developing world. It must be recognized, though, that water is a necessary but not sufficient factor. Small scale irrigation projects should not be engineering projects with technical assistance and services appendages. Rather, they should be technical assistance and services projects based on a relatively assured source of water for irrigation.

Peru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Mendoza
Lambayeque
Chiclayo
Cajamarca
Pacasmayo
Huamachuco
Trujillo
Corongo
Huallanca
Chimbote
Pucallpa
Tingo Maria
Huaras
Huanuco
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Cerro de Pasco
La Oroya
Lima
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Puerto Maldonado
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Cuzco
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Ica
Nazca
Juliaca
Lake Titicaca
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Project Sites
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I. PROJECT SETTING

A. Peru's Agricultural Sector

The agricultural sector in Peru is characterized by a general production shortfall in relation to requirements, both for domestic consumption and for possible exports. This situation has prevailed over at least the last ten years, even under normal growing conditions; it has been aggravated, however, by four consecutive years of drought (1978-1981) in certain parts of the country. In the aggregate, both domestic agricultural production and per capita availabilities have tended to decline in relation to steadily rising national needs. In contrast to a population growth rate of some 2.8 percent annually, total agricultural production has virtually stagnated. As a result, and partly due to Government of Peru (GOP) policies that favor food imports, Peru has become heavily dependent on imported food and feed commodities, including: wheat, corn, grain sorghum, rice, soybeans, beef and offals, milk products, and vegetable oils. Lately, even sugar, a traditional major export commodity for Peru, has been added to the list of imports because of difficulties in meeting domestic demand.

Faced with these conditions, Peru's agricultural development problem has been described as requiring a vastly improved and more effective use of land and water resources, along with increased agricultural labor force productivity. The underlying need, furthermore, is to more adequately provide for the country's poorest people, most of whom are in the Sierra and who constitute a large segment of the total population.

B. Agriculture in the Sierra

The Sierra, the name given the Andean mountain range running north-to-south through Peru, is a region of isolated mountain valleys and a few high plains. It supports over half of Peru's rural population, primarily through subsistence farming. Although some 2.5 million hectares (seven percent) of the Sierra's total surface possibly could be used for agricultural purposes, the amount of land actually cultivated represents approximately 1.8 million hectares, or only five percent of the total. Currently, of the area employed, slightly more than 1.8 million hectares are devoted to rainfed agriculture and 340,000 hectares are cultivated under irrigation. An additional 18 million hectares are devoted to natural pastures.

Overall, much of the soil in the Sierra is relatively poor and production technology ranges from low to primitive.

Subsistence agriculture on minifundia (landholdings typically smaller than one hectare) is the most common production pattern, with low yields and widespread recourse to off-farm employment to supplement incomes being the norm. These factors, combined with increasing population pressures, lack of additional suitable land for farming and a serious erosion problem combine to make many inhabitants of the Sierra the poorest in the country.

C. The Project Context

The Improved Water and Land Use in the Sierra Project (known as "Plan MERIS", after the Spanish acronym for Mejoramiento de Riegos en la Sierra) was conceived and designed during a period beginning with General Velasco's military takeover in 1968. In this period, a number of efforts had been initiated to address constraints affecting the social and production structures of agriculture in the Sierra. Chief among these efforts was the sweeping Agrarian Reform program, which expropriated large landholdings and redistributed them among the peasants working on them. The Agrarian Reform both limited the size of the largest individual Sierra landholdings and attempted to establish a minimum family farm size of three hectares, while encouraging the amalgamation of small plots (minifundios). The latter provision of the law, however, was never put into effect; as a result, the bulk of the lands in the Sierra continue to be held in minifundios.

A second important effort directed at the Sierra was increased public investments in irrigation. Although much of the agricultural production in this area is dependent on rainfall, there is a long tradition of community-based irrigation in parts of the Sierra. One of the first foreign assisted efforts to bring small scale irrigation systems to the Sierra was represented by the Inter-American Development Bank's (IADB) 1970 "Linea Global I". In effect the precursor of the later Plan MERIS effort by AID, Linea Global I was, unlike Plan MERIS, conceived and implemented as a completely integrated approach. In contrast, Plan MERIS emphasized the infrastructure element, while including a line of credit for on-farm investment costs such as land-leveling, drainage, digging of tertiary canals and other improvements. Production loans were not to be provided from this credit fund since the Agrarian Bank was seen as a ready source. Provision of research and extension services directly to the beneficiaries was a GOP responsibility; the question of rural services was not addressed.

II. THE IMPROVED WATER AND LAND USE IN THE SIERRA (PLAN MERIS) PROJECT

A. Project Design

Initially proposed by the Ministry of Agriculture's General Directorate of Waters (Direccion General de Aguas - DGA) in mid-1974, the project paper was developed between August, 1974 and January, 1975. Submitted to AID/Washington by September, 1975, a loan agreement was signed between the GOP and AID in September, 1976. It provided for an AID contribution of $11,000,000, and a Government of Peru counterpart contribution equivalent to $10,000,000.

Plan MERIS was designed as a five-year effort "contributing to the planning and implementation of a program of improved water and land use in the Sierra". This was to be achieved through: (a) an increase in productive land areas; (b) an increase in crop yields; (c) expansion of cropping alternatives; (d) an increase in the efficiency of water use; (e) reduction in soil erosion; and, (d) strengthening of GOP technical capacity at the regional level.

The target group was small farm families having, on average, less than two hectares of land per family in the Cajamarca and Mantaro valley areas. This group is almost entirely dependent on marginal agriculture for their livelihood, farming individually- or cooperatively-owned crop or pasture land.

To achieve the project purpose and reach the intended beneficiary group of small farmers, the project encompassed: (a) construction of irrigation and drainage works for up to 27 subprojects -- $8,000,000; (b) establishment of a special fund in the Agrarian Bank (Banco Agrario - BAP) for investment loans for on-farm land development -- $3,000,000; (c) high level technical advisory services to the DGA in planning and project analysis -- $1,000,000; (d) strengthening of the regional offices with additional personnel and required machinery and equipment -- $1,270,000; (e) an afforestation and reforestation program -- $3,800,000; (f) long and short-term training for Ministry of Agriculture personnel -- $155,000; and (g) funds to finance watershed planning studies -- $250,000. An additional $4,000,000 was budgeted for construction contingencies (at 16 percent) and for inflation (at 11 percent).

Within the above components, the evaluation team determined the following four to be critical, at this time, to judging project impact on the intended beneficiaries: provision of water through infrastructure construction; availability of credit; the availability to farmers, and nature of,

agricultural technical assistance; and, progress of the reforestation effort. The team did not attempt to evaluate fully the indicators of project purpose attainment, as presented in the project paper, because of the relative newness of most subprojects and the short period of time under full irrigation in most areas. Despite this, it was felt that evaluating the above four components, from which project attainments would necessarily flow, would provide an indication of current and likely impact.(Appendix E, however, contains a preliminary economic analysis for the six oldest subjprojects.)

B. Project Implementation

The project was not implemented as had been planned. Rather than 27 subprojects, 17 were built in the space of a little over seven years -- from September, 1976 to an amended project assistance completion date of January, 1984. This period included a two-year extension recommended by a 1981 USAID/Lima evaluation. Delays in project implementation can be traced, initially, to the transfer of project responsibilities within the Government of Peru from the DGA to the General Executive Directorate (Direccion General Ejecutiva - DGE) at the beginning of project implementation. This resulted in a ten-month delay in the early project stages, with staffing and organization of the Plan MERIS regional offices not being completed until mid-1978. In addition, subproject feasibility studies were completed more slowly than anticipated, and the purchase of construction machinery, equipment and material suffered from a delayed approval process within the Ministry of Agriculture.

As a result, total project beneficiaries were reduced from the 21,737 small farm families envisioned in the early stages of the project to a level of 11,261. In addition, total irrigated hectares, both in new and improved systems, were reduced from a projected 27,900 to an estimated 13,443.

Disbursement of the credit component was also much slower than anticipated. Four months before reaching the project's final contribution date of July, 1983, only $100,000 of the AID share of $1 million had been disbursed -- approximately $1.4 million of the total $3 million (AID and GOP contribution) available for investment loans had been disbursed. In addition, much of the credit activity took place after November, 1982, when USAID/Lima expanded the investment credit criteria to include the purchase of milk cattle and the improvement of pasture lands. This represented an adaptation of the project to tenancy and production patterns which had not been taken into account during project design.

Beyond the credit component, the major implementation weakness was the lack of technical assistance provided by the

GOP to beneficiaries. This derives, in part, from several GOP "years of austerity", in which depressed economic conditions led to restricted government revenues, reductions in the government's budget, and a lack of personnel with which to carry out extension and agricultural development activities. There also appears to have been an emphasis, at the Lima level, on the physical infrastructure aspects of Plan MERIS, rather than on agricultural development. As a result, technical assistance is not reaching the minifundista; as in the case of the credit component, what technical assistance is being provided primarily benefits the larger landowners.

The forestry component of the project, after initial delays, appears to be progressing at an adequate rate -- in spite of relatively high plant loss rates -- along canals and on slopes subject to erosion. Although the project paper envisioned reforestation and afforestation of some 1,200 hectares, since the number of subprojects is lower, and forestry activities did not begin until early 1981, the total area likely to be forested is also lower. As of the end of December, 1982, 654.5 hectares had been reforested, an impressive figure given the late start of this component.

In general, the lack of continuity in design, implementation, and evaluation activities was a serious problem plaguing the project. One major discontinuity stemmed from a succession of four project managers over a seven-year period.

In spite of the above shortalls in implementation, the design of the physical infrastructures appears to be appropriate to conditions in the Sierra and requirements for water supply. Construction costs per hectare are relatively low, especially in comparison to the large irrigation projects implemented on the Costa, the narrow desert coastal area of Peru, where most larger-scale agriculture is found. As such, if the design of supporting components is appropriate and cost-effective, this small-scale irrigation model would be worthy of replication both in Peru and elsewhere.

III. PROJECT IMPACT

Of the 17 subprojects to be built, eleven were completed as of April, 1983. Of these, the evaluation team visited three in the Cajamarca area and four in the Mantaro area. (See Appendix A for summary data on the 17 subprojects.) A constraint to assessing both the direct and indirect economic impact of the project is that insufficient time has elapsed since most subprojects have been completed. Thus, it is difficult at this time to establish the impact on agricultural production and farm incomes. The team, therefore, was left with the necessity of looking at the impact on the project's four principal components and on several other related aspects of the project.

A. Provision of Water

The provision of water is the principal impact of the Plan MERIS project. Its availability will serve to reduce one of the most significant risk factors in Sierra agriculture -- that of unexpected or prolonged dry spells and their disastrous effects on subsistence farmers. In general, water is available as planned in the subproject sites, although not yet to the full extent of each subproject's command area. Much of the digging of tertiary canals has been done, to date, through reliance on beneficiary self-help, supplemented by a food-for-work scheme administered in connection with Plan MERIS. The latter may lead to delays in bringing water to the smallest farmers, or those most distant from a secondary canal, once Plan MERIS ends its involvement in a subproject.

Maintenance of completed systems does not, at this time, appear to be a problem. It is being performed on a routine basis twice a year, both prior to and after the irrigation season, using beneficiary labor. Whether this will continue in the future depends, to a large extent, on the strength and vitality of the Irrigators Committees (Comites de Regantes) which Plan MERIS has organized. In only one instance, the Chupaca subproject, was it apparent that these committees were not functioning. The project manager at this site stated that, since the people in the area had been irrigating for some twenty years prior to Plan MERIS' arrival, it was difficult to change old habits and that, in fact, there was little beneficiary interest in participating on the committees.

It is unlikely, however, that maintenance at any subproject will be self-financing, at least for the foreseeable future. Although most project sites are charging some type of fee for the use of water, they are not charging a water tariff. The fee is, variously, used to pay the maintenance man responsible for the system's intake, or has been levied to get the beneficiaries accustomed to paying for the use of water. There is some question, however, as to whether sufficient fees can be charged to meet normal system maintenance costs. Beneficiaries at Namora, for example, pay five soles (.004 cents) per hour of irrigation; at the same time, they have asked to be temporarily exempted from paying the Water District's water tariff of 30 centavos (.0002 cents) per cubic meter of water. At such a generally low level, and given the past problems which DGA has had in collecting water tariffs, it is unlikely that subprojects will generate sufficient resources to pay for any maintenance requiring inputs other than manual labor. Instead, long-term maintenance of Plan MERIS systems is likely to become an addition to the DGA's present budget line-item for maintenance, which comes from government appropriated funds.

In addition, several factors currently reduce the full benefits of the provision of water. Water discipline, for one, does not seem to be well developed, particularly in subprojects composed mostly of beneficiaries who are individual landowners, as opposed to those composed primarily of peasant communities. These communities have a strong tradition of self-help and support, and the community council provides a ready system for imposing and enforcing penalties on members who act against the best interests of others.

At some sites, furthermore, larger landowners seem to be pressuring minifundistas to pass up their turn at irrigation. This appears to be most prevalent at sites where irrigation turns are based on one section of the system irrigating during a predetermined number of hours on assigned days, rather than on the amount of land owned by each irrigator. Such problems were reported at both Chupaca and La Huaycha in the Mantaro valley. This valley, significantly, has a long history of producing crops under irrigation.

Moreover, water theft and improper methods of irrigation, typically involving overwatering, also take a toll. All Plan MERIS sites reported problems with the unauthorized opening of irrigation gates or the breaking of canal walls to draw off water. These problems are currently dealt with by Plan MERIS staff directly with the transgressors, but will eventually become the responsibility of DGA's Water Districts; effective monitoring will depend, at that time, on whether a water technician is assigned specifically to the project sites. It is evident that greater efforts must be made by the GOP to ensure that a sense of water discipline is imparted to all irrigators -- not just Plan MERIS beneficiaries.

Access to water is also affected by the structure of land ownership in the Sierra and its primarily minifundista character. Putting a small tertiary canal through to a farmer's field may involve crossing the holdings of several other farmers, all of whom must give permission for the canal to be dug. In several instances, intervening farmers had denied permission for a canal to be dug across their fields, even though they also stood to benefit from the water. Again, this appears to be a more prevalent problem in non-peasant community areas, such as in Chupaca and La Huaycha. It is unclear how amenable to resolution such problems are, but they must be overcome before all farmers in the command area can have access to water.

A further problem is mistrust of irrigation among some small farmers, typically those without prior irrigation experience. Interestingly, some of the same farmers who admitted the benefits of irrigating natural and improved pastures also stated the belief that irrigation would ruin

seedlings and plants. Thus, they irrigated to prepare the fields, but stopped as soon as plant growth began, relying instead on the availability of rainwater. In Chicche, for example, this occurred even during a period of drought.

Improper drainage of irrigation water does not appear to be a widespread problem; in those few areas where it has been, engineers are taking steps to rectify this condition.

It is likely, of course, that the advantages of irrigation will be increasingly perceived by all project beneficiaries as they become accustomed to a steady and reliable source of water. The availability of new or improved irrigation will most likely stimulate, over the long run, increased crop diversification and double cropping. But, at this time, the regional markets and distribution mechanisms appear to be major influences leading to changes in cropping patterns.

It should be remembered, however, that irrigation is often a costly means of substituting for other inputs. In much of the Sierra, production increases from irrigation with traditional cropping practices are about the same as could be expected from using improved seed and fertilizer under rainfed conditions. Thus, except in the case where irrigation can be inexpensively developed and applied, it would be more cost-effective to obtain the same production increases by improving agronomic inputs.

B. Availability of Credit

This aspect of the project clearly is not having any impact on the small farmer target group. Minifundistas, who represent 80 to 95 percent of the beneficiaries in each subproject, do not have any practical access to credit under this project. Much of this can be traced to the Agrarian Bank's requirement that borrowers have title to their land. Most minifundistas do not have clear title; rather, they have it through inheritance or informal bills of sale, neither of which tend to be registered with the legal authorities and are not accepted by the BAP. In addition, those minifundistas who happen to own clear title may be excluded from receiving credit by the fact that the BAP will not loan funds to owners of less than 1/2 hectare in the Cajamarca area and less than 1 hectare in the Mantaro area. The BAP does not consider loans to owners of such smaller holdings to be economically justifiable. In the case of investment credit, the BAP may well be correct. The income benefits from agricultural production on minifundia receiving investment (vice production) credit are most likely not sufficient to cover loan repayment.

Credit was to be made available on concessional terms through the BAP's Agricultural Development Fund for integrated

medium- to long-term investment programs designed to maximize the efficiency of water distribution and application, and to finance supplementary on-farm improvements. Prior to mid-1981, the Agrarian Bank was willing to consider such loans for beneficiaries who only had "certificates of possession", which are not titles to the land free and clear. Few loans, however, were given under this arrangement, since most subprojects were not yet completed and, as noted below, effective demand for investment credit among minifundistas is low. Certificates of possession are relatively simple to obtain, involving a notary public or justice of the peace and at least two witnesses. But, in mid-1981 the Agrarian Bank decided that, while it would continue to make production loans from its normal funds available to holders of these certificates, it would only make Plan MERIS investment credit available to beneficiaries who had, at least, imperfect land titles (titulos supletorios).

While Plan MERIS personnel are helping beneficiaries obtain such imperfect titles, the procedure is rather onerous in terms of time and resources. Since it involves lawyer's fees, court costs and cadastral surveys, this procedure may cost a minifundista as much as S/40,000 - 50,000 ($32 - $41) -- a not inconsiderable amount when compared to per family cash incomes which can be as low as $200 annually in the Sierra. It also requires at least two trips to the provincial capital, which may take as much as 8-12 hours one way. As a result, there is little effective demand for this service among the smaller landowners who are, thus, unable to obtain BAP investment credit.

In addition, the minifundistas' negative perception of the BAP as a source of credit also reduces the possibility of increasing its use. Many small farmers state they would use credit to purchase inputs, but also state that, if BAP credit were available, they would not use it. The most commonly offered explanation is the fear that defaulting on their loans will result in the loss of their land. Agrarian Bank personnel denied that such a loss was possible; in fact, it is specifically prohibited by the law under which the Bank operates. Nevertheless, the farmers' perception is controlling and further reduces the demand for, and use of, credit from the Agrarian Bank. Instead, small farmers continue to rely on agricultural produce wholesalers, the traditional sources of production credit. The rate of interest offered by the wholesaler is likely to vary with the type of product, its quality, the producer's knowledge and awareness, the size of the loan, and other related factors. In the Plan MERIS context, therefore, production credit has not complemented investment loans to the extent anticipated.

As a result, the principal impact which the credit component has had is on the small proportion of beneficiaries

who farm more than two hectares. This is particularly true in Cajamarca; the greater flexibility displayed by BAP agents in the Mantaro area has resulted in some 30 percent of the loans there going to beneficiaries with one-two hectares. This development, however, was very recent and encompassed, at the time of the evaluation, only 13 beneficiaries. However, even the group eligible for credit did not have much demand for BAP funds until the eligibility criteria were changed to include the purchase of livestock and the improvement of pastures. As a result, only 107 loans had been approved or were in the approval process, representing less than one percent of the families benefitted by the project. At least 60 percent of the credit requests, furthermore, were for activities related to milk production, such as the purchase of livestock, improvement of pastures and construction of farm buildings.

There is some question, moreover, as to whether minifundistas and small farmers can be adequately reached through the BAP's Agricultural Development Fund, given the Bank's need to peg its rates to the rate of inflation. The suggestion has been made, for example, that a more appropriate method of extending credit to such farmers is through commodity loan schemes, where repayment is also in the form of commodities.

In sum, Plan MERIS' credit component has not had the impact anticipated in the project paper. Primarily as a result of faulty project design, Agrarian Bank loan policies, and minifundista perceptions about credit, the positive impact of this component is accruing almost exclusively to larger farmers. Credit, of course, has had a beneficial effect on their production levels, particularly of milk cattle. This impact however, is causing a widening income and productivity gap between the larger and smaller farmers. There are, incidentally, no apparent ethnic differences between these two groups. The net result is that the Plan MERIS project paper identified as target beneficiaries, farmers without adequate potential productive capacity, or legal recognition, to be viable investment credit risks.

C. Agricultural Technical Assistance

Failure to deliver agricultural technical assistance to small farmers is the major weakness in Plan MERIS' implementation. The project design envisioned that on-site technical assistance would be provided by the GOP; that this did not occur is due to a chronic lack of GOP resources and the state of agricultural extension services in Peru following the agrarian reform in 1969. At that time, the government dismantled a research and extension service which had been among the leading such systems in Latin America. Extension personnel were assigned to duties within the agrarian reform program and extension was virtually ignored for more than ten years.

In fact, if it had not been for Plan MERIS' special status as a foreign-assisted project, it is unlikely that as much technical assistance as has done so would have reached the beneficiaries. This does not mitigate the fact, however, that extension work in Plan MERIS is underfunded and is seriously deficient in terms of sufficient personnel. Plan MERIS field personnel reported that their budgetary support began to erode in 1982 and that, other than for salaries, no operating expenses had been received during the first three months of 1983. Plan MERIS personnel in Lima ascribed this to: the fact that the GOP Treasury had not yet issued any funds, and that Plan MERIS' 1983 budget was still in the final stages of completion. Funds, they believed, would begin to be available in April. This contrasts sharply with the physical infrastructure side of Plan MERIS. Because its funds come from AID, there have been no reported shortages of funds for the construction work, or for personnel assigned to that work.

In the Cajamarca area, wage laborers, including some technical personnel, had not been paid for almost three months. In addition, there was no money for gasoline, agricultural inputs or office supplies. All of these were either being borrowed from Plan MERIS' construction division, or were being obtained on credit from local suppliers. To reduce field work costs, furthermore, some 80 percent of the personnel in the Cajamarca agricultural development division were ordered to take their annual vacations in January and February, during the growing season. In the Mantaro area, the agricultural development division has been borrowing both supplies and operating funds from the infrastructure division. Wage laborers in Mantaro, however, had not been paid for 45 days. And, as in Cajamarca, field technicians usually did not have the means or funds to travel within their project area, other than on foot. The situation is summed up by a Cajamarca agricultural technician's plea to the evaluation team, "Please tell Lima to send us even a little money so that we can do our work."

Beyond this, however, is the problem of personnel shortages. At most project sites one, or at most two, technicians provide agricultural technical assistance, along with advice on credit and some measure of social assistance. It is only at projects that have recently been inaugurated that there is a full complement of 3-4 technicians. This never seems to last very long, however, as the opening of a subsequent project then demands the attentions of a full team. As a result, the farmer-to-technician ratios are astronomically high. In the Apata subproject, for example, one technician advises and supports 573 farm families. Once the subproject is turned over to the beneficiaries, though,the Ministry of Agriculture's extensionist will be responsible for some 2,400 farm families.

Thus, it is only natural that Plan MERIS extension personnel tend to concentrate on larger farmers, who are better able, through their command of time and resources, to take advantage of the available technical assistance. It is not incidental, furthermore, that access to credit is highly correlated with adoption of new or changed technologies.

In addition, there appears to be some minifundista resistance to the technology being presented. This may be due, in part, to the effectiveness of the demonstration methods and talks presented. All farmers interviewed were aware of the extension talks and demonstration field days held by the agricultural technicians. A high proportion of them, however, reported not changing their methods of production as a result of these presentations. The bulk of these respondents were minifundistas and small farmers. For example, a small farmer in Chicche stated that the talks were "interesting but not useful". This he ascribed to the fact that "the technicians do not know as much as we do, since we have always farmed and lived on the land." As proof, he pointed to two small plots owned by agricultural technicians and said, "Look at that; they lost more crops than I did this year. Why should I do what they say?"

Small farmers in other areas also asserted that their methods were better than those presented by the technicians. As a matter of fact, the team found that the traditional methods used by small farmers are not at all inappropriate. There is widespread use of manure as a fertilizer at planting time among both irrigating and rainfed farmers. In addition, most farmers know the value of using urea fertilizer on their crops during the growing season, as well as the results obtainable from using pesticides and fungicides. In general, a relatively high level of knowledge about cropping methods already exists among small farmers. Their access to needed inputs, however, is another question altogether.

Most small farmers interviewed stated that they used purchased inputs when they had the money, but that all inputs were becoming too expensive. Besides, most were reluctant to travel long distances to purchase only a small amount of inputs. Various sources have also reported that ENCI, the state fertilizer distribution monopoly, is ineffectively run and often does not have sufficient amounts of the appropriate fertilizer for the agricultural needs of particular crops or regions.

The small farmer is probably highly receptive to the use of technical inputs in his agriculture. Such inputs, however, must be perceived as effective and, more importantly, be affordable and readily obtainable. That current technical packages being offered the farmers do not seem to met these

criteria can be seen in that there appears to have been little perceptible change in the methods of production used by small farmers. Several farmers reported that the only difference between their pre- and post-Plan MERIS methods of cultivation was the fact that water was now available on a more-or-less permanent basis. Furthermore, in-depth farm level surveys in the Cajamarca and Mantaro areas indicate a disparity in yields between minifundistas and medium-sized farmers. The former are likely to be obtaining yields 15-20 percent less than larger farmers. In addition, some of the reluctance to adopt improved methods may be due to the inappropriate materials used by technicians. One technician reported having to show a film about wheat growing in Canada to illustrate a talk on pesticides and fungicides. This may be improved by materials which are now being produced in Peru by CESPAC, a government agency charged with providing audio-visual production and distribution services to government-sponsored activities.

The availability of water in itself, of course, will serve to reduce the chances of crop failures. Yield increases in the Plan MERIS area are mostly attributable to irrigation; these increases, however, appear to have been limited by the lack of appropriate agricultural inputs and technical assistance. This may be partly responsible for the fact that many small farmers are not producing, at this time, a second crop under irrigation. In fact, because of frost hazard, only pastureland is a viable year-round use of the land above 3,400 meters of elevation; even with irrigation, only one crop of vegetables is possible above this elevation.

In addition, it is questionable whether the marketing infrastructure is sufficiently developed to accomodate two crops. The full impact of irrigation, thus, is not yet being felt. In the Apata subproject, for example, a second crop of vegetables and legumes was reported for only 20 percent of the lands under irrigation. Non-traditional second crops, however, are more prevalent in subprojects close to Huancayo and Lima because of the demand created by these areas. Cajamarca, on the other hand, is much less urbanized and there is far less demand for non-traditional crops. In general, though, cropping patterns in six subprojects for which there is time-series data showed no major changes.

As mentioned above, most of the adoption of technical assistance is found among larger landowners; and, most of it appears to be related to the production of improved pastures and milk cattle. The expansion of dairy activities, encouraged by Plan MERIS personnel, has a high potential for reducing the effects of inflation on a producer's income. Because of government controls on the prices of basic agricultural commodities, and the resultant declining returns to production as input costs have increased rapidly, agricultural income has

lagged behind the rate of inflation. The consequent lack of incentives to engage in agricultural production has, not incidentally, served to undermine the project's potential impact.

Ownership of cattle, on the other hand, is a hedge against inflation, since the price of cattle tends to keep up with the rate of inflation. Moreover, farmers tended to be more interested in livestock, since milk could be produced year-round with little risk of loss. A second factor also not sufficiently recognized in the project paper was that pasture for livestock already accounted for a large proportion of land in both project areas. While the impact on milk production is a positive one, it is an impact not anticipated in the project paper, and one from which small farmers are mostly excluded. A milk cow currently costs approximately $1,200 -- a staggering figure for most small farmers. At the same time, about one-half hectare of pasture land is needed per head of cattle. Thus, unless a small farmer has a steady source of income away from the land, there is little opportunity to get out of agriculture and into the more profitable production of milk. This conclusion is supported by observations at Carahuanga, Chupaca and La Huaycha, all of which are 15 minutes or less from an urban center and in which most small farmers work away from their land as wage laborers during the day. Here, small farmers are increasingly moving into dairy production, something which is not happening to much of an extent at other sites.

In sum, the benefits of the technical assistance being provided by the GOP are accruing primarily to larger landowners, who tend to be in a position to use investment credit and who tend to concentrate on the production of milk. As a result, technical assistance is also contributing to a widening gap in income and opportunity between smaller and larger producers, which was not anticipated in the project paper.

D. Forestry Activities

This component appears to be progressing at a satisfactory rate. However, reforestation activities are, for the most part, being carried out by INFOR wage labor, rather than the community labor envisioned in the project paper. Some limited food-for-work planting and maintenance has taken place, primarily using women and children for the labor force, but this is not widespread.

The long-term impact of this activity is likely to be varied, depending on the location within the subproject of the reforestation. Presently, average losses of plantings is running at a 20-25 percent annual rate; at one project,

Chupaca, estimated annual losses are running as high as 40 percent. In all instances, the main causes for losses were identified as overpasturing by animals and vandalism. The latter, in many cases, was ascribed to "envy" by beneficiaries not having trees planted on or near their land. In all subprojects, however, some awareness education was taking place, ranging from activities at the local schools to the organization of Reforestation Committees among beneficiaries.

Such awareness efforts are being undertaken, in most cases, well into the reforestation effort, rather than at the beginning. And, they are starting at a time when INFOR is preparing to end its involvement with most Plan MERIS subprojects. Thus, it would appear that losses of plantings will continue after subproject turnover to the beneficiaries at a significant, although decreasing, rate. It is likely that plantings along the canals, since they are mostly on individually- or peasant community-owned land, will be viewed as "property" and protected by the landowners. At the same time, since they may well be seen as a free resource, plantings on slopes subject to erosion are probably in greater danger, unless the beneficiaries understand the importance of erosion control. Ironically, these plantings are more important for long-term agricultural productivity than those planted along waterways for canal protection. Thus, the ultimate reforestation impact hinges on the ability of GOP extensionists to instill a sense of responsibility for all trees, regardless of location, in both project beneficiaries and those non-beneficiaries adjacent to project sites.

IV. ADDITIONAL IMPACTS

A. Employment-generation Impact

This impact also appears to have been less than anticipated in the project paper. Quantifying the employment generated by the project, however, was not possible during project design and is not possible for this evaluation. Project beneficiaries and some landless poor did participate in the construction phase of all irrigation systems. However, up to 50 percent of the labor required for construction of the Cajamarca subprojects was brought in from outside the area. While this was not contrary to project design, it was not anticipated in the project paper's analysis of employment-generation. Plan MERIS managers stated that, given the project deadlines, outside labor was necessary because local labor lacked the necessary skills to perform such tasks as working with concrete. As a result, project beneficiaries and landless poor were apparently limited mostly to performing manual labor tasks such as the digging of canals.

There has also been some employment-generation from increases in productivity on larger holdings. Several larger farmers reported hiring laborers for land clearing, digging of tertiary canals, construction of farm buildings, maintenance of crops, and related activities. While a positive impact, this is also a limited one, given the small proportion of larger-sized holdings (approximately 10 percent, in the aggregate) within Plan MERIS. The only site where this impact is likely to be significant is in El Chingol, where some 800 hectares of new land were brought under irrigation. These lands had also been subject to the agrarian reform and, thus, were of a larger size than most of the holdings in the older areas of El Chingol and other subprojects, which did not come under the agrarian reform. The continuing employment-generation impact of Plan MERIS, therefore, is necessarily limited by the fact that the only farms able to use wage labor in an economically viable manner are a small percentage of the lands involved.

B. Social Impacts

Plan MERIS appears to have had a significant impact on at least the peasant communities in the project area. Irrigation has served to enhance economic opportunities for these groups, given that most of them own and cultivate land in common. This, in turn, has led to a resurgence of comunero participation in the affairs of the community. Peasant communities in the Apata and Yanacancha subprojects, for example, are planning to enter the commercial production of milk and milk products. The Apata community, furthermore, reported a one-third increase in its membership, primarily as a result of comuneros returning from off-farm employment once economic opportunities within the community expanded.

In addition, the Plan MERIS project has had an overall social impact on its beneficiaries by the fact that the project was executed at all. There is an undoubted value in being the object of attention by one's government and foreign donors. To fully capture these impacts, however, project such as Plan MERIS must be implemented with less emphasis on infrastructure and more emphasis on services and technical assistance.

C. Institutional Impacts

These have, in fact, been some of the principal impacts of this project. Plan MERIS has demonstrated that a large number of farmers in the Sierra can be reached by relatively inexpensive, on a per hectare cost basis, irrigation systems. Thus, Plan MERIS is an excellent prototype for projects that the GOP should pursue in preference to the much larger and more costly irrigation projects of Peru's coastal areas. Plan MERIS, in fact, is already being replicated by the Development

Corporation for the Department of Junin (CORDE Junin). CORDE Junin, like similar organizations in Peru's 17 other departments, is responsible for general development in the department, both in urban and rural areas. The emphasis of these bodies, however, has traditionally been in the more urbanized areas and has typically encompassed works such as road construction.

In the Mantaro valley, though, CORDE Junin and Plan MERIS have signed an agreement to construct up to ten irrigation systems based on the Plan MERIS selection and design criteria. These works will be financed by CORDE Junin, which, along with CORDE Cajamarca, receives much of its budget from a USAID/Lima integrated rural development project. Project implementation will be by Plan MERIS personnel. This agreement might well serve as an example on which to base further expansion of the Plan MERIS experience throughout the Peruvian highlands.

Prior to it being an effective model, however, some improvement in institutional arrangements will be necessary. CORDE Junin personnel stated they had no immediate plans to coordinate with the Ministry of Agriculture's extension service. Similarly, contacts between Plan MERIS has had minimal contact with the national extension service until a short time before a project is turned over to its beneficiaries.

In sum, Plan MERIS' status as a special project has been both an advantage and a disadvantage. In receiving special attention, Plan MERIS has been able to continue much of its work during periods of severe belt-tightening by the GOP. This, however, has been mostly true for the AID-assisted portions, and not for the entire project. At the same time, this special status has resulted in the development of a structure apart from, and in many instances duplicative of, other similar activities within the GOP. Such duplication, especially in the area of technical assistance, seems endemic in Peru -- the evaluation team identified at least four entities, including Plan MERIS, which were undertaking extension activities without any reference to, or coordination among, each other. Individually, moreover, these entities do not seem to provide adequate support to their client group.

The fact that the Plan MERIS model appears to be gaining acceptance by the GOP as a viable development vehicle could outweigh its possible negative impacts. But such projects must be properly designed to reach the majority of potential beneficiaries.

V. CONCLUSIONS

1. More water is now available to farmers on a reliable basis for crop and pasture irrigation. As a result, some significant long-term production and economic benefits are likely to derive from this project, at least for larger landowners. The availability of water is also a benefit to small farmers and minifundistas, but these groups are likely to reap fewer long-term economic benefits. A significant benefit accruing to the small farmers, however, is a decrease in the risk of catastrophic failure associated with a lack of rainfall.

2. The physical infrastructure works appear to be well designed and construction costs per hectare are relatively low. This is particularly true in comparison to the GOP's large-scale irrigation projects in the coastal regions. The Plan MERIS irrigation model has a great potential for reaching significant levels of beneficiaries and land at a relatively low cost. At the same time, a change in project emphasis away from physical infrastructure and toward technical assistance and services will be necessary before the project's benefits can be fully realized.

3. The credit component was poorly designed, given the intended target group. This is evident by the fact that virtually no small farmers have taken advantage of this component. Because of BAP policies and small farmer perceptions of the dangers of credit, only farmers with clear title are able to obtain, or seem willing to request, credit. The credit that has been disbursed, however, has had a positive impact, especially since there are few other sources of investment capital in the Sierra. At the same time, small farmers have less need for investment credit than they do for production loans at affordable rates of interest. Therefore, they will not benefit from credit until a special effort is made to reach them with creative forms of financial assistance.

4. Agricultural technical assistance is not reaching the majority of the intended beneficiaries. Although Plan MERIS personnel are doing an outstanding job with the few resources and facilities at their disposal, the technical assistance effort is bypassing the small farmers; benefits from these activities are accruing to the larger farmers. There is no question of receptivity here; small farmers are probably as receptive as larger farmers to improved techniques and methods. The latter, however, have the adequate resources -- sufficient land, credit, inputs -- to take advantage of the assistance being offered. To reach the project's intended beneficiary group, the small farmer, an effort must be made to put more extension personnel in the field. They must also be provided with appropriate technical assistance packages which address Sierra conditions.

5. Maintenance of the water systems may become a problem in the future. The current national water tariff structure is unlikely to produce the revenues necessary to make maintenance self-financing. Even though recent changes provide for tariff revenues to be kept within the Water District which collects them, it is unlikely that the rates charged, assuming full compliance by water users, will cover all costs of maintenance and improvements. Thus, additional government budget support is likely to be needed. Participation by the beneficiaries in the maintenance work is occurring at all project sites; such work probably defrays a significant portion of the maintenance costs. The DGA's Water Districts, though, must ensure that viable, fully active Irrigators Committees continue operating at Plan MERIS sites.

6. Reforestation and afforestation efforts are likely to be less effective than anticipated. Project managers have identified a lack of understanding of reforestation benefits as a principal shortcoming in these activities. Without a thorough program to develop such an understanding, the expected reduction in soil erosion is not likely to be achieved.

VI. LESSONS LEARNED

A. Project Financing

When a host-country government is in financial difficulties, project counterpart activities are likely to suffer. It is also evident that the provision of irrigation alone will not result in full benefits from the project; an effective and wide-ranging agricultural extension effort is also needed. In circumstances such as those in Peru, where an effective extension effort cannot be mounted due to a lack of personnel and resources, AID should seriously consider financing the costs of agricultural extension, even if it means reducing the number of irrigation systems built. To do otherwise risks losing the full benefits of irrigation.

B. Beneficiary Identification and Involvement

The proper beneficiaries have to be carefully targeted in order to meet project objectives. In Plan MERIS, the identification of farmers with less than two hectares of land was misplaced, if the intention was to increase the land under cultivation, diversify crop composition, and raise yields. In addition, potential beneficiaries should be fully involved in the selection of project sites and, to the extent possible, in the design and course of the waterways. Beneficiary involvement is also key to the survival of the irrigation system and to the success of ancillary project efforts. An effort should be made, throughout the project process, to imbue the beneficiaries with the notion that the project is "theirs".

C. Provision of Credit

Medium- to long-term investment credit is not a cost-effective proposition for small farmers if they lack the capacity to purchase needed inputs. Production credit, as well as appropriate and sufficient agricultural extension, is needed to ensure that the multiplier effect of irrigation and inputs on agricultural production can be realized.

D. Agricultural and Extension Services

This aspect is critical to the success of any irrigation project. Such assistance should begin at the same time as the construction work, so that beneficiaries have a period of time in which to observe, and probably improve, the technical assistance before planting their first crop under full irrigation. Additionally, technical assistance packages must be appropriate to the agriculture practiced. Thus, it is useless to present a subsistence farmer with a technical package requiring expensive or scarce inputs when the bulk of production will go for family consumption and the costs of production are unlikely to be covered by any incidental sales. It would be far better to present such a farmer with a technical package which improves his methods of production but which changes little, if any, of the inputs used. Finally, it is crucial for project design and implementation to recognize the importance of existing land cultivation and production patterns, as well as the role played by government pricing policies in the agricultural sector.

E. Land Ownership and Titling

The patterns of land ownership in a project site are critical to the success of an irrigation and agricultural development project. In cases where the majority of the beneficiaries are small, subsistence farmers lacking clear title to the land, it is useless for project components to require, or depend on, legal documents or a minimum extension of land to be fully operative. Similarly, the relative economic strengths of the beneficiaries must be considered during project design and implementation to ensure that all are reached.

F. Institutional Arrangements

Projects which have the best chances of success are those in which all organizations involved have a continuing and active interest. While "special category" projects often are implemented quickly, their gains can also be quickly dissipated if the organizations responsible for continuing the project are not involved in its implementation, even if as advisors. Not doing this risks turning a special project into one without a

constituency. Ideally, this special status should not imply a duplication, or ignoring, of efforts conducted by other agencies. Rather, it should be expressed through coordinating mechanisms which involve all agencies having an interest in the activities being pursued by the project. While this may slow implementation, it may well assure the gains from the project in the longer term.

G. Project Design

Irrigation projects always seem to cost more, and take longer to implement, than anticipated. Given this, project design should allow for longer disbursement periods, or for fewer subproject starts within a limited disbursement period. From AID's standpoint, this implies either projects which are allowed to run longer, in many cases quite a bit longer, than the preferred five years, or projects which fit in the five-year timeframe but involve a drastically smaller number of sites. With this latter course, provisions should be made to allow mission funding of follow-on projects until sufficient experience is developed with which to get larger donors, such as the Work Bank, interested in this type of project.

On the whole, the Plan MERIS model is extremely well suited to the small-farmer agriculture conditions prevailing in much of the developing world. Its potential should not be overlooked because of implementation problems. However, it must be recognized that, in these projects, water is a necessary but not sufficient factor. Small-scale irrigation projects do have an impact but, as implemented in Peru, it has been far less than its potential. They should not be engineering projects with technical assistance and services appendages. Rather, they should be technical assistance and services projects based on an assured source of water for irrigation.

APPENDIX A

EVALUATION METHODOLOGY

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The methodology and scope of work for the Plan MERIS impact evaluation were developed by the team in meetings prior to leaving Washington and, shortly after arriving in Peru, following initial discussions with USAID/Lima and Government of Peru personnel.

Prior to leaving Washington, team members reviewed available project documentation and two mission-funded Project Evaluation Summaries conducted in 1979 and 1981. Following the documentation review, team members met with various officers who had been involved in the Plan MERIS project during the period 1976-1980 and who were now assigned to AID/Washington. Additional, more general, data was obtained from sources at the InterAmerican Development Bank and the World Bank. The meetings and review of data provided the team members with what subsequently proved to be a fairly accurate asessment of present conditions in the Peruvian agricultural sector and the Plan MERIS project itself.

As initially developed, the evaluation scope of work encompassed four elements:

a) characteristics of project viability;
b) socio-economic impact on beneficiaries;
c) impact of other forces on, or by, the project; and,
d) overall, an assessment of project effectiveness and lessons learned.

During its initial meetings, the team decided to send one member to Peru five days ahead of the rest of the team. This person was to obtain and review any additional pertinent data available either in the mission or the Government of Peru, as well as finalize the schedule of field trips to project sites.

Given the transportation problems encountered during the trip due to the unseasonable rains, the resultant mud and landslides which closed many roads, and the time required to visit some isolated sites -- up to six hours, one-way -- the team decided to not visit sites under construction or those in which the physical infrastructure had only recently been completed, especially since agricultural development activities had, in most cases, yet to be initated at these sites. The team felt justified in this approach given that most sub-projects involved both the improvement of existing

irrigation systems as well as the incorporation of new lands under irrigation. Thus, it was felt that an adequate cross-section could be obtained of both farmers who were new irrigators and farmers who had previous experience with irrigation.

In both Cajamarca and the Mantaro valley, the team chose to visit sub-project sites which had been completed for the longest period of time, allowing a better view of Plan MERIS' impact. The team considered this to be the most feasible approach to allow a comparison with pre-project indicators. Thus, a sample of subprojects with at least two cropping seasons under new or improved irrigation was selected for site visits.

In the Mantaro Valley, the team also visited a non-irrigated area; this was done in order to attempt a comparison of farming techniques between small farmers in irrigated and non-irrigated areas. Other than for the availability and relatively greater use of water in irrigated areas, these techniques were found to be remarkably similar.

The general uncertainty associated with travel arrangements because of the disruptive effects of the El Nino warm ocean current, however, resulted in one-day delays in reaching both Cajamarca and the Mantaro Valley, reducing the amount of time available in the field. Thus, some four days were spent at each of the two regional sites; two sub-project sites were visited each day.

Upon arrival at the regional sites, the team met with Plan MERIS regional staff to discuss the purpose of the evaluation, the team's itinerary and desired goals, and the general environment of the particular site. These discussions covered the general scope of work for the evaluation, with emphasis on the impact of external forces on the project's implementation. The team also sought Plan MERIS' assessment of the impact of the project on its beneficiaries; these were later compared to the beneficiaries' perception of this impact. Following these meetings, individual sub-project site visits were conducted; the team operated as a unit during these visits, although individual team members made an effort to interview both small- and medium-scale farmers in an effort to determine differential project impact, if any, on each group.

Farmers interviewed were selected at random -- as were the women who were interviewed -- and interviews were conducted in a semi-structured manner. Each team member had a common list of questions and concerns the team felt were important. It soon became evident, however, that after some initial questions and the establishment of rapport, more information could be

obtained by allowing the interview to become free-flowing, rather than completely structured. Interviews with project beneficiaries emphasized the impact aspects of the scope of work. Questions directed at the farmers covered: their access to and use of credit and technical assistance; changes in production techniques or patterns; changes in income since project inception; and, in general, their perception of the benefits they are deriving from the project. The night after each site visit the team met to discuss its findings, exchange impressions and determine areas of information which required greater or lesser attention.

At the completion of each regional site visit, the team met with Plan MERIS, Agrarian Bank and other regional personnel to informally discuss its findings and obtain clarification, if needed, on points of fact concerning what had been learned. These sessions proved to be valuable to both the team and the Government of Peru participants.

Following the site visits, the team spent some six days in Lima collecting additional data, conducting interviews with Plan MERIS and other personnel at the national level, and producing a first draft of the report. The drafting of the report was aided immeasurably by the fact that, following the first site visit -- to Cajamarca -- the team produced a detailed outline of the likely final report. Following the second site visit -- to the Mantaro Valley -- this outline was expanded and modified, as needed, into a final outline. As a result, the first draft was produced quickly and while the information was still fresh in the team's mind.

While the above approach to the impact evaluation worked well for the team, three shortcomings should be noted:

1) Lack of adequate baseline and current data on factors such as production patterns and yields, land tenure patterns, farm-level income and nature and pattern of off-farm employment. Some data on agricultural production was available, but it was too aggregated to be useful; most of the data is being collected at the provincial level, and does not allow for comparisons to be made between particular areas within a province. Also, production data was not disaggregated by size of producing unit. And, available data on farm-level incomes is unclear, and not amenable to analysis, since it does not take into account, or does not specifically calculate, costs associated with production.

It does not appear, furthermore, that this and related data is being collected in a systematic manner; much of the data that was available seemed to be estimates and informed judgments. As a result, the team was unable to do comparative

cost-benefit analyses between individual sub-project feasibility studies and actual conditions in completed sub-projects. Such an analysis was not possible given several constraints. The computer program used in calculating the projected rate of return for the feasibility analysis in the project paper was not available either in Peru or in AID/Washington. Plan MERIS, furthermore, did not have adequate staff or financial resources to draw up comprehensive statistics. And, given the delayed construction schedule, calculating rates of return at a later date would have been more appropriate.

The lack of adequate data, it should be noted, also hampered the efforts of the Water Management Synthesis project team which was in Peru at the same time as the impact evaluation team. It would, thus, be well worth it for the mission and the Government of Peru to consider devoting resources to an extensive farm-level social and economic survey to develop needed data on which to base future program and project decisions.

2) Since Plan MERIS is an irrigation project, it might have been preferable to have conducted the evaluation during the irrigating season. While the timing of the evaluation was not a major shortcoming, the team agreed that visiting Peru during the dry season might have provided a somewhat different view of farm-level activities. However, the team does not believe that any of its conclusions or recommendations would have been altered by conducting the evaluation at a different time of the year.

3) The team also agreed that the time available in the field was too short and did not allow for, ideally, revisiting sites to confirm or modify impressions gathered during the half- or one-day trips to each site. It also did not allow for visiting a non-irrigated site in each region, although an effort was made to interview farmers at each site who were either not receiving irrigation water or who were only irrigating part of their holdings. Again, although the team would have been more sure of its conclusions with such visits, it does not believe that these would have been materially changed by additional visits to the sites.

Of the above three shortcomings, the greatest one, in the team's opinion, is the first. The lack of adequate and regularly-collected reliable data, though, is not an impediment to just evaluating rural activities such as Plan MERIS. More significantly, it is likely to hinder the design and implementation of any project undertaken in rural Peru.

APPENDIX B

SUB-PROJECT DATA TABLE

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Name	Irrigated Area (in hectares) New	Improved	Total	Total Cost Infrastructure	Cost Per Hectare	Beneficiaries (Families)	Year Construction Began	Year Completed	Comments
Central Sierra (Mantaro)									
Yanacancha	700	--	700	$236,600	$338	350	Nov 1980	May 1982	
Apata	548	102	650	$602,600	$927	573	Oct 1980	July 1982	
Chicche	327	357	684	$334,400	$489	350	Oct 1977	Apr 1979	
La Huaycha	186	354	540	$186,000	$344	620	Dec 1978	Dec 1979	
Chupaca	1,785	1,966	3,571	$1,054,900	$295	4,285	Sept 1978	Dec 1980	
Sincos	200	260	460	$253,800	$522	230	Apr 1981	Dec 1982	
*Cotosh	190	340	530	$68,900	n/a	1,250		NC	40% complete
*Huasahuasi	--	420	420	$255,500	n/a	590		NC	" "
Northern Sierra (Cajamarca)									
Santa Rita	--	617	617	$272,100	$441	976	Mar 1980	June 1982	
Carahuanga	--	970	970	$302,900	$312	636	Sept 1980	Dec 1981	
Namora	--	222	222	$254,800	$1,148	220	Sept 1979	Oct 1980	
Chingol	807	653	1,460	$1,174,800	$805	250	Feb 1979	Mar 1981	
Granja-Porcon	66	124	190	$132,600	$697	60	June 1981	Dec 1982	
*Carrizal-La Grama	250	432	682	$439,900	n/a	294		NC	70% complete
*Cholocal	--	655	655	$352,200	n/a	162		NC	" "
*Tabacal-Amarcucho	--	522	522	$318,500	n/a	138		NC	70% complete
*San Marcos	130	260	390	$10,900	n/a	277		NC	25% complete

*Construction not completed. Total cost of infrastructure is total cost spent as of December 1982.

APPENDIX C

THE RURAL COMMUNITY AND THE SMALL FARMER

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A. Land and Water Resources

According to the 1972 National Agricultural Census, Peru has 1,390,000 agricultural units which, together, encompass 23,545,247 hectares of land. This land extension is distributed in the following manner:

Major Use of the Land	Hectares	Percentage
Farming	3,691,417	16
- Rainfed	(2,417,904)	
- Irrigated	(1,273,513)	
Natural Pastures	15,128,861	64
Woods and Forests	3,069,381	13
Other	1,580,487	7
Not Determined	75,001	--
TOTAL	23,545,247	100

In looking at rural Peru, one is immediately struck by the fact that the available agricultural land is insufficient for a population that is constantly growing. One can also discern that, at present, the land which could be intensively cultivated is very limited, given the fact that, within the 3,690,000 hectares farmed, only 34 percent comprise irrigated lands, compared to the 66 percent which are rainfed.

It should be noted, further, that 59 percent (approximately 750,000 hectares) of the irrigated lands are in the Costa; in other words, some 80 percent of agricultural areas in the Sierra consist of rainfed lands. In general, this would mean that, in 1982, without taking into account the 15 million hectares of natural pastures, the total of 3,690,000 hectares of farming land in Peru was the actual base of a rural population of 6 million. This would mean that, on average, each rural family -- with the typical family size being five individuals -- had only three hectares available for farming.

The small extent of farming land available in the Sierra would not be so critical if the following factors did not also have to be taken into account:

1) The low quality of these lands;

2) Their location, generally on steep slopes and, therefore, subject to dangerously erosive conditions;

3) The severe climatic conditions -- droughts, freezes, hailstorms and, sometimes, excessive rainfall -- which, practically speaking, allow only one crop per year in much of the Sierra;

4) The prolonged fallow periods (from two to seven years) needed to regain land fertility, absent the extensive use of fertilizers; and,

5) The extremely polarized structure of land tenure; that is to say, most of the farming lands are concentrated in a small number of cropland and cattle-raising farm units, while most of the population has access only to very small and dispersed parcels of land. This makes it difficult, and sometimes impossible, to provide such small units with technical assistance or credit, even if these inputs were abundant or readily available.

Thus, as seen in the table below, concentration and minifundia are the two most outstanding characteristics of land distribution in rural Peru. Although the data on which the analysis is based correspond to 1972, the conclusion is still valid at present, since the Agrarian Reform -- initiated in 1969 -- has not resulted in significant land tenure changes.

Agricultural Units

Size of Unit (Hectares)	Percentage of Total Units	Percentage of Total Area	Average Hectare/Unit
Less than 1	34.8	0.8	0.4
1 to 5	43.2	5.9	2.3
5 to 50	20.0	14.3	12.1
50 to 100	1.8	17.3	158.0
100 to 2500	0.1	7.4	1484.7

Agricultural Units (con't)

Size of Unit (Hectares)	Percentage of Total Units	Percentage of Total Area	Average Hectare/Unit
Above 2500	0.1	54.3	12577.0
TOTAL	100.0	100.0	16.0

The above data is based on a total of 1,290,288 farm units encompassing some 23,545,147 hectares.

This data clearly illustrates three fundamental characteristics of land tenure in Peru:

1) Almost two-thirds of the area farmed (61.7 percent) is held by only 0.2 percent of the farm units;

2) Medium-sized farm units (ranging from 5 to 100 hectares) represent 21.8 percent of all farm units, but occupy somewhat less than one-third of all lands (31.6 percent); and,

3) The bulk of the farm units (78 percent) typically farm only a small area (up to 5 hectares in the best of cases) and, as a group, encompass only 6.7 percent of the total agricultural lands.

Land tenure in the Sierra, furthermore, is remarkable not only because of land concentration and a marked minifundismo. It is also remarkable for land dispersion and the division of farming units into various parcels. In the Mantaro valley, for example, researchers have found a one-hectare plot of land which has been divided into 24 separate parcels. This situation is not unusual elsewhere in the Sierra.

Using additional sources of information, it may be estimated that, in 1982, of the total of 23,500,000 hectares in rural Peru, 8,000,000 hectares belonged to the more than 3,000 recognized rural communities, comprising 600,000 families. Five million hectares belonged to the 670 agrarian production cooperatives, agro-industrial complexes, social ownership enterprises, and agricultural social interest societies. Between them, these organizations comprised 34,000 families. And, finally, the remaining 10,500,000 hectares were owned by an undetermined, but probably large, number of non-recognized rural communities, independent minifundistas, and small landowners which, in sum, represented 566,000 families.

B. The Rural Communities and the Small Farmers

The rural communites, 98 percent of which are located in the Sierra, range in character between two extremes. At one extreme are those communities which are highly isolated and almost self-sufficient. Within such communities, predominant norms and values are the result of a complicated fusion of pre-Columbian and colonial Hispanic elements.

At the other extreme are communities which are dynamically integrated into the market economy, mainly as a result of their proximity to cities and large markets. This integration does not necessarily imply the loss of traditional values; rather, these values have been adapted to the exigencies of life within a modern society. This type of integration and adaptation, for example, is evident among communities in the Mantaro valley.

Whatever its character, the rural community is frequently characterized -- beyond ethnic and racial considerations -- as involving the communal exploitation of land. While such a characterization is based on historical fact, it lacks validity today. In fact, since Colonial times, rural communities have undergone deep transformations involving their: ethnic composition; governmental structure -- which parallels traditional structures persisting from the Colonial era; land tenure and access to the land; organization of labor; and, ideologies, norms and values. In short, most of the original characteristics of rural communities have been effectively weakened, although they continue to retain their original form.

In government and administration, for example, new methods of organization representing regional or national interests have been introduced and are taking the place of some community functions. This is the case, for instance, where rural communities have become the seat of a district or provincial government. In this situation, the community both loses authority over the lands considered urban and also suffers the loss of some members who become alienated from the communal organization. The presence of officials -- governors, lieutenant governors, and municipal agents -- representing the central government also plays a role in destabilizing the authority of community officials such as the presidents of administrative and supervisory councils.

The ethnic composition of rural communities -- which in the past identified them as "indian towns" -- has also changed following centuries of inter-racial contact and intermarriage. In the past few decades, migration into and out of the communities has played an important role as well. This migration has been due both to the very poor or insufficient resources available to a rapidly-growing population and to the

rising expectations generated by increased contacts with the outside world.

These local change processes are damaging to old values such as: the prestige derived from physical work; the integrative nature of communal work; and, the patriarchal position of the husband in relation to his wife and children. Equally disruptive, however, are the urbanization and industrialization processes occurring on a more global basis. These phenomena, however, also have a countervailing influence on the downfall of the old community, and on its quick integration into modern society. Thus, the survival of the community, in spite of centuries of acculturation and siege, can be seen as a reaction to these forces of modernization.

In short, changes occurring within rural communities do not necessarily mean that their basic characteristics have been destroyed. Rather, these characteristics continue today, even though some of their external manifestations no longer occur or are suppressed.

Given this, we can point to the following identifying characteristics of the present rural communities:

1) Communal tenure of land. Community members are usufructuaries of the land, with the exception of lands set aside for communal exploitation. Depending on the community, this communal land has either symbolic or economic importance.

2) Communal identification on the basis of a defined land extension, and a strong sense of community expressed through communal work, religious celebrations, customs, ideologies and ethnocentric events.

3) Frequent meetings to discuss and solve community problems, as well the election processes for officials, express a greater or lesser degree of active institutional life.

4) Acceptance of administrative and governing decisions -- although not always democratic in nature -- adopted by their leaders.

5) Active participation in socio-cultural events, under common rules; the failure to fulfill these rules is the object of sanctions by the community.

Within these communities, water and land are clearly the most interesting and crucial factors related to modernization

and the implementation of rural development projects. It should be noted that:

1) Only since the 1920 Constitution has the juridical existence of the communities been recognized, making their land inalienable; legal recognition of these communities dates from 1926. As a result, a partial end was brought to the taking of community lands by medium- and large-sized landowners.

2) Most of the communities occupy only a small area of land, generally located on soils less advantageous for agricultural development. This is aggravated by the fact that, as the community's population increases and land is made available to new families, each family has access to progressively smaller areas of land, eventually facing a serious minifundia problem. The hereditary system of land succession, thus, is an important reason why many community members migrate. Migration is primarily to cities in the Costa, to mining centers, or to the Selva Alta.

3) The unequal distribution of land is a source of permanent tensions and conflicts. The concentration of land in a few hands and minifundismo are noted most sharply in rural communities. As an example, within Plan MERIS' six irrigation projects in Cajamarca, 71 percent of the 2,461 farm units are landholdings of one hectare or less; 21 percent of the landholdings range from 1 to 5 hectares; and, only 8 percent encompass more than 5 hectares. Similar conditions can be found in the Mantaro valley.

4) Given these conditions, it is obviously difficult for people who own very small and dispersed fields to obtain whatever limited technical assistance and credit are aviailable from private or governmental agencies. For this reason, agricultural or rural development projects have only tended to benefit medium- and large-scale owners. There have only been a few exceptions to this pattern, as in the case of the Puno-Tambopata Project (a United Nations and Government of Peru project during the 1960s), which carried out a succesful program of land reconcentration, aimed at overcoming the problems of minifundia and land dispersion, to achieve socio-economic development.

5) As stated in Section 25(a) of the 1970 Special Statute for Farmer Communities, the community, as a legal entity, is the sole owner of all resources encompassed by its land. Community members only have the right "to participate of the goods and services....in the manner established by the internal

rules (of the community)". In reality, however, the control the community has over its resources is only formal since, in practice, its members consider themselves "owners" of the parcels of land they work. As a result of this, sales contracts for these lands are very common, with titles generally issued by justices of the peace, although such titles have no legal standing.

6) The persistence of communal work (commonly known as "faenas") allows the communities to solve internal needs, such as the construction or maintenance of community roads, schools, churches, graveyards, etc. And, in the past, communal work has made it possible to build important irrigation systems, allowing water distribution according to the size of the parcels of land worked by each community member.

7) The farmers who live outside of a recognized community are primarily merely holders of the lands and pastures they work, as they usually do not have title to their land. This is generally true regardless of the manner in which they acquired their land -- whether through hereditary succession, traditional (undocumented) ownership, unregistered purchase, mortgages, etc.

C. The Farm Economy

The following characteristics can be noted among both farm communities and small farmers living outside a communal system:

1) Working tools are extremely simple and are constrained mostly to the use of the Spanish plow pulled by oxen and the "chaquitaclla", or pre-Columbian foot plow. The use of machinery such as tractors is very limited. Farming techniques tend to be primitive: non-irrigated cultivation; land left under prolonged fallow to regain fertility; little use of fertilizers, which are primarily limited to animal droppings; use of native seeds and traditional farming practices. Given these conditions, change comes slowly and incompletely.

2) The prevalent technical backwardness finds its expression in an elementary division of labor, often based on the traditional differentiation between sexes. Knowledge of agriculture and cattle-raising, however, is common to both men and women. In more advanced communities, though, such as those in the Mantaro valley, artisan and service specialization may be found. While such specialization occurs, it does not mean an abandonment of agricultural work or the occasional provision of off-farm labor. Specialization is often undertaken to meet

the need for a cash income. Such an income is used to satisfy traditional small-farm needs or those which arise from contact with the market economy.

3) Productivity is low, as a result of: technical backwardness; the poor quality of available resources; and, the lack of, or difficulty of access to, cheap credit or adequate technical assistance.

4) The availability of capital goods is limited: home implements are simple and of poor quality, as are farming tools; there are few oxen; animals, mostly cows and sheep, are primarily considered as a form of savings or are prestige items; and, even the land, in addition to being of low quality and limited extent, is closely tied to fundamental social beliefs and rules. This latter factor contributes to segregating the land from strictly commercial considerations; and, it means that demographic pressures are not decreased when a family migrates. Migrants tend to retain ownership of their land through renting it out, exploiting it through a partnership arrangement, or just leaving it in the care of relatives or other persons.

5) The farther communities and small farmers are from important urban centers -- which helps determine their amount of contact with the market economy -- the more they tend to take on a subsistence character, because these farm units produce hardly enough to fulfill the family's needs. On the other hand, cattle raising, especially of sheep, is directed to external markets. Even milk production has become important since national enterprises such as FONGAL (Fomento Nacional de la Ganaderia Lechera - National Milk Cattle Development), as well as transnational enterprises, have created an efficient storage and processing system, assuring producers of a regular daily income.

6) Agricultural production, besides being affected by the small size of most farm units, is also often restricted by climatic factors which sometimes result in the total loss of plantings or harvests. This also contributes to the lack of enthusiasm for production credit on the part of many farmers.

7) During planting and harvest periods, the shortfall of family-supplied labor is made up by free reciprocal labor ("ayne", "huajate", "yanapa" are all regional terms for such labor) by relatives, godparents, and neighbors. At the same time, wage labor is almost nonexistent -- even though it may exist in symbolic form, as wages do not meet the minimum

established by law and are paid partly in money and partly in food, drink and, almost invariably, coca. Reciprocal work is also a common practice for other activities, such as house building.

8) Despite the above, in wide areas of the country agricultural and cattle production is increasingly participating in the market economy and is abandoning its subsistence character. This can be traced to the existence of: improved communications channels; greater contact with the modern world; changes in food consumption patterns; the need to educate children; and, increased desire for access to manufactured goods.

9) Incomes that communities and small farmers can obtain as a result of their participation in the market economy are based more on the exploitation of their labor, than on the fair prices they could obtain for their products.

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APPENDIX D

AGRICULTURAL RESOURCE BASE

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Peru is a large, geographically diverse nation with a tremendous variety of different agroecological zones. Almost every conceivable climate and land form is present. Within this geographical diversity, Peru has a rapidly growing population of approximately 16 million.

Topography: Peru is physically divided into three distinct large land systems -- coastal (Costa), highlands (Sierra), and lowlands (Selva). The agriculture in each of these systems is quite different, with a tremendous diversity of agroecological zones among and within these systems. A breakdown of the total land area and the current agricultural land estimates is given in Table 1.

Table 1

Surface Land Areas (ha)

	Total Area	Cropland		
		Irrigated	Rainfed	Total
Costa	13,000,000	700,000	negligible	700,000
Sierra	35,000,000	340,000	1,850,000	2,190,000
Selva	80,000,000	30,000	570,000	600,000
Total	128,000,000	1,070,000	2,420,000	3,490,000

The Costa system is an arid and semiarid area crossed by numerous river valleys of differing sizes and productivity. Agriculture in the Costa system is completely dependent upon irrigation, with an estimated total of 700,000 hectares in production. This area is the principal source of Peru's export crops, notably sugar cane and cotton. Although the Costa region is agriculturally the most intensively developed, only about half of the agriculturally useful land is being exploited. Water is the major constraint. Rainfall is negligible and for intensive production, water must be made available continually throughout the year.

The Sierra system is the large inter-Andean basin system with the agriculturally useful areas having elevations of 1200 to 4000 meters. Climatic conditions vary from temperate to frigid, with an extremely high number of microclimates. Rainfall in the agriculturally important areas ranges from 400 to 800 mm, being generally sufficient for rainfed production of one crop growing season. Principal biophysical constraints to production are frosts at the higher altitudes and droughts of varying intensities and duration. Rainfed production occurs on about 1.8 million hectares with another 18 million hectares in natural pastures, much of very limited productivity. As much as a third of the rainfed area may be under long-term (3 to 7 years) fallow at any one time. About 340,000 hectares are under irrigated production with varying levels of management intensity. Irrigation serves to reduce risks and stabilize rainy season production and, ideally, provide for a second cropping season, depending on altitude and resultant frost risk. While irrigation may help prevent frost damage, there is no local data available on the protection that the current ability to manage water may give against the radiative type frosts dominant in the Sierra. An additional 500,000 hectares could be placed under irrigation, if water can be supplied.

The Selva system is the extensive and isolated jungle region with elevations up to 1200 meters and numerous large river basins. Less than an eighth of the potentially useful agricultural land is being used. Currently, much more emphasis is being given, by the government and foreign donors, to the Selva Alta or "Ceja de Selva" as the area having the greatest, most readily attainable, agricultural potential.

Climate: The topographic features of the country are complex and this creates very diverse climatic conditions with many microclimates, particularly in the Sierra and Selva Alta. Some examples of basic climatic data for the Costa, Sierra and Selva Alta are given in Table 2. The climate in the Costa is temperate, allowing for crop production the entire year if water is available. In the Sierra the climate varies with the altitude, with mean temperatures of 12-16 ^{o}C and annual precipitation of 400-800 mm. Generally, the period of rainfall is 4-6 months and there is a 6-7^{o} C decrease in temperature for every 1000 m altitude. Frequent frosts and droughts are the main climatic constraints. In the Selva Alta the mean temperatures are similar to the Costa but with precipitation greater than 1000 - 1200 mm. Still, there is generally a pronounced dry season where precipitation is limiting to normal plant growth.

Good, extensive, and reliable historical and current meteorological data is essential for successful technology

transfer and rapid agricultural development. The data is essential for good system design in irrigated agriculture. It is also equally important, however, in rainfed agriculture for crop zoning and matching agronomic inputs to probable production. Rainfall probabilities also allow for better selection of planting dates, harvest dates, and crop varieties. Reliable data collecting and processing requires high manpower and equipment inputs. While Peru has much basic meteorological data, there is a question about the reliability of much of the data. There is an urgent need for better collaboration among the various institutions involved in agriculture in obtaining better, more extensive, meteorological data.

Costa Agriculture: Irrigation is essential for agricultural production in the Costa. The soils are very low in nitrogen, medium in phosphorus and more or less rich in potassium. The principal crops include cotton, sugar cane, rice, corn, alfalfa, vegetables, and fruits. The Costa uses the greatest proportion of the fertilizer in the country and produces 40% of the agricultural output with only 21% of the cultivated land. While additional hectareage is available to irrigation, providing water can be extremely expensive and not economically justifiable from a production standpoint; this, for example, has been the experience with the Majes project. This is a large-scale irrigation scheme in southern Peru estimated to cost approximately $20,000 per hectare. A third of the cultivated land in the Costa has salinity and/or drainage problems, with 20 % of the land having severe problems.

Sierra Agriculture: Sierra agriculture faces many constraints deriving from varied agroecological settings as well as infrastructural problems, particularly that of difficult transportation and its resulting effect on marketing. The Sierra also contains 40 % of the population, most of very limited means. There is a generalized need to increase food production, both for the people within the Sierra and for the urban Lima market. Increased production would also address the socioeconomic factors of improving life for the Sierra inhabitants and reducing the rate of emigration to the coast, with its resulting political, social, and economic costs.

Much of the Peruvian Sierra has sufficient precipitation and distribution to provide one good growing season. However, the Sierra is also subject to rather devastating droughts, which have a tremendous impact on the social well-being of the Sierra people and serious food production implications, not only for the Sierra inhabitants but also for Greater Lima. Irrigation can greatly reduce this risk-effect but does not always do so to the extent hoped. Risk insurance may be a viable alternative in many rainfed areas depending on drouth probabilities.

Sierra soils lack nitrogen and phosphorus and are medium in potassium. The principal crops are potatoes, wheat, barley, corn and alfalfa. Traditional Andean crops such as quinoa, olluca, and tarwi are also grown. Crops in the Sierra require a growing season 15-20 % longer than in the Costa. There is a need to increase production in the lower parts of the valleys so that the farming intensity can be decreased at the higher elevations where erosion is generally more severe.

Irrigation serves to reduce risks and stabilize rainy season production and, ideally, provides for a second cropping season. Irrigation systems in the Sierra are generally small and have a limited infrastructure of lined canals. Maintenance of the systems is generally poor to nonexistent. An additional problem in a number of Sierra river systems is poor water quality due to contamination of the system by mine tailings and/or processing. This has been a major problem in the past in the Mantaro valley. Although efforts are being made to decrease the problem, it is still a factor in favor of considering projects which primarily use smaller alternate water courses which are not contaminated.

Two crops per year in lower elevations under irrigation might be an effective means of increasing production in the Sierra, but it requires a knowledge of the frequency and intensity of frosts and average temperatures throughout the year, resistance of specific crops to frosts and low temperatures, vegetative period of crops, crop water requirements, water availability and crop values. Yields may differ more than 80 % from one field to the next, even under the same climatic conditions, due to differences in technological levels.

Generally, only pastures can be cropped the entire year above 3400 m. Given the difficult climatic and geographic conditions, any increase in production in the Sierra will have to come from improved pasture and livestock management, more and better-managed irrigation, and the successful transfer of production technology such as fertilizers and improved seed.

Selva Alta: The mean temperatures in this area are similar to the Costa but with precipitation generally greater than 1000 mm. The principal crops are coffee, rice, corn, citrus, banana, cacao, oil palm, and coca. The soils are generally very good and frequently do not need large amounts of fertilizer at least during initial cropping seasons; as improved management increases yields and nutrient depletion becomes more important, fertilizer need will increase. Soil conservation and water management problems are similar to the Sierra and, thus, require similar improved practices.

Agricultural Production: Peru continues to have rather serious shortfalls in the production of a number of basic foodstuffs. Reasons for this are complex and include agronomic, infrastructure, pricing, and marketing considerations. Wheat, corn, milk products, and oils are the most consistent and serious shortfalls. Others are important at various times, depending on particular conditions such as droughts, floods, landslides, and earthquakes.

Total production may be increased by either increasing the area cultivated or by increasing yields. Peru has large additional areas that can be brought under cultivation in the coast, if water can be made available, and in the Selva, if infrastructure and production technology can be made available. Such expansion in either area, however, involves environmental considerations which require high levels of resource management capability. It would seem, therefore, that possibly greater benefits can be obtained by increasing the productivity of land currently being cultivated. Much of the land currently under fallow for one to three years in the Sierra could be brought under at least annual production with minimal input costs. Irrigated yields are also far below what they should be and could be increased considerably if inputs were available and used. Thus, increasing yields, decreasing fallow periods, and double and triple cropping should provide the greatest production increase at the lowest costs to both the producers and country as a whole.

Small and Medium Irrigation in the Sierra: Irrigation in the Sierra is very inefficient and prospects for immediate improvement are not good. Most farmers are using primitive production methods and traditional technologies in the use of fertilizers, herbicides, insecticides, plant varieties, and seeds. Irrigation and soil conservation are poorly understood and practiced. These poor production techniques, and the marginal lands used, produce low yields and limited returns. Irrigation of unimproved crops on lands with capability limitations provides limited short-term benefits and may have questionable long-term effects on crop yields as well as disastrous effects on soil erosion.

The Directorate for Preservation and Conservation (DIPRECO) was created within the Directorate General of Water (DGA) to address the problem of small and medium irrigations and help communities improve their systems. The DGA, and DIPRECO in particular, was staffed primarily with agricultural engineers and agronomists reflecting their major concern with agricultural production. This is in contrast to the Directorate General of Irrigations (DGI), which was staffed primarily by civil engineers concerned with works and with responsibility for large projects.

Plan MERIS was proposed as a part of the overall plan for Sierra irrigation in Peru. It was originally intended to be concerned with projects that were simple to design and construct and which were inexpensive, as local materials and unskilled labor would be used. While it was expected that beneficiaries would do most of the work, it was also realized that a large technical assistance input would be needed to fully realize the benefits of irrigation. As the project moved through the design process, however, more civil engineers became involved and more specific detail was required. As a result, Plan MERIS eventually became more of a construction project with a credit component for land improvement. When the project was then placed in the new General Executive Directorate (DGE), instead of the DGA, decreased emphasis on technical assistance and community interest resulted, as the DGE was also primarily staffed with civil engineers.

Support for the research component of the project was also decreased. Originally, this component was to support extension efforts in applying new technology to improve water conveyance efficiency and water application efficiency, as well as improved agronomic technology. The changed nature of the project, though, was manifested in the fact, for example, that the possibility of using gravity-fed sprinkler systems as both a more effective and efficient means of irrigating some areas with difficult terrain and as a means to decrease erosion was deleted.

The major Plan MERIS effort in the Sierra has taken place in two of the most Sierra important valleys. The Mantaro Valley (Huancayo) in the central Sierra is the larger and more densely populated. Because it is much closer to Lima, the resulting marketing situation is much better, a condition not present in the Cajamarca Valley in the northern Sierra. The Plan MERIS subprojects in the Mantaro valley were primarily developed with water sources other than the Mantaro river, which supplies the major older established irrigation system and was contaminated by the mining industry. This contamination apparently has been decreased and the most recent subproject is mixing Mantaro water with another source. Mantaro farmers, however, still exhibit a reluctance to use water they have known to be contaminated in the past.

In general, the physical engineering aspects of the subprojects are adequate, and have not encountered major problems. The extensive lining of canals has certainly decreased water losses in the main canal system, but the on-farm canal systems appear to have had very limited technical imput and, in many cases, could be improved as to their layout and use. Waterlogging and salinity is not a major problem, but drainage is necessary in several localized areas. It seems

apparent that more water is available to more farmers and more reliably within the project area than before. The actual impact of this availability is more questionable, however. The very high level of minifundistas within the project area (90%) makes improving the water management and production technology difficult. The difficulties posed by this factor were certainly underestimated during project planning and have still not been addressed in an adequate way.

Irrigation is practiced to increase crop yields. This may take the form of supplying water during a precipitation-deficient period in a supplemental manner, or by supplying water during the dry season for a second crop in the same year. A second crop has the same effect as opening new land, and possibly at lower cost if the water supply is readily available. A second crop may, however, have unexpected socioeconomic effects in that, while it allows for more efficient production (as some fixed costs are spread over two seasons), the increased production may lower prices, creating adversity for other farmers who remain limited to one crop per year. Generally, however, other marketing factors are probably more important.

In the case of Plan MERIS, several of the subprojects were not able to double crop because of the frost hazard present at the high elevations at which they are located. It also seems questionable, in several cases, whether the marketing infrastructure is developed sufficiently to accomodate two crops. It seems apparent that some of the traditional Andean crops, although they could be produced at somewhat higher elevations during the second growing season, have a very limited market potential.

Supplemental irrigation may also act to lengthen the growing season. A pre-irrigation may allow planting before the rainy season and thus allow the crop to receive more benefit from the subsequent normal rainfall. This may be a major benefit in the case of Plan MERIS as rainfall during November in the Sierra, which is the normal planting month, is extremely variable. Being able to plant at a specified time may also have some very real market advantages.

An additional benefit of irrigation is that it allows a better payoff from inputs such as fertilizers, pesticides, improved seed, etc. The converse, however, is also true. To increase yields significantly and obtain maximum return from the applied water the associated complementary inputs of high yielding varieties, fertilizers, disease and pest control, and improved agronomic management must be supplied. If these inputs are not provided, then the full impact of irrigation is lost.

Frequently, in justifying irrigation projects, production under irrigation with improved agronomic technology is compared with existing rainfed production without improved agronomic technology. This, of course, overestimates the probable benefits of irrigation.

Unfortunately, there is not sufficient resource information (soils and climate) and data on potential gains from irrigation with and without improved cropping practices to accurately deal with the rainfed versus irrigated question in Peru. However, there is considerable evidence from other countries with similar conditions that, in many conditions, rainfed yields can be doubled if inputs, training, and assistance are provided to farmers. Given the current average national yields of 0.8-1.0 T/ha for grains, and 6-7 T/ha for potatoes, improved agronomic practices or irrigation should provide a two-fold increase. Irrigation plus improved agronomic technology should provide an additional two-fold increase. It would seem wise,therefore, to not begin new projects until the existing ones are brought up to this potential.

Irrigation is often a very costly, capital-intensive means of substituting for other inputs. This appears to be true in the case of Peru. In much of the Sierra, production increases from irrigation with traditional cropping practices are about the same as could be expected from using improved seed and fertilizer under rainfed conditions. This is to be expected when water is supplied 'free' or needed inputs are not available. In the case of new irrigation development, except in situations where irrigation water supplies can be very inexpensively developed and applied, it would be more cost effective to obtain the same crop production increases by improving agronomic inputs (seeds, fertilizers, management) under rainfed conditions or by opening new lands to settlement.

The experience with settlement of new lands in the Selva Alta appears to substantiate this conclusion. Input costs are still low as disease systems have not yet been established and the soils have high native fertility. Yields are good for rainfed conditions with irrigation giving a considerable additional increase.

In a number of the Plan MERIS subprojects, less than 50% of the expected area was being irrigated although water was available for more area. In some cases, much of the area was not even cultivated. While there was some supposed double-cropping in certain cases, reducing the area in fallow and obtaining annual cropping may be a higher priority because of cost and input supply. A greater effort, therefore, must be made in the supplying of technical assistance. It is evident that there is a challenge for creative social scientists to devise ways of increasing acceptance and implementation of

improved production technology by the minifundistas, whether on rainfed or irrigated lands.

Technology must be made available to reduce the risks associated with rainfed agriculture, while increasing and stabilizing production consistent with conservation of available soil and water resources. Technology is also essential to realize maximum production benefits from irrigated lands. Improved seed and fertilizer are the technological inputs that are most effective in increasing land use productivity. The use patterns of both are very poor in Peru at present, and particularly so in the Sierra. Fertilizer use in the Sierra is only a fraction of that in the coast, although there are actually more outlets in the Sierra. Using improved potato seed as an example; 85% of the farmers on the coast use improved seed, whereas only 3% of the farmers in the Sierra use improved seed.

Short-season varieties reduce the time of climatic exposure in the field. Crops do not vary much in daily water requirements during the growing season, particularly after they cover much of the surface; therefore the length of the growing season is a major factor in total water demand. Although a short-season variety may have a lower potential yield, actual yields may average somewhat higher because of reduced climatic risk when compared to long-season varieties.

Rainfed croplands are the source of much of Peru's food. Indeed, the current food role of rainfed techniques would be even more important except that output is constrained in regions that still rely upon a traditional technology that evolved to reduce risk of losses in dry years. With this emphasis, some of the potential benefits that could accrue in good years is lost. The design of new or improved technology should be focused on opportunities for farmers to invest safely in anticipation of good years. New technology should prevent destruction or diminution of the biological potential of land, maximize economic benefits from a given environment, and minimize damage through manmade as well as natural processes of desertification.

Rainfed agricultural systems revolve around the principle that water is the limiting factor. To increase or maintain yields, the water use efficiency for crop production must be maximized. This efficiency may be defined as the yield of product per unit area and unit of water and is, to a considerable extent, a reflection of management skill. Thus, while the yield potential in rainfed areas may be limited by the moisture supply, the actual yield obtained is determined by the skill in manipulating agronomic practices to optimize water use. Improved management practices may, in many cases,

account for 50% of the yield increase in rainfed agriculture, with improved varieties accounting for 30%, and improved planting and harvesting accounting for the other 20%.

Conclusions and Summary: It is evident that the Peruvian irrigation sector as a whole, including Plan MERIS, performs well below its potential. This is not unexpected as new irrigation schemes invariably fail to achieve either area or productivity targets, and always exceed estimated costs and time required for implementation. Thus, food demand always outstrips production increases and the economic justification on which the project rests is not attained.

The Plan Meris model, with per hectare costs of less than $1000 does, however, appear to be much more viable than some of the coastal projects with costs of $20,000 per hectare. While the transportation and marketing costs in the Sierra may exceed those of the coast, the resulting social benefits are probably more important to the well-being of the country.

The immediate needs are those of education and extension. A concerted effort should be made to intensify educational and extension services on all established projects. Efforts should be concentrated and directed to basic farm management, production techniques, water management, and soil conservation practices. It is, however, quite possible that no amount of technical assistance will overcome the current disincentives in pricing and marketing.

There can be no disagreement with the conclusion of the Sederhana (Indonesia) Impact evaluation:

> "... greatest value of the irrigation system is the reliability of the water supply. While production increases are also valued highly, farmers prefer stable yields to yields that vary from a bumper crop one year to a bad crop the next. The greatest benefits of a small-scale irrigation system, then, are those that first assure water security and build water management activities and other production increases on that solid base."

or, with those of the Impact Evaluation series in general:

> "Strikingly consistent theme - participation of the project's beneficiaries is as essential to the successful project as any physical input, and that sustaining the benefits of development projects depends increasingly on the interest, care and support provided by beneficiaries."

In sum, irrigation programs can provide substantial benefits for the rural poor but they must be integrated with other agricultural development and national development efforts.

Table 2: Regional Meteorological Data

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
COSTA													
La Molina (238 m):													
Mean ppt.	1.0	1.0	1.0	1.0	2.0	3.0	3.0	3.0	2.0	1.0	1.0	1.0	17.0
M.A.I.1/	0.00	0.00	0.00	0.0	0.00	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00
Temp.	20.9	21.5	21.1	19.1	16.8	15.2	14.2	14.0	14.4	15.3	16.0	17.9	17.2
Piura (49 m):													
Mean ppt.	8.0	27.0	13.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0	83.0
M.A.I.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Temp.	27.1	28.1	28.2	27.1	25.2	23.2	22.0	22.1	22.3	22.8	23.8	25.3	24.7
Tacna (458 m):													
Mean ppt.	1.0	1.0	0.0	1.0	2.0	3.0	7.0	8.0	12.0	4.0	1.0	1.0	41.0
M.A.I.	0.00	0.02	0.03	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
Temp.	25.1	26.6	26.7	25.2	23.7	21.9	20.2	20.1	20.4	21.2	21.5	23.3	23.0
SIERRA:													
Cajamarca (2640 m):													
Mean ppt.	89.0	102.0	126.0	93.0	37.0	13.0	6.0	8.0	34.0	76.0	58.0	78.0	719
M.A.I.	0.47	0.65	0.84	0.67	0.16	0.01	0.00	0.01	0.15	0.36	0.27	0.35	0.45
Temp.	14.4	14.3	14.3	14.1	13.7	13.4	13.4	13.9	14.4	14.2	14.3	14.3	14.1
Huancayo (3350 m):													
Mean ppt.	121.0	131.0	109.0	57.0	24.0	7.0	8.0	19.0	38.0	68.0	64.0	92.0	740
M.A.I.	0.76	0.91	0.69	0.36	0.09	0.00	0.00	0.03	0.21	0.36	0.35	0.57	0.88
Temp.	12.2	12.0	11.7	11.4	10.5	9.7	9.4	10.5	11.9	12.5	12.8	12.5	11.4
Cuzco (3312 m):													
Mean ppt.	144.0	126.0	100.0	36.0	11.0	3.0	4.0	6.0	21.0	43.0	68.0	120.0	681
M.A.I.	0.55	0.56	0.41	0.18	0.01	0.00	0.00	0.01	0.06	0.17	0.22	0.42	0.30
Temp.	13.1	12.9	13.1	13.0	12.6	11.7	11.4	12.2	13.1	14.1	14.3	13.6	12.9
SELVA ALTA:													
Juanjui (500 m):													
Mean ppt.	108.0	136.0	146.0	195.0	120.0	64.0	57.0	54.0	98.0	157.0	143.0	116.0	1394
M.A.I.	0.33	0.65	0.88	1.33	0.57	0.16	0.22	0.09	0.41	0.75	0.82	0.45	0.78
Mean temp.	27.2	26.6	26.5	26.2	26.0	25.6	25.6	26.3	26.6	26.7	26.9	26.9	26.4
Tarapoto (313 m):													
Mean ppt.	90.0	121.0	156.0	149.0	122.0	66.0	56.0	63.0	79.0	139.0	114.0	93.0	1250
M.A.I.	0.28	0.66	0.94	0.90	0.64	0.31	0.27	0.23	0.34	0.60	0.62	0.27	0.74
Mean temp.	27.1	26.6	26.2	25.9	25.8	25.4	25.2	25.8	26.1	26.4	26.5	27.1	26.2
Tingo Maria (660 m):													
Mean ppt.	390.0	327.0	283.0	299.0	202.0	125.0	134.0	137.0	156.0	275.0	343.0	361.0	3040
M.A.I.	2.58	2.56	1.72	1.91	1.27	0.57	0.80	0.65	0.91	1.47	1.87	2.4	1.8
Mean temp.	23.1	22.7	23.4	23.6	23.5	24.1	22.7	23.2	23.3	23.6	23.8	23.8	23.4

1/ *Moisture Availability Index: Equals dependable precipitation (75% probability) divided by potential evapotranspiration.*

APPENDIX E

PLAN MERIS PROJECT IMPACT: ECONOMIC ISSUES

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This appendix will analyze several economic issues raised by the Plan MERIS project. First, the cost and use of agricultural inputs, particularly the credit component of the Plan MERIS project, will be examined. An important assumption of this project was that irrigation is necessary, but not sufficient, to improve agricultural production. Therefore, it is important to analyze the way in which select agricultural inputs, particularly credit, contributed or did not contribute to the project outcome. A related issue to be discussed is the Peruvian government's agricultural pricing policy. While the complexities of subsidization and price supports can not be fully addressed here, it is important to examine how price incentives and disincentives may have exerted an influence on farmers in the Sierra over the life of the Plan MERIS project.

Second, economic trends in a select group of subprojects will be examined. The assessment will include a discussion of land use, cropping patterns, crop yields, income and employment, as well as milk and meat production, indicators not originally identified as part of the Plan MERIS project. The issues of income and employment will be discussed only in passing, since the lack of verifiable information substantially limits the analysis of these factors. The overall aim is to identify the preliminary changes underway in the subproject areas and to compare these to regional statistics to the extent possible. In short, in what way does the Plan MERIS project appear to have influenced agricultural production in the Sierra, or do other factors appear to have played a primary role? This appendix also includes a preliminary list of lessons learned to guide future AID assistance to similar projects.

It is important to mention than this appendix does not attempt to calculate an economic rate of return for the subprojects. Such an analysis was not possible, given various constraints. The computer program used in calculating the projected rate of return for the project paper was not available either in Peru or in AID/Washington. Plan MERIS did not have adequate staff or financial resources to draw up comprehensive statistics. Also, given the delayed construction schedule, calculating these returns at a later date would be more appropriate.

I. Agricultural Inputs--Credit and Working Capital

A critical assumption of the Plan MERIS project is that provision of both a steady water supply and agricultural inputs--such as credit, fertilizer, and extension--are required to assure improved agricultural production. Without the proper use of irrigation, together with specific inputs, the benefits of a multiplier effect on agricultural production will probably be negligible. In the Plan MERIS project, given delays in feasibility study preparation and canal construction, agricultural production under new or improved irrigation has been slow to get underway. By March, 1983, six subprojects had had two cropping seasons, while agricultural production was just getting started in five others. Therefore, it is possible to take only a limited look at the use and effect of agricultural inputs.

One serious limitation to the use of agricultural inputs in conjunction with irrigation by farmers in Peru has been the sharply rising cost of fertilizer, pesticides, and agricultural equipment - all critical inputs in agricultural production. In January, 1979, just as agricultural production was getting underway in the first subprojects, the Peruvian government eliminated subsidies on fertilizer purchased for agricultural production. Prior to that time, subsidy payments covered 35 percent of the total cost of fertilizer. In 1979, fertilizer prices jumped an average of 180 percent. By 1980, fertilizer prices were up another 60 percent (U.S.D.A. Agricultural Situation Reports).

The world energy crisis, the rising cost of transportation (e.g., of agricultural inputs), the Peruvian government's austerity program, and other factors contributed to similar rises in the prices of pesticides, and in the replacement and operating costs of agricultural equipment. Just the additional cost of fertilizer alone is substantial, when farmers use up to 56 kilos of fertilizer per hectare of corn and up to 41 kilos per hectare of potatoes. Inevitably, producers have been compelled to limit their use of these inputs and, given their smaller operating margins, the small scale farmers have been most affected by the price squeeze.

The Plan MERIS project paper did identify the lack of medium- to long-term credit for on-farm improvements, such as land leveling and clearing, canal hook-ups, drainage, and fence construction, as a critical constraint to agricultural development in the subproject areas. Even with irrigation, the land has to be prepared for agricultural production. As a result, the Banco Agrario del Peru (BAP), assumed management of

a medium- to long-term investment credit fund for on-farm improvements in the Plan MERIS subproject areas. However, Plan MERIS did not consider working capital loans for the purchase of fertilizer, pesticides, and other inputs, or other factors, such as land tenure, to be potential bottlenecks. In 1975, working capital loans from the Agrarian Bank were relatively available and affordable. Moreover, since the agrarian reform was still underway, it appeared that the small farmers in the Sierra would soon gain title to a plot of land.

Unfortunately, by 1981, the change in monetary policy of the Banco de la Reserva, the Peruvian equivalent of the U.S. Federal Reserve Bank, resulted in a sharp rise in the interest rates charged by the Agrarian Bank, both for short and long-term credit. Peru's high inflation rate had led to increased government concern about decapitalization of local banks, given that the interest rate charged was usually below the rate of inflation. More significant than the high cost of the credit was the fact that the Agrarian Bank was increasingly less interested in serving the small, private farmers. As it faced an interest rate squeeze, it became more concerned with return on its investment than it had been previously. It is important to remember that between 70 and 80 percent of the Agrarian Bank's annual lending is in short-term production credit, primarily to medium- to large-scale cooperative enterprises. In 1980, 64 percent of the value of the Agrarian Bank's new agricultural loans went to cooperatives; almost 36 percent to farms with more than 20 hectares, and only four-tenths of a percent to small-scale, private farms.1/

One problem for the small- to medium-sized farmer in the Sierra is that while production costs were more than doubling, access to short-term production credit to purchase the necessary fertilizer, seeds, pesticides, and equipment, became even more limited than the data suggests. In the Plan MERIS project context, therefore, working-capital credit has not complemented investment loans for on-farm improvements to the extent anticipated, at least in the Cajamarca region. In Cajamarca, 31 medium-term loans were disbursed for on-farm improvements between 1980 and 1982; however, only one short-term production loan was disbursed in this same time period (source: BAP regional office in Cajamarca). A similar

1/ These World Bank figures on small-scale, private farms refer to farms of 20 hectares or less. In fact, it is unlikely that many farmers in the beneficiary target group of Plan MERIS were recipients of BAP production credit.

breakdown of short- and medium-term loans was not available for the Mantaro region, even though production credit from the Agrarian Bank was generally more available in this area, according to farmers interviewed in these subprojects. Nonetheless, in both regions, the cost of production credit was increasing substantially, from 18 to 20 percent in 1978, to 32.5 percent in 1981, and 46.5 percent in 1982.

II. Banco Agrario del Peru's On-Farm Credit Fund

Slow disbursement of the on-farm medium-term credit fund and the concomitant limited access of beneficiaries to this credit has been a serious problem for farmers in the Plan MERIS subprojects. Between 1979 and 1982, the BAP had disbursed only $1.4 million of the $3 million budgeted for the on-farm investment fund. In this time period, 79 medium- to long-term loans had reached farmers in the Plan MERIS subprojects.[2/] The issue raised by the slow rate of disbursement is what kinds of farmers have benefited from the credit fund and what kinds have not.

For borrowers in the Plan MERIS subprojects, a breakdown of loans by size of landholding would be useful to test the assertion that a small group of medium-sized farmers have been the prime beneficiaries of this on-farm credit fund. Unfortunately, comparable breakdowns of loans by size of land holding in both Mantaro and Cajamarca regional subprojects were not available.

Still, it is possible to compile a rough picture of the Plan MERIS borrower population. First, between 80 and 95 percent of the farmers in those subprojects with two cropping seasons, have one or less than one hectare of land. Only in the Chingol subproject do the majority--54 percent--have over five hectares, with nine percent having one or less than one hectare (see Table I). In the Mantaro area, 30 percent of the 45 Agrarian Bank on-farm investment loans (45 in total) were approved for farmers with two hectares or less of land, according to statistics provided by the Plan MERIS regional staff. Moreover, 54 percent of these Agrarian Bank loans went to farmers in the Mantaro region with three hectares or less of land, according to the same statistics.

2/ This figure was submitted by the BAP's regional staff offices; however, the number of loans may be greater if information were available concerning loans for the Cajamarca region for 1979 and 1980.

In short, a limited number of small farmers in the Mantaro subprojects, understood to be those with three hectares or less of land, have benefited substantially from on-farm, investment credit from the Agrarian Bank. However, these same statistics reveal that 41 percent of the Agrarian Bank loans for the Mantaro region went to medium to large farmers, who are farmers with over three hectares of land. The latter were not among the beneficiaries anticipated by the project paper.

It is not possible to make a statistical comparison between borrowers in the Mantaro and the Cajamarca regions since a similar detailed breakdown of borrowers by size of land holding for the Cajamarca region is not available. Nonetheless, estimates about the size of the land holdings of the borrowers can be deduced from the size of the loans. If one assumes, as does the Agrarian Bank's regional staff, that the bank will lend S/1,200,000 (in 1982 soles) for every one and one-half hectares, the Bank appears to have favored the medium to large farmer over the small farmer, especially in the Cajamarca subproject sites (see Table II).

In the Cajamarca region, where small farmers are those with less than five hectares, 89 percent of all loans have been in the over S/4,000,000 range, i.e. to farmers with over five hectares of land. Even in the Mantaro region, the Agrarian Bank appears to have favored medium-sized farmers more than the Plan MERIS Regional Office figures suggest. Sixty-four percent of the Agrarian Bank on-farm, capitalization loans have been in the S/2,400,000 and up range, i.e. to farmers with over three hectares. Moreover, 38 percent are in the over five hectare range. The disparity between loans in the Mantaro region and those in the Cajamarca region can be attributed, in part, to the fact that farms in Cajamarca, well known for their livestock, tend to be larger than those in Mantaro. Nonetheless, the breakdown of loans by amount does suggest that the "small farmers" with two hectares or less -- the beneficiaries identified in the original project paper -- have, by no means, been the primary beneficiaries of the on-farm credit program.

Other information on this credit fund confirms the perceived trend toward favoring the medium-sized farmer, especially in the Cajamarca region. Interviews with Plan MERIS staff indicate that loan activity has been concentrated in only a few subprojects. For example, farmers in the Chingol subproject have been primary beneficiaries; 23 of the 35 loans extended in the Cajamarca region have been to farmers in this subproject. Significantly, almost all these borrowers are

farmers with 8 to 20 hectares of newly irrigated land. The minifundistas on one-half to two hectares plots, with improved irrigation, have not had access to credit from the Agrarian Bank.

Similarly, 24 of the 45 loans extended in the Mantaro region have been to borrowers in the Chupaca subproject. In this case, the borrowers also appear to be those benefiting from newly irrigated land. While it is not clear how large their farms are, it appears that those farmers with sufficient land to pasture livestock or to cultivate a highly marketable product may have been the prime beneficiaries of the credit program. In Chupaca, yields on pastureland jumped from zero to 16.1 tons per hectare between 1978 and 1982 (see Table V). Moreover, with new irrigation, farmers cultivating vegetables may have been perceived as good credit risks by the Agrarian Bank. Yields on vegetables more than doubled in Chupaca between 1978 and 1982 (See Table V).

Medium-term loans from the Agrarian Bank's on-farm credit fund have not only largely benefited medium-sized farms in a few subproject areas, but also have been used primarily to purchase livestock and to build fences for the livestock. In subprojects in both the Cajamarca and Mantaro regions, at least 55 percent of the loans from this on-farm credit fund have permitted borrowers to buy cattle and construct fences (see Table III). The percentage for livestock-related activities is even higher if one includes land clearing and leveling, and planting for improved pastures as a use of the credit. Prior to November 1982, the Agrarian Bank could only earmark 25 percent of this on-farm credit fund for livestock activities. Even though the objective of the Plan MERIS project was to improve agricultural production, increasingly, the credit fund stimulated livestock activities. By November 1982, AID no longer restricted the Agrarian Bank's lending for livestock-related activities from the on-farm credit fund.

This trend in lending, in effect, affirms the Agrarian Bank's claim that it is uneconomic to lend to farmers with holdings of less than one to two hectares. In fact, interviews with minifundistas in the subproject areas revealed that most of he agricultural produce from their landholding is consumed by the household, and is not marketed. Cash income was most often forthcoming from off-farm, as opposed to on-farm, employment. Moreover, various studies have found that the smaller the plot, the larger the amount of agricultural produce consumed on the farm. Another finding of these studies was

that the smaller the farm, the lower the yields.[3/] In short, the income benefits from agricultural production on minifundios receiving on-farm credit are most likely not sufficient to cover repayment of an investment loan. As well, these minifundistas tended to be farmers without title to their land. This proved to be a major obstacle since the Agrarian Bank required title to disburse a medium-to-long term investment loan.

The net result is that the original project paper for Plan MERIS identified as target beneficiaries farmers without adequate potential productive capacity or legal recognition to be viable credit risks. Instead, the Plan MERIS project would have been better directed to targeting inputs, such as on-farm credit, to those "medium-sized" farms with the potential to reap the benefits of agricultural production. Also, these so-called "medium-sized" farmers, e.g., those with more than three hectares (Mantaro) or more than five hectares (Cajamarca), are still small farmers relative to those in Peru as a whole.

Use of On-Farm Credit Fund

Medium-term loans from the Agrarian Bank's on-farm credit fund have not only largely benefited medium-sized farms in a few subproject areas, but also have been used primarily to purchase livestock and to build fences and other infrastructure for the livestock. In subprojects in both the Cajamarca and Mantaro regions, at least 55 percent of the loans from this on-farm credit fund have permitted borrowers to buy cattle and construct rural infrastructure (see Table III). The percentage for livestock-related activities is even higher if one includes land clearing and leveling, and planting for improved pastures as a use of the credit.

Prior to November 1982, AID required that the Agrarian Bank earmark only 25 percent of this Plan MERIS on-farm credit fund for livestock activities. Even though the objective of the Plan MERIS project was primarily to improve agricultural production, increasingly, the credit fund was used to support livestock activities. By November 1982, AID no longer restricted the Agrarian Bank's lending for livestock-related

3/ D. Horton, et al., "Tecnologia de la Produccion de Papa en el Valle del Mantaro, Peru," International Potato Center, 1980, and E. Franco, T. Haller, G. Gonzales, "Proyecto Cajamarca La Libertad -- Programa de Estudios Socio-Economicos," 1976.

activities from the on-farm credit fund. After this decision was made, disbursements from the credit fund accelerated.

In effect, AID was belatedly acknowledging the increasing importance of livestock in the subproject areas. Even prior to AID's decision in November 1982, when the limit was 25 percent for livestock-related use, the Agrarian Bank had allowed anywhere from 30 to 50 percent of the loans for on-farm improvements to be used for the purchase of livestock, leaving aside the use for rural construction.

From the point of view of the majority of farmers interviewed in the subproject areas, livestock was a valuable hedge against rapidly-rising inflation. Moreover, farmers tended to be more interested in livestock, since milk could be produced year-round with little risk of loss, while farmers interviewed perceived agricultural crops as seasonal and with a greater potential for loss. A second factor not sufficiently recognized in the original project paper was that pasture for livestock already accounted for a large proportion of the land area in both Cajamarca and Mantaro. In the Cajamarca subprojects, over 70 percent of the land area is dedicated to pasture for livestock. Third, credit for livestock-related activities appears to be a more attractive investment to the Agrarian Bank than credit for on-farm improvements for agricultural production. Both the decontrolled price of meat, the rising price of milk, and the established milk marketing system have made livestock a good investment, while agricultural production, particularly on small plots, has not been perceived to be as attractive.

In sum, the tendency of the on-farm credit fund to favor medium-sized farmers, particularly for livestock-related activities, suggests that the design of the original project paper was inappropriate. The aim of the project -- to reach the minifundistas, i.e., those with less than two hectares -- was consistent with the basic human needs philosophy adopted by AID in the mid-1970s. However, the expectations as to the actual agricultural productive capacity of this target group were unrealistic, even assuming the presence of new or improved irrigation. If minifundistas were to be the prime beneficiaries, the credit fund would have to be redesigned to serve their diverse needs.

Pricing Policy and Agricultural Production

Another problem for the small- to medium-sized farmer in the Sierra is that producers' returns have been declining since the prices of most inputs have been going up faster than the prices of most outputs. Given the dramatic rises in the price of fertilizer alone -- up 160 percent in 1979 and another 60 percent in 1980 -- the small farmer is already in a difficult situation. However, the government's price control policy in effect from 1968 through 1980 has been a major disincentive to producers of main foodstuffs, such as corn, potatoes, and wheat.

Domestic prices for these goods were insulated by the price controls, to some extent, from changes in international prices, but they did not provide sufficient stimulus to increase production. While imports of agricultural commodities have been increasing, domestic production of the main foodstuffs have remained stationary or in some cases even declined. Also, direct subsidies of imported foods has probably discouraged producers from growing substitutes (e.g., substantial imports of wheat and decline in quinua production). The new government has made a major effort to remove marketing and price controls, and to eliminate subsidies. The new Agricultural Promotion and Development Law, issued November 17, 1980, is specifically aimed at increasing yields and overall food production. However, the drought, combined with the political demands of urban consumers, has made implementing this well-intentioned initiative difficult.

For the farmers interviewed in the Plan MERIS subprojects, disincentives to engage in agricultural production have encouraged them to diversify into livestock production. As early as 1978, the government had subsidized dairy production, and had dismantled the agrarian reform in the dairy producing sector. Dairy producer prices were up 64 percent by 1978. As a result, even despite increasing production costs, farmers were re-investing in livestock. By 1980, the drought had brought down the level of both agricultural and livestock production; imports of dairy products and agricultural crops were on the rise. Nonetheless, livestock has remained an attractive asset in highly inflationary times and climatically variable regions.

III. Economic Indicators in Six Plan MERIS Subprojects

One serious constraint to assessing the direct and indirect economic effects of the Plan MERIS project is that insufficient

time has elapsed in which to establish the impact of irrigation on agricultural production and, ideally, on farm incomes. Each of the subprojects has three phases: first, the feasibility study; second, the construction of the canal works; and third, agricultural development. However, by March 1983, construction had not yet been completed in six subprojects and had only recently been finished in five others. Under these circumstances, the most feasible approach which would provide some basis for comparison with pre-project indicators was determined to be preselection of a sample of subprojects with at least two cropping seasons with new or improved irrigation.

This preselected sample includes three subprojects from the Mantaro area (Chicche, Chupaca, and La Huaycha) and three subprojects from the Cajamarca area (El Chingol, Namora, and Carahuanga). The primary source of information on these subprojects was a statistical annex prepared by the Plan MERIS staff (Evaluacion del Impacto Socio-Economico del Proyecto Plan MERIS - Primera Etapa - 1982). While this document was most useful in providing a base of statistical information, the resource limitations on the Plan MERIS staff in its preparation suggested that it should be used with caution. Semi-structured interviews with farmers in these six subprojects and Plan MERIS regional staff served to supplement this document. This restricted information base limited the analysis to the following economic indicators: land under cultivation, crop composition and multicropping, crop yields, and milk and meat production. Statistics on employment were not available, and the data on increases in income was questionable. For example, it assumed that the costs of production had not increased over the life of the project to date.

A. Land Under Cultivation

In the Sierra, only 1.8 million hectares - five percent of this region's total land surface - is actually under cultivation for agricultural production. Moreover, only 700,000 additional hectares are suitable for conversion to agricultural use. Natural pastures account for the largest percentage of the Sierra's land area - approximately 18 million hectares.

The great majority of the Sierra's rural population is involved in dry land subsistence farming. In 1980, approximately 1.5 million hectares were cultivated under dry land farming, while only 250,000 hectares produced crops under irrigation. Among the most serious constraints to expanding agricultural production in the Sierra are the extremely limited cultivable land base, the large proportion of fallow land, and inefficient water use.

The Plan MERIS project aimed to increase the cultivable land base in the Cajamarca and Mantaro regions. The plan was to bring 14,900 hectares under new irrigation and to improve irrigation facilities on 13,000 hectares in up to 27 subprojects. The Plan MERIS' decision to reduce the number of subprojects from the 27 envisioned in the project paper to the eventual 17 scaled down considerably the expectations about the amount of land to receive new or improved irrigation. It is necessary to limit the analysis of the amount of land under cultivation to those thirteen subprojects which had initiated farming with irrigation. The other four on which construction had not yet been completed are not included.

In 1978, prior to the new construction and/or canal improvements of the Plan MERIS project, 5,227 hectares of irrigated land were already under cultivation in these thirteen sites. By 1982, a total of 8,295 hectares of irrigated land -- an increase of 3,068 hectares -- was being farmed in those same subproject sites. In short, Plan MERIS had succeeded in expanding the irrigated cultivable land base by nearly six percent in 13 subprojects.[4/]

While an increase to 8,295 hectares of irrigated cultivable land by 1982 is significant, this amount is substantially less than the rise of 27,900 hectares originally anticipated. Nonetheless, if the Plan MERIS project is able to reach its goal of 11,800 hectares of irrigated, cultivable land in these thirteen project sites, the project will have been directly responsible for a twenty percent increase in the Mantaro and Cajamarca subproject areas.

As Table III indicates, those subprojects in which construction has been completed for several years tend to have a high proportion of land under cultivation. On the other hand, those subprojects lacking completed canal infrastructure tend to have a way to go to reach the anticipated levels of cultivable land. However, the different relative increases in the amount of land under cultivation for the various subprojects can also be attributed to the fact that, in some cases, the land is being irrigated for the first time, while in other cases, Plan MERIS is just improving upon old irrigation systems. Thus, in the Mantaro region, the high percentage

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[4/] A breakdown was not available of the amount of newly irrigated land as opposed to land with improved irrigation.

increase of irrigated land under cultivation may be due to the fact that more than half of the land area in the subprojects had not been irrigated previously. In Cajamarca, the percentage increase of cultivable land is much smaller, in part, because Plan MERIS improved upon existing irrigation in 80 percent of the subproject areas and provided new irrigation to the other 20 percent.

Despite these advances, the current and anticipated increases in the land area farmed in the Plan MERIS subprojects probably still overestimate the amount and actual usage of cultivable land. Given that underutilization of potentially productive land is a problem observed in most subproject areas visited, figures on increases in cultivable land have to be examined with caution.

First, interviewed beneficiaries who live at high elevations were unfamiliar with, and generally wary of, irrigation as an agricultural input. At one project site in the high Sierra (Chicche, at 3,500 meters), only 20 percent of the community used irrigated water for pasture or agricultural production; instead, it was used as a source of drinking water for their livestock. At these higher elevations, the risk to agricultural production associated with frost and the tendency to often leave land fallow because of soil quality has seriously inhibited full utilization of "cultivable land." Also, insufficient or ineffective agricultural extension has not encouraged farmers to overcome traditional biases and to increase usage or irrigation for agricultural production, at least at this time.

A second, serious constraint on usage of cultivable, irrigable land is the farmers' perception of the potential costs and benefits. In on-site interviews, small farmers, particularly minifundistas, often did not consider it worth the additional cost in time and money to dig a tertiary canal to reach their land. The majority of the beneficiaries -- minifundistas who have not received technical support or credit -- tended not to have constructed an ancillary canal to their farm. On the other hand, those beneficiaries with at least 3 to 5 hectares, who often had received technical support and credit to prepare land for cultivation, tended to already have dug tertiary canals and to put a high value on access to irrigation. This might be traceable to the fact that the small landholders interviewed relied on their plot as a means to provide for home consumption, not as a primary source of cash income. In turn, the anticipated benefit of gaining access to the irrigation was often perceived to be insufficient to

outweigh the perceived costs of securing their neighbors' acquiescence, digging the tertiary canal and sacrificing time which could be used to earn cash income from employment off the farm. One minifundista who launders clothes for extra income stated, "I have no one to help me and it isn't worth the time and trouble."

The fact that 80 to 95 percent of the farmers in the Plan MERIS subprojects are minifundistas -- many of whom are women -- underlines the significance of this constraint (see Table I). In Mantaro, the decreasing size of farms, as they are subdivided by families into increasingly smaller plots, has brought about a situation in which 90 percent of the farms in the Chicche, Chupaca and La Huaycha subprojects have less than one hectare. In turn, it is not surprising that at least 25 percent of beneficiaries in Chicche are engaged in off-farm employment, according to interviews with Plan MERIS staff. The number may in fact be much higher, since estimates of the number employed off the farm for the Mantaro region range from 60 to 80 percent, according to an extensive farm survey conducted by the International Potato Center in 1980. Another factor has been the abandonment of cultivable land, which has occurred as a result of outmigration in Chupaca and La Huaycha, subprojects in the Mantaro region. In sum, while the Plan MERIS project has increased the amount of new and improved cultivable land by at least six percent, the lack of incentives to engage in agricultural production have also served to undermine the intent of the project.

B. Crop Composition and Multicropping

Cropping patterns in these six subprojects have not undergone major changes since the initiation of the Plan MERIS project. Between 1978 and 1982, there has been a greater diversification of crops under cultivation in the Mantaro region subprojects, while in the Cajamarca region the pattern of crop cultivation has remained relatively static (see Table V). In the Cajamarca area, the predominance of pasture and the trend to improve on existing irrigation has been a disincentive to diversifying into agricultural production.

In the Mantaro subprojects, improved pastures have assumed a rapidly-growing proportion of cultivable land, increasing from near zero in 1978 to 12 percent of the total in 1982. Interviews in all three Mantaro region subprojects revealed that a second crop in improved pastures or the development of perennial pasture was increasingly the trend, even at the higher altitudes. Double cropping, already common at the lower

elevations in the Mantaro valley, is more prevalent at slightly higher elevations than prior to the Plan MERIS project, according to farmers in Chupaca and La Huaycha. While this benefit is directly traceable to the availability of irrigation water, its impact in the context of the Plan MERIS project has been slight.

In the Mantaro subprojects, vegetables, potatoes and sweet corn still remain the primary crops under cultivation. Vegetables, which includes beans and peas, still occupy the largest percentage of the cultivated land area in the subprojects; but, as a percentage of the total, vegetables dropped from 46 to 30 percent, apparently due solely to the dramatic shift into improved pastures in the large Chupaca subproject. Despite this drop, the increase in land cultivated in sweet corn, and the appearance of improved pasture, wheat and barley indicates a probable rise in multicropping in the Mantaro area.

In Cajamarca, known for the heavy predominance of livestock, pastures continue to occupy over 70 percent of the cropland, though dropping a percentage point between 1978 and 1982. Since the start of the Plan MERIS project, however, vegetables and dried legumes have begun to assume a minimal presence in the subprojects in Cajamarca. Cropping patterns in Cajamarca may have been less affected by irrigation, since the majority of subprojects have improved on existing irrigation infrastructure, which is in sharp contrast to the situation in the Mantaro region. Also, the small amount of new land brought into cultivation in Cajamarca has only recently begun to be leveled and prepared for planting.

In both areas, the presence of new or improved irrigation will most likely stimulate, over the long run, increased crop diversification and more double cropping. But, at this time, the regional markets and the distribution mechanisms in place appear to be influential factors leading to changes in cropping patterns. In the Mantaro area, farmers interviewed cited the high value placed on livestock and the proximity of the Lima and Huancayo markets for vegetables as major influences on their cropping decisions. In the Cajamarca region, farmers mentioned the well-developed distribution system for milk production and the relative inaccessibility of their farms to the Cajamarca and coast markets for vegetables and other perishable crops as factors affecting their cropping decisions. Nevertheless, growing vegetables or corn would not have been possible without irrigation reducing the risks. But consistently, farmers mentioned marketing factors when asked why they chose to cultivate a particular crop.

C. Crop Yields

An irrigation project such as Plan MERIS aims not only to bring fallow land into agricultural production and to diversify cropping patterns, but also to improve crop yields on the new or improved irrigated land. Table V illustrates how 1978 pre-project crop yields in the six subprojects compare with 1982 crop yields. This same table also includes a comparison of Mantaro and Cajamarca subproject yields for 1978 and 1982, with average crop yields for the regions as a whole for the same time period.

From Table V, it is apparent that, for the majority of subprojects, the 1982 yields were higher than the "before project" state. The rise in yields, particularly of corn and vegetables, was relatively large, ranging from 133 to 219 percent in corn, with the exception of Chupaca, and from 13 to 132 percent in vegetables. Also, in comparison with average crop yields for the Mantaro and Cajamarca regions, as well as for Peru as a whole, subproject yields are consistently higher.

Despite these positive indicators, the Plan MERIS project performance in terms of crop yields is not as impressive as these figures suggest. First, on-farm interviews and direct observation of crops, usually potatoes, corn, or pasture indicated that the improved yields cited by Plan MERIS were probably overstated. Second, the increase to a yield level of 13.1 metric tons per hectare for potatoes is good, but not outstanding. With the appropriate use of irrigation and other agricultural inputs, the potato yields of small farmers, taken from a sample in the lower Mantaro valley, increased from 17 to 29 metric tons.[5/] Thus, in Chupaca, a subproject also in the lower Mantaro valley, a rise in potato yields from 8.5 to 13.5 metric tons per hectare suggests that the appropriate mix of inputs has not been realized in terms of crop yields. In other words, crop yield increases in the Plan MERIS project are mostly attributable to the availability of irrigation; however, these yield increases appear to have been limited by the lack of appropriate agricultural inputs and technical assistance.

In the Plan MERIS subprojects, there is also the strong likelihood of a significant disparity in crop yields between minifundistas or small producers, and medium-sized farmers with

5/ The sample was taken from publication, "Tecnologia de la Produccion de Papa en el Valle del Mantaro, Peru," International Potato Center, 1980.

more than three hectares (in the case of the Mantaro region) and more than five hectares (in the case of the Cajamarca region). In-depth, farm-level surveys of crop production -- potatoes in Mantaro[6/] and potatoes, corn, wheat, and barley in Cajamarca[7/] -- have found a positive correlation between crop yields and the size of the production unit. Consistently, the smaller producers have significantly lower yields relative to larger producers. Given the large proportion of minifundistas and small farmers in the Plan MERIS subprojects, this finding may be relevant in estimating which farmers are the most likely beneficiaries of the higher crop yields.

Minifundistas and small producers in the subprojects are likely to be obtaining yields 15 to 20 percent less than those obtained by medium- and large-sized farmers, if one accepts the findings of the above cited farm-level surveys. This exercise may help place the relative benefits accruing to the small-andmedium-sized farmer in the subprojects in perspective. The Plan MERIS statistics may also be skewed in favor of the larger farmers. It is likely that the Plan MERIS staff used the yield figures primarily from the medium and larger farms, rather than from the minifundios, which are both more numerous and from which it is more difficult to obtain sample yield data.

D. Livestock Production

Irrigation water is not only a significant input in terms of improving crop yields. Also, irrigation has the potential to keep pastures green year-round, which is especially important at high altitudes and in the hot months between July and January. Between 1978 and 1982, milk production doubled in the six subprojects with two cropping seasons. Meat production, though miniscule relative to the production of milk, more than doubled in these same subprojects (see Table VI). While the presence of water has not been the only factor leading to improved livestock productivity, increased milk and meat production has been a significant outcome in the subprojects -- one unanticipated in the project paper.

6/ D. Horton, et al. "Tecnologia de la Produccion de Papa en el Valle del Mantaro, Peru," International Potato Center, 1980.

7/ E. Franco, T. Haller, G. Gonzales, "Proyecto Cajamarca La Libertad - Programa de Estudios Socio-Economicos," 1976.

Livestock production is concentrated in the Sierra. The Cajamarca valley is well known as a major dairy production area, while the Mantaro region is a smaller but still significant dairy production area. The large percentage of cultivated land dedicated to pasture in the subprojects is a reflection of this tendency. As was mentioned previously, several factors have contributed to increased investment in the production of livestock. First, in 1978, the Peruvian government brought to a halt the agrarian reform on dairy-producing land, which has encouraged reinvestment in livestock. Second, in this same year, the government also increased producer prices of milk by 64 per cent and decontrolled the price of meat (U.S.D.A. Agricultural Situation Reports). Third, medium-term credit from the Plan MERIS project was available through the BAP for the purchase of cattle; and an even larger amount was available by 1982. Finally, the raising of livestock was becoming an increasingly good investment because sales from milk production were able to keep pace with inflation, often better than agricultural produce from traditional seed crops.

An important issue for the Plan MERIS subprojects is which farmers have benefited from this rise in milk and meat production. Farmers in the Chupaca subproject were able to increase their milk production nearly threefold and to increase their meat production over 75 times -- from 38 to 2,901 metric tons. The concentration of on-farm investment credit in the Chupaca subproject (see section on credit fund), suggests that this dramatic rise in milk and meat production has probably benefited the farmers with sufficient land to engage in large-scale livestock production. In the other subprojects, it is likely that the medium-sized farmers have been able to increase their production of milk and meat more than small farmers, since they tended also to be the main beneficiaries of the on-farm credit program.

IV. Lessons Learned

Several important lessons emerge from this overview of the Plan MERIS project. First, for such irrigation projects to have an impact on agricultural production, adequate attention needs to be paid to the provision of essential agricultural inputs. An on-farm medium-term investment credit fund is not a cost-effective proposition for the small- and medium-sized farmer is he lacks the capacity to purchase fertilizer, pesticides, and other inputs. Production credit, as well as sufficient agricultural extension, need to be available to

ensure that the multiplier effect of irrigation and agricultural inputs on agricultural production is able to be realized.

Second, for an irrigation project to stimulate agricultural production, it is crucial to recognize the importance of existing land cultivation and production patterns. In the Plan MERIS project insufficient attention was given to the importance of pastureland in the subproject areas. As a result, despite the intent of the project, on-farm credit was used less for agricultural production and more for livestock-related activities. Moreover, the role that government pricing policies have played, particularly in stimulating milk and meat production, was not sufficiently recognized over the life of the project.

Third, irrigation projects -- large-scale or small-scale -- which aim primarily to increase agricultural production and, ideally, to raise incomes have to carefully target the most appropriate beneficiaries. In Plan MERIS, the identification of farmers with less than two hectares of land was misplaced, if the intention was to increase the land under cultivation, to diversify the crop composition and to raise crop yields. The construction of new or improved irrigation sites, the establishment of an on-farm investment credit fund, and the provision of limited agricultural extension were not sufficient incentive for the minifundista to dramatically change his manner of making a living. If the purpose was, in fact, to improve the welfare of the minifundistas in the Sierra, another approach is required.

To reach the minifundista in the Plan MERIS subproject areas, it is essential to document comprehensively the various sources of income of these farmers. For example, to what extent is off-farm employment a primary source of income? Are there sufficient incentives for the minifundista to engage primarily in agricultural production? In short, increasing agricultural production of the minifundista may not be the best way to improve his welfare. More attention should be paid to the linkages between on-farm and off-farm employment.

A fourth lesson of the Plan MERIS project is that new construction or irrigation canals on previously unirrigated land has the greatest capacity to increase yields. In the Plan MERIS subproject areas, farmers on newly irrigated land tended to have medium-sized farms and the greatest access to on-farm credit. Moreover, the subprojects with the largest proportion of new, as opposed to improved, irrigation registered the highest yields.

Also, canal construction *per se* is often not sufficient to reap the full benefits of irrigation. Especially for the *minifundistas*, many of whom are women, assistance in digging a terciary canal is needed to ensure that those farmers will benefit.

Finally, the Plan MERIS project demonstrates the importance of market demand as a key factor influencing the success or failure of the farmer to make effective use of irrigation. The dramatic increase in yields of vegetables and pasture in the Mantaro region are testament to the stimulative effect that irrigation and the adjacent markets of Huancayo and Lima have had on production.

Table I
LAND OWNERSHIP IN SIX PLAN MERIS SUBPROJECTS

	1 hectare or less	1.1 - 5 hectares	Over 5 hectares
	(as percentages of total land ownership)		
Mantaro Region Subprojects *			
1. Chicche	83	n/a	n/a
2. La Huaycha	90	n/a	n/a
3. Chupaca	90	n/a	n/a
Cajamarca Region Subprojects			
4. Chingol	9	37	54
5. Namora	80	16	4
6. Carahuanga	88	6	5

* The percentages for the Mantaro region subprojects are estimates by Plan MERIS staff. Exact breakdowns were not available in all cases.

Source: Plan MERIS Regional Office Statistics (1983)

Table II
Banco Agrario del Peru (BAP)/Plan MERIS Credit Fund
Number and Size of Medium-Term Loans for Subprojects in
Mantaro and Cajamarca Regions (1979-83)

Year	Total Number of Loans	Distribution of Loan by Size: $1,200 or less (1.5 ha)	S/1,201 to 2,400 (1.5-3 ha)	S/2,401 to 4,000 (3-5 ha)	S/4,001 to 8,000 (5-10 ha)	Over S/8,000 (over 10 ha)
	Mantaro Region Subprojects					
1979	1	-0	-0	-0	100	-0
1980	26	19	23	23	19	15
1981	7	43	14	14	-0	29
1982	7	-0	-0	43	14	43
1983	4	-0	25	50	25	-0
	Cajamarca Region Subprojects					
1979	n/a	--	--	--	--	--
1980	n/a	--	--	--	--	--
1981	9	11	11	11	44	22
1982	23	4	-0	-0	70	26
1983	3	-0	-0	-0	33	67

Source: Banco Agrario del Peru (BAP), Huancayo and Cajamarca Regional Offices

Table III
LOANS DISBURSED AND CATEGORIES OF INVESTMENT USE
in Cajamarca and Mantaro Regions (1979-1983)
(In Thousands of Soles - December 1982 constant)

Year	Number of Loans	Total Amount	Rural Construction +Livestock as % of Total Loan Amount	Investment Uses					
				Rural Construction	Livestock	Land Clearing Leveling	Planting	Equipment Machinery	Misc.
	Mantaro Region								
1979	1	1,400	59%	101	702	-0-	344	-0-	235
1980	26	52,557	40%	5,487	15,571	12,167	3,432	6,953	8,737
1981	7	22,450	54%	2,921	9,150	3,759	580	4,282	1,758
1982	7	69,500	51%	9,324	26,100	3,102	3,799	19,316	7,859
1983 *	4	15,100	64%	3,004	6,600	1,988	1,633	201	1,674
	Cajamarca Region								
1979	n/a	n/a	n/a	n/a		n/a			n/a
1980	n/a	n/a	n/a	n/a		n/a			
1981	9	43,820	77%	17,814	15,920	3,518	5,362	269	937
1982	23	241,355	52%	79,728	46,800	31,616	37,942	27,928	17,341
1983	3	50,500	70%	27,763	7,350	2,925	-0-	5,010	7,452
Total Plan MERIS Subprojects:									
1979-80	80	511,777	55%	148,358	134,810	61,061	58,348	64,102	47,319

• 1983 figures refer to loans in January-March 1983.
Sources: Documentation submitted on borrowers by Plan MERIS regional offices (1983)

Table IV
LAND UNDER CULTIVATION
(in Hectares)

in Sub-Project Areas* without project (1978), with project (1982) and expected in year of consolidation

Date Construction Completed	Subprojects	Land Under Cultivation without project (1978)	Land Under Cultivation with project (1982)	Land Under Cultivation Expected Year of Consolidation
	Mantaro Region			
April 1979	1. Chicche	146	603	650
Dec. 1979	2. La Huaycha	76	416	540
Dec. 1980	3. Chupaca	1,372	2,844	3,751
May 1982	4. Yanacancha	41	42	700
July 1982	5. Apata	220	341	650
Dec. 1982	6. Sincos	197	241	460
	Cajamarca Region			
March 1981	7. Chingol	652	1,039	2,030
Not Completed	8. Carizal la Grama	341	644	644
Oct. 1980	9. Namora	122	210	210
June 1982	10. Santa Rita	616	601	601
Dec. 1981	11. Carahuanga	970	654	954
Not Completed	12. Tabacal Amarcucho**	49	311	311
Not Completed	13. Cholocal**	445	349	379
TOTAL		5,227	8,295	11,880

*Information not available for land under cultivation for subprojects not completed including Cotosh, Huasahuasi, San Marcos, and Granja-Porcon.
**Construction not completed.

Sources: PE-AMI Informe Anual-Ano 1982.
Peru Anuario de Estadistica Agricola, 1979
Boletin Estadistico de la Produccion Agropecuaria - 1981

Table V
CROP YIELDS (metric tons/hectares)
In Six Plan MERIS Subprojects,
Mantaro and Cajamarca Regions, and Peru (1978-1982)

	Potatoes		Corn		Wheat		Barley		Vegetables		Pasture	
	1978	1982 *	1978	1982	1978	1982	1978	1982	1978	1982	1978	1982
Mantaro Region Subprojects												
Chicche	8.0	11.9	-	-	-	3.0	2.0	3.5	-	-	18.0	20.4
La Huaycha	9.8	13.4	1.4	4.4	1.5	0.6	2.1	1.3	10.0	15.6	34.5	9.1
Chupaca	8.5	13.5	10.8	6.3	-	1.2	-	2.0	13.0	28.1	-	16.1
Subproject yields	8.5	13.1	9.7	5.9	1.5	1.3	2.0	1.8	13.0	27.9	29.0	16.1
Regional Yields *	8.5	9.6	1.0	1.2	1.2	1.2	n/a	n/a	n/a	n/a	30.0	n/a
Rainfed-Irrigated	8.1-10.5		1.0-1.2		0.7-0.9		1.2-1.1		15.7-16.7		n/a-30	
Cajamarca Region Subprojects												
Chingol	8.0	11	0.9	2.8	1.0	1.2	-	-	3.0	3.4	2.5	31.2
Namora	8.0	11	1.1	2.6	1.0	1.3	-	-	2.0	3.2	30.0	35.8
Carahuanga	8.0	10.5	1.2	2.8	1.3	1.5	-	-	2.8	6.5	35.0	20.9
Subproject Yields	8.0	11.2	1.0	2.7	1.0	0.8	-	-	2.7	4.1	58.3	39.4
Regional Yields	7.2	8.4	0.7	0.8	0.7	1.1	n/a	n/a	n/a	n/a	n/a	n/a
Rainfed-Irrigated	7.2-6.5		0.7-1.0		0.0-1.3		0.6-0.7		5.3-6.0		30.0-33.4	
Peru												
Yields	6.9	8.4	1.0	1.1	1.0	1.2	0.9	n/a	n/a	n/a	n/a	n/a

* Yields are not available for the Mantaro region for 1982. The figures in the yield column for 1982 under Mantaro Region are the 1981 yields reported for Junin Province. They are given as a basis for comparison with the Cajamarca Region.

Sources: Evaluation del Impacto Socio-Economico del Proyecto AID-Plan MERIS, 1983 and Peru Anuario de Estadistica Agricola, 1979.

Table VI
MILK AND MEAT PRODUCTION (metric tons)
In Six Plan MERIS Subprojects (1979-1982)

Subprojects	Milk Production 1979	Milk Production 1982	Meat Production 1979	Meat Production 1982
Mantaro Region				
Chicche	150	367	7	15
La Huaycha	154	317	6	17
Chupaca	935	3,591	38	2,901
Cajamarca Region				
Chingol	199	322	14	39
Namora	89	81	6	8
Carahuanga	2,523	3,024	38	91

Source: Evaluation del Impacto Socio-Economico del Proyecto AID-Plan MERIS, 1983.

APPENDIX F

INSTITUTIONAL ISSUES

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From its inception, the Plan MERIS program was charged with two principal tasks: the construction of small and medium scale irrigation systems; and the complementary development of a system of agricultural practices in the Sierra which would raise production levels and hence increase social and economic welfare among peasant farmers. The requirements of the first task were material and therefore explicit, requiring the transfer of financial resources and the application of an already existing technical capacity. The exigencies of the second task, however, were more complex and less straightforward; agricultural development required a constellation of goods and services depending not simply on physical infrastructure, but also on support and stimulation from a wide array of institutions ranging from government organs setting relevant macro-policies to community organizations or even family units working at the local level. This appendix will examine the way in which institutional factors affected the planning, implementation and eventual impact of the Plan MERIS project.

I. INSTITUTIONAL FACTORS: AID Procedures and Mission Management

Among the most important institutional factors affecting the project impact were the effects of a series of AID practices--both in the Mission and Washington. Some of the problems generated by these procedures may be traced to the specific circumstances of the Plan MERIS project, but many reflect more general weaknesses in the way in which AID does business and could be usefully considered in the design of projects of this type elsewhere.

First, the lack of continuity in AID design, implementation and evaluation activities was a serious problem plaguing the project throughout its life. For example, one major discontinuity stemmed from a succession of four project managers - in addition to the original design officer - over a seven year period. This high turnover was probably linked to the characteristic weakness of AID's personnel system, which propels employees into rapid rotation just at the moment when they have mastered the tasks of the previous job.

In this project, such discontinuities were exacerbated by a bumpy transition from one manager to another. At best, successive administrations learned the ropes through informal means, and at worst, managers were installed without the benefit of essential information necessary to carry out key project tasks. Poor transition procedures became problematic, for instance, when one incoming manager who was new to AID did not act upon the GOP's letter of implementation requesting funds disbursement for Plan MERIS' credit program for nine months because he was not made aware of its importance by his predecessor.

This manager complained, as well, that aside from the lack of systematic transition procedures, project continuity was also ruptured by his admitted inexperience and the negligible management training he received from AID when recruited.

Lack of continuity also characterized the project's life cycle. Though the project paper was written by a capital development officer in the Mission, it was then shuffled between the engineering section and the agricultural development office. Thereafter, the capital development office had virtually no input into project management or evaluation. This procedure, reported as routine for most projects by Mission staff, meant that no one person in the Mission followed the project from beginning to end.

Of course, this management problem reflected larger discontinuities within the Mission as a whole. From 1974 to 1983 there were four successive Mission Directors in Peru. Though this rate of turnover was deemed by current Mission personnel as fairly low in relation to overall AID averages, an average tenure of 2 1/2 years cannot provide the necessary continuity of leadership from inception to completion of projects of this proportion. Moreover, with this changeover of Directors, policy priorities within the Mission and in the Agency as a whole shifted. Changes in Mission ethos can negatively affect implementation of projects designed in an earlier era. It was reported, for example, that the Plan MERIS Project had been considered a high priority by the Mission when rhetorical commitment to basic human needs ran high. With changing AID values and without a routine management monitoring system to focus and sustain attention on project implementation, however, interest was drawn to those newly generated projects elsewhere in the Mission portfolio which responded more directly to what were perceived to be central AID concerns.

The cyclical nature of Mission interest in this project was explained by one informant as a function, as well, of exogenous influences on the AID-Peru portfolio during this period. When the Plan MERIS Project was initiated, it was one of only two projects accepted and undertaken by the Peruvian military regime after a hiatus of several years. Thus, any project which could win approval by what had been considered a government hostile to U.S. bilateral assistance would be viewed positively by the Mission. All the more enthusiasm greeted a project whose origin could be traced to the GOP itself rather than one initiated by USAID. Thus, as an 11 million dollar project in a small portfolio (outside of food aid), Plan MERIS had a good deal riding on its success. Early attention to the project was overshadowed, however, by the subsequent inflow of nearly 120 million dollars to USAID/Lima's portfolio. Now the pendulum may have swung back again. To reinforce what are now friendly bilateral ties, USAID/Lima's interest in promoting small- and medium-scale irrigation as a model for projects in other areas of the country may be partially fueled by the enthusiasm which the GOP has displayed in replicating this sort of project elsewhere.

Finally, because the project development cycle in AID emphasizes project initiation rather than implementation, rewards within the bureaucracy are much greater for Project Identification Documents and Project Papers than for successful management performance. For one thing, there seems to be little verifiable documentation of such performance, aside from project evaluation summaries and Impact Evaluations--which, while it may not be a universally-shared perception, one mission staff person informed our team, "nobody reads or cares about." Even in Peru, where the pipeline has grown embarassingly large, the apparent emphasis on "implementation" seeks to "move the money" but does not focus on management issues. It is, in fact, viewed as an accounting problem, perhaps reflecting inordinate stress on quantitative outputs in place of long-term insitutional objectives.

II. EVALUATION AND MONITORING

One element which might have provided continuity and coherence to the management process--but didn't--was the evaluation and monitoring procedure followed in the course of this project. Although two "mid-term" evaluations were carried out--one in 1979 and the other in 1981--several factors constrained their constructive utilization for management improvement.

First, some conclusions drawn in the evaluations may have been in error, leading to false assumptions that all was well with the project when, in fact, it was not. The first evaluation completed in 1979, for example, found "no disruptive effects to (sic) the project as a result of Agrarian Reform." This finding, which reflected a similar assumption in the Project Paper, ignored the Agrarian Reform's significant impact on land tenure and title, which in turn influenced credit availability and incorrectly signaled AID management that land entitlement procedures were not problematic. Indeed, the 1981 PES recognized that credit disbursement was not proceeding properly but did not elaborate on the role of land title and legal obstacles in the delay, thus leaving to chance the removal of these constraints. Had some of these structural problems been discovered and analyzed earlier, perhaps solutions could have been found that would have enhanced the effectiveness of the project at a critical stage.

Such findings highlight possible methodological flaws in the execution of the mid-term evaluations. Although both evaluation reports claim to have made site inspections, they seem to have focused more on physical infrastructure than on social or legal factors impacting the beneficiaries. In all probability, interviews with minifundistas would have raised questions about their access to credit and its relationship to their legal status as land owners.

The mid-term evaluations seemed also to concentrate excessively on the achievement of quantitative goals. Because excessive attention was paid to meeting construction deadlines without huge cost over-runs, sight was sometimes lost of institutional and human impacts of the project. Because of this focus, the alarm button is sounded only when clearly measurable goals are not met, but not when social objectives are not reached. The incorporation of institutional considerations into the internal evaluation system would have improved its utility. In addition, this monitoring process should have been occuring with greater frequency than just twice in seven years in order to provide useful feedback for project management.

The evaluation process was also constrained by the quality of the base-line data provided in the feasibility studies commissioned by AID at the initiation of the project. Data provided on production levels and income statistics, for example, were unattributed and unverifiable. The methodology used to gather these data was never fully explained and, as a result, the credibility of all evaluations utilizing this

information as a point of departure is open to question. It is difficult to judge progress when the starting point is, by and large, an unknown. Thus, the evaluation process should consider from the beginning the state of knowledge about the project context, and feasibility studies which do not meet minimal standards of rigor should not be accepted by AID as a basis for projects.

Finally, mention should be made of the lack of institutional and social diagnostic analysis which accompanied the preparation of the documents for this project. Although some five feasibility studies were done in preparation for construction of canals and site selection, the bulk of the studies related to site selection were underway only after the project paper had been written and the funding approved by AID. What would have been useful earlier was a social and institutional profile, delineating those institutions which would be most capable of carrying out specific development tasks. This would seem to have been particularly important for this project because of the relatively long hiatus without AID involvement in Peru. Knowledge of GOP institutions was undoubtedly rusty after this lack of contact, especially in view of the major changes instituted by the military government. An institutional profile before project initiation might have enabled the Mission to avoid the delays caused by the switch of implementing organizations from the DGA (General Directorate of Waters) to the DGE (General Executive Directorate) within the MOA (Ministry of Agriculture).

The above critiques notwithstanding, the two evaluations did yield a number of useful policy recommendations: they suggested, for example, that more emphasis be placed on agricultural development by putting more extension personnel in the Regional Offices and providing more support for research, advisory and evaluation services; the Regional Offices should emphasize the availability of the Credit Fund to the farmers, and the processing of these loans should be accelerated. The 1981 evaluation also recommended that AID ascertain that the requisite socio-economic data were being gathered to permit measurement of project impact and also recommended a follow-up evaluation of the project within six months.

Significantly, however, except for the credit component, the bulk of these recommendations were not adopted, thus illustrating another fundamental flaw in the evaluation/feedback process. Indeed, aside from a Mission review board which met irregularly to discuss projects, there were no institutionalized mechanisms to ensure responses to

evaluation recommendations. This is not to say, of course, that changes were not made along the way in project administration. For example, modifications were made in the credit program to adapt to changing realities. But this flexibility was not systematically encouraged by the project structure or by the structure of the evaluation process. In addition, there was apparently no mechanism through which the GOP counterparts could participate in the AID evaluation process, nor were Plan MERIS personnel, at least at the Regional Office level, informed of the results of these evaluations. In this way, both sides lost valuable feedback about project progress. Indeed, Plan MERIS staff seemed genuinely to welcome the opportunity to take part in the impact evaluation in that it gave them a chance to express their views about the problems they face and what sorts of changes are needed in project administration.

III. AID PROJECT MANAGEMENT

AID management of the Plan MERIS project was found to be lacking in other respects too. For example, field visits by the current project manager to Plan MERIS sub-project sites appear to have been made only infrequently. Indeed, in discussions with the evaluation team, neither the Chief of the Plan MERIS Mantaro Regional Office nor his staff could even identify the current AID project manager, who has been in his position for more than one year. Needless to say, Plan MERIS sub-projects in the field have had even less contact with USAID/Lima. Again, it seems clear that the high turnover in project managers has contributed to this shortcoming, but perhaps minimal field visitation requirements linked to an on-going monitoring mechanism would help compensate for variable management quality.

IV. TECHNICAL ASSISTANCE

Possibly some of AID's project management problems, particularly those stemming from lack of continuity, might have been avoided by building a longer term technical assistance component into the project design. Technical assistance was provided with a loan-financed, host country contract between DGE and the association of two Peruvian contracting firms and the Consortium for International Development (ATA/CLASS/CID). This technical assistance was offered primarily in the areas of water use research, construction and irrigation extension and was aimed at supplementing GOP/DGE expertise in feasibility

study preparation and construction planning, as well as training of DGE staff. Included in the long term consultant team were an expert in planning, evaluation and management as Project Chief, an expert in applied irrigation research, and an expert in the development of extension techniques.

This arrangement produced several problems. First, two of the consultants (the team leader and the extension specialist) did not speak Spanish, making them ineffective in their tasks. This difficulty could have been avoided either through pre-project language training or through the recruitment of alternative team members with more appropriate skills.

Importing non-Peruvians to provide technical assistance created other problems too. Settling-in difficulties such as visa delays and household moves were time- and labor-consuming and contributed to a delay of several months in the commencement of technical assistance. These delays cut into the already short amount of time alloted for these activities. Clearly, a longer time frame should have been considered for such services, or professionals whose adjustment would have been easier, logistically and culturally, should have been hired. Indeed, several months into the life of the project these expatriates were replaced with Peruvian counterparts. Furthermore, some of these difficulties occurred because the contract with ATA/CLASS was host country-administered. While this arrangement afforded the GOP greater management autonomy, it nonetheless highlighted the lack of experience of Peruvian government counterparts in the details of contracting with consultants. Therefore, procedures which would have been handled routinely within the AID system took longer to work out. This, of course, implied a learning process for GOP administrators, which is all to the good. But more time should have been allotted for such a process.

Within these constraints--lack of appropriate skills and lack of time--there were also serious problems with the quality of technical assistance provided. As mentioned earlier, help rendered on the early feasibility studies did not eliminate methodological deficiencies in the data collection process. The presence of a trained social scientist would have been beneficial here.

In addition, the technical assistance component in both agricultural research and extension services may have been too little too soon, reaching only the few initial projects and, in some cases, beginning and ending before construction of canals was completed. Indeed, although the agricultural

research-extensionist was highly regarded by sub-project participants, there is little evidence that, other than for the use of materials he prepared, his work was continued after his departure.

Also, because there was no insitutionalized monitoring mechanism, there was no reliable way to determine the relative effectiveness of this technical package. For example, although the mid-term evaluations asserted that farmers did continue to participate in field day demonstrations begun by the research-extensionist, no systematic analysis of the technical package was made in the PES; nor was its appliation by farmers tracked in any rigorous way. Thus, it was difficult for the Impact Evaluation team to determine its overall utility for beneficiaries.

The Project's training component was also inadequate. Approximately $300,000 was spent on training during the course of the project. This amount represented a one month training program for Plan MERIS employees from February to March, 1979 in which 154 professionals from DGE and MOA participated. No records were available, however to indicate how many specific Plan MERIS staff members took part in this program. Once again, the content and impact of this training was unclear. Standardized monitoring techniques would have been helpful in determining the usefulness of the one month course. Also, it is not clear as to how many of the original participants are still working for Plan MERIS, or what sort of refresher program might be appropriate midway through the project. In addition to this short-term training, three MOA professionals (two from the Lima office and one from the regional office) went to Mexico for one year of academic training in irrigation use and engineering. As of March, 1983 none of the trained individuals was participating in the project and no documentation regarding the content or utility of their training was available in project files. In addition, it was reported that one of these three trainees was a blood relative of the then head of the project, and another was never, in fact, officially connected with the Plan MERIS program. Clearly, whatever marginal benefits were derived from the long-term training, they were not far-reaching enough, nor continuous enough to have a significant impact. The academic training of a few individuals in Mexico must be viewed, therefore, as an unnecessary component which had no appreciable effect on project progress.

Another problem relates to the time frame allocated for the completion of project activities. AID scheduled a five year termination date for this project (1976-1981) despite previous

experience with irrigation projects of similar scale and scope, such as the IDB's Linea Global I, indicating that such projects could take as long as ten years to complete. This prior IDB experience, coupled with the numerous implementation delays of the Plan MERIS project, suggest that this five year deadline was unrealistic and responded more directly to the bureaucratic concerns of AID/Washington rather than to the institutional requirements of the project itself. A more flexible scheduling system would have more appropriately addressed this problem.

AID's management performance also fell short in its efforts to coordinate activities with other donors in the area of small and medium scale irrigation in Peru. A number of international donors have operated in this sector over the last twenty years, including the United Nations, the Interamerican Development Bank, the West German KFW, and USAID. Essentially, these donors have created a market in which GOP planners have competed for project funds, seeking money from the highest or most willing bidder. This market effect can be seen as both positive and negative. On the one hand, the nature of project activity is diversified and GOP dependence on a sole donor is minimized. In addition, the resourcefulness and coalition building capacity of the Peruvian adminstrative and political apparatus is sharpened in its search for financial support. On the other hand, the lack of coordination among donors means that planning in the irrigation sector as a whole is weak. Also, as with the time frame issue just discussed, the lack of coordination results in poor learning from past experience on the part of each new donor entering the sector.

Coordination between AID and the GOP was also problematic -- especially in the planning and design phase of the Plan MERIS project. It is ironic that although the initiative for the project appeared to come from the Peruvian government, in fact the degree of cooperation between USAID project design and GOP planning was limited. For example, Plan MERIS personnel, at least at the Regional Office level, had never seen the USAID-prepared project paper and had little knowledge of the project development cycle within USAID. This lack of understanding of the AID funding process opened up infinite possibilities for confusion within the GOP about AID expectations.

The lack of coordination among projects within the Mission portfolio itself was also problematic. Plan MERIS' inability to deliver a technical assistance package for small farmer agricultural development, for example, was related to the overall state of the research-extension system in Peru.

Although midway into the life of the Plan MERIS project, USAID/Lima began an effort to fortify the national research and extension system that had fallen into disrepair, virtually no attempt was made to integrate these two AID activities. Nor, apparently, was thought given to the state of the research-extension service in Peru before embarking on the funding for the Plan MERIS project. This reflected not only the lack of institutional diagnosis on the part of by the designers of the Plan MERIS program, but also, again, the inordinate attention focused on engineering infrastructure at the expense of agricultural development. This lack of intra-AID coordination was also evidenced by the minimal attempt made to integrate the activities of Plan MERIS with another relevant AID activity, the Integrated Regional Development Project operating in both Cajamarca and Junin (Mantaro) during the same period.

Still another questionable AID practice is the use of loans rather than grants to host governments for technical assistance. In the Plan MERIS project, funds from USAID constituted $900,000 of the total loan disbursement and were designed to be spent on technical services, training equipment, and studies related to the project. No further specification was made for the use of these funds in the loan agreement. The balance of the total project cost, or an estimated $3,400,000 represents the costs of administering the project, including personnel and local support, office facilities and materials, as well as a reserve fund from which to finance cost increases due to inflation. These costs were to be financed from the GOP contribution.

The vagueness which characterized the allocation of these funds meant that responsibility for technical assistance funds was unclear and unspecified. As a result of a built-in bias toward the infrastructural aspects of this project, agricultural development activities got short shrift in project implementation, especially when finances were strained, beginning during the Year of Austerity in 1979, when the GOP economic crisis required severe budget cuts. Had the USAID contribution to the project more adequately covered technical assistance, agricultural activities could have continued along with the construction of irrigation infrastructure. Although it is reasonable to look to the GOP to provide ongoing support for these services, it is not realistic to expect, when fiscally constrained, that the GOP make the hard choices required to support technical assistance rather than infrastructure construction -- particularly since the immediate

political payoffs from construction of canals may be so much greater than from the intangible longer-term rewards of technical assistance. If technical assistance for agricultural development is to be assured, AID may have to re-examine its reluctance to cover all costs, at least in financial situations such as those faced by Peru.

The preceding discussion focused on AID's role in the institutional development of Plan MERIS. Though AID's activities were critical to project impact, they supply only half the equation. Institutional and social factors operating within the Peruvian national context, as well as at the local level, were major determinants of project outcomes and, indeed, remain the key which unlocks the possibilities for sustained deveopment through the Plan MERIS program in the future. This section will examine institutional variables at three levels: the national government level; the internal organizational level of Plan MERIS; and the nexus between the project and the client community at the local level.

V. INSTITUTIONAL CONTEXT: CENTRAL GOVERNMENT ARENA

At the central level, a wide constellation of administrative and policy-making organs within the GOP were important in defining the nature of Plan MERIS and in influencing its performance. Indeed, some of the problems affecting the project's early progress resulted directly from its location within the GOP bureaucratic apparatus and from its role in the internecine conflicts that characterized agricultural policy in Peru during this period.

For example, from the beginning, the project's location within the Ministry of Agriculture was complicated and problematic. Project functions were slow in getting started in part because implementation responsibilities within the Ministry of Agriculture were transfered from the Direccion General de Aguas (DGA - General Directorate of Waters) to the Direcccion General Ejecutiva (DGE) in 1977. This resulted in a 10 month delay in project activities. This shift from one organ to another within the MOA was an early reflection of two significant institutional issues: the tension between proponents of a project emphasis on physical infrastructure and the defenders of agricultural and social development; and, the conflict between Plan MERIS' status as a special project unit--separate from the MOA bureaucratic apparatus--and its function within the line ministry as part of a network of public organs working in the agricultural sector.

The first issue revolved around the conflict between the DGA and the DGE. In 1974, the DGA spawned a conception of the Sierra irrigation project which was based on small scale infrastructure whose construction and maintenance would be performed predominantly by community labor. The integration of agricultural technical assistance to the small farmer in these works was considered essential to this concept. This emphasis prevailed because the DGA was heavily staffed by agronomists, rather than engineers as was the case in the DGE. The project was shifted from DGA to DGE as a result of an essentially political decision. With a changeover of Ministers of Agriculture in 1976, the bureaucratic power of the DGA was eclipsed by that of the DGE, which was led by a particularly dynamic engineer. This individual found considerable support within the government for the change in emphasis of the Sierra Irrigation project from small scale construction coupled with agricultural development assistance to medium scale infrastructure with greater weight placed upon engineering aspects.

The move from the DGA to the DGE, thus, was more than a simple intra-agency shuffle. It constituted a significant change in project conception and, therefore, the type of personnel administering the project. Indeed, the recruitment of engineers into key positions in central project management has been a key determinant in the kinds of policies pursued in Plan MERIS. The imbalance, for instance, toward physical irrigation works and away from institutionalized agricultural development might have been offset by a staffing pattern which reflected the presence of more agronomists at the central level. Although there <u>were</u> agronomists working at the regional levels, their number was insufficient, and their power was severely limited by lack of funds and by the highly centralized management style of Plan MERIS.

The transition from the DGA to the DGE also meant the use of a special project unit outside of conventional MOA channels to implement project activities. The DGE was the unit responsible for special projects with multinational funding. The purpose of placing the Plan MERIS project under the DGE's domain was to afford project management a greater degree of financial and bureaucratic autonomy than would have been possible had the project been centrally controlled within the line ministry. Later, organizational changes in the MOA made DGE the directorate for INAF (Instituto National de Ampliacion de la Frontera Agricola - National Institute for Agricultural Zone Development). INAF is one of four semi-autonomous institutes within the MOA which, though nominally part of the

line agency, independently administers project funds from outside donors. It recruits its own staff and maintains limited communication with other MOA offices. The relative merits of "special project units" have been well debated. The usual trade-offs are between project efficiency and institutionalization of administrative capacity, but these tensions seem less apparent in the Plan MERIS case. Here, it would seem the benefits of this institutional arrangement outweighed the negative effects. As a special project unit, Plan MERIS was able to move more resources more rapidly in the absence of MOA red tape. This was particularly true in 1979, the "Year of Austerity" when government spending nearly ground to a halt and after which GOP resources became increasingly scarce. In addition, evidence to support the conventional argument that special project units drain trained personnel away from line ministries without contributing to the overall learning process of line agencies is relatively weak in this case. Indeed, there seems to have been considerable crossover between line positions in the Ministry and Project personnel.

The correlary reasoning that special project units create an internationalized technocratic class who may be lured away by the highest bidder-often outside the host country-may have more applicability. But, indeed, the principal attrition of trained project personnel resulted more from the gradual decline of bureaucratic salaries. This was the result of policies during the last days of the military regime which were reinforced by Belaunde's debilitation of the public sector because of severe financial pressure on the economy as a whole. Consequently, Plan MERIS staff had become, on the average, younger and less experienced as the Project progressed. As for the concern that special project units fail to become institutionilized within the bureaucratic mainstream, at the national level, at any rate, this seems not to have been the case. One of the more successful aspects of this project is the degree to which its model has been accepted and emulated within the Peruvian government as an approach to irrigation problems. Evidence for this institutionalization is found in the recent decision of the Development Corporation of Junin to reapply the Plan MERIS model of medium scale irrigation to heretofore unreached areas of the region. The German KFW's support of Plan MERIS II is another example, as are GOP plans to build similar medium-scale projects on the coast, jungle and elsewhere in the Sierra -- perhaps with additional AID money.

Clearly, the degree to which the Plan MERIS model has been "institutionalized" is linked to what is perceived to have been a relatively efficient and, despite delays, rapid accomplishment of physical goals when compared to large-scale, costly irrigation projects undertaken elsewhere in Peru. This sort of project has appeal both for fiscal conservatives as well as for engineers who seek the application of technical solutions to developmental problems. The more penetrating question, however, is not whether the project has achieved an adequate level of institutionalization within the public arena, but rather whether such a model should be institutionalized, or at least which aspects of its operations should be emulated and which should be discarded or amended. In some respects, this project may have been "over-institutionalized." Indeed, new proponents of the Plan MERIS model may be embarking unquestioningly on projects that repeat the planning and implementation errors of the original model.

Of course, there were disadvantages to Plan MERIS' status as a special unit. The extent to which the INAF/Plan MERIS operation was unintegrated into the mainstream of the MOA may have contributed to the atomization of Plan MERIS activities from other governmental entities operating in the same regions of the agricultural sector. An examination of Plan MERIS' coordination with the other relevant agencies follows.

VI. INTER-AGENCY INTERACTION

A. Research and Extension

The area in which Plan MERIS coordination with relevant others was most critical and most inadequate was that of agricultural research and extension. Technical assistance to agricultural development was an essential component of the Plan MERIS program, but insufficient financial and policy support from the central office made such activities the weak link in project operations. Not willing or able to offer adequate services on its own, Plan MERIS made little systematic effort to coordinate its endeavors with other organs working in the field.

Of course, Plan MERIS should hardly shoulder full responsibility for this lack of coordination. After all, the general environment for agricultural research and extension in Peru was in extreme disarray during the life of this project. The history of the decline of these services coincides with the period of military rule. When the Junta came to power in 1968,

the organ charged with carrying out agricultural research and extension, IRPA, (Institute for Agrarian Reform and Agricultural Extension)--which had worked contractually with the UNA (National Agricultural University) in an effective national research program--was integrated into the Ministry of Agriculture. As the military regime progressed, however, research and extension became stepsisters to the top priority policy in agriculture -- agrarian reform. Extension staff were subsequently shifted to agrarian reform assignments, and budget constraints coupled with the general neglect of extension and research virtually destroyed these services which had been successfully developed during the previous 25 years. The de-emphasis of professional competence in research and extension and a decline in salary scales, in real terms, in an inflationary environment, resulted in a serious brain drain of experienced agricultural scientists to appointments abroad.

Although the government made several institutional changes in the mid-1970s in attempts to improve agricultural research and extension, the problems of severe budgetary constraints and the lack of sufficiently qualified personnel militated against the desired improvements. The latest institutional change took place in 1981, when, under Legislative Decree No. 21 "Agricultural Sector Organization Law", the Ministry of Agriculture retained responsibility for policy planning and administrative, regulatory and control functions in the agricultural sector. Technical support functions and activities were assigned to four semi-autonomous institutes and two public enterprises. Among these, the National Institute for Agriculture Research and Extension (INIPA) became the principal central government organ providing research and extension services in the agricultural sector.

INIPA's activities have been limited and very centralized and its resources are only now being buttressed by a sizeable loan (approximately $60 million over four years) from the World Bank, which comes on the heels of an AID five-year, $15 million loan begun in 1981 (the Agricultural Research, Extension and Education Project, 527-0192.) The decentralized units of INIPA are the CIPAS (Agricultural and Livestock Investigation and Research Centers), which administer field extension services and carry out research on a regionalized basis. The CIPAS operate in 18 Zonas de Promocion Agropecuaria around the country, using a modified training and visit system. The ratio of extensionist to farm families is approximately 1:11,500. Although INAF is planning a future affiliation with INIPA/CIPA in the adminstration of agricultural field research and extension services in connection with Plan MERIS II, no

previous formal links ever existed during the Plan MERIS I project. At the field level, communication between CIPA agents and Plan MERIS personnel were negligible. For example, although one Plan MERIS agronomist in Namora knew that a CIPA agent was living in the community and conducting trials and field visits, other Cajamarca area Plan MERIS personnel were unaware of CIPA's activities in the sub-project. Indeed, in general, Plan MERIS' information about the way in which CIPA agents operated in the field was sparse and often erroneous, mostly because of the limited degree of contact between the two organs. The pity of this is that these institutions both were plagued by extremely scarce resources which might have been more efficiently stretched by a higher degree of coordination.

While INIPA/CIPA was not the only other organ providing extension and research service to farmers in Plan MERIS' area of operation, the Project's coordination with other entities was not much better. Another organ offering technical assistance to farmers in Cajamarca and Huancayo, for instance, is FONGAL (Fomento Nacional de Ganado Lacteo - National Milk Cattle Development). This is an organization of cattle and dairy farmers which is a cross between a semi-autonomous state autarchy and a producers' cooperative whose principal function is the marketing of regional products. FONGAL offers its members technical assistance packages, including veterinary services. Despite the growing importance of livestock and dairy production in the regions where several Plan MERIS subprojects are operating, there has never existed any formal agreement between FONGAL and Plan MERIS I concerning the delivery of technical assistance to farmers. Although informal communication seemed somewhat better between FONGAL extensionists and Plan MERIS field staff, these casual arrangements could not achieve the level of coordination necessary to provide adequate non-duplicative services to the beneficiary.

This lack of coordination also affected the quality of the technical assistance package delivered to small farmers. Recently, for instance, the DGA, in connection with its activities in its Department of Operations and Maintenance engaged the services of CESPAC (Centro de Servicios de Pedagogia Audiovisual para la Capacitacion - Center for Audiovisual Pedagogic Services) to prepare an audio-visual training package for small scale irrigators, instructing them in maintenance operations as well as appropriate agricultural techniques to be used in conjunction with irrigation activities. Although Plan MERIS has just signed an agreement with the DGA to utilize this package, this is clearly an

activity which should have been undertaken long before this point in the project. Moreover, neither Plan MERIS regional staff nor local farmers themselves participated in the preparation of, or planning for, this audio-visual package. Consequently, the instructional units are often targeted either above or below the cognitive level of beneficiaries, or else, contain irrelevant information.

The same apparent lack of coordination characterized Plan MERIS' relationship with ENCI (Empresa Nacional de Comercializacion de Insumos - National Enterprise for Marketing of Inputs), the state enterprise responsible for the distribution and commercialization of seeds and fertilizer throughout the country. This undoubtedly inhibited the timely delivery of appropriate inputs in conjunction with the increase in water beneficiaries. In contrast, Plan MERIS did have a formal agreement with INFOR (Instituto Nacional de Forestal y Caza - National Forestry and Fauna Institute), the MOA's forestry unit. As a result, forrestry planting and maintenance appeared to be proceeding well. The potential difficulties with regard to this activity were related not to present performance but, rather, to the future capacity and willingness of farmers to sustain and maintain plantings when the INFOR/Plan MERIS contract was terminated. Though INFOR agents had stimulated local interest and capabilities through various successful outreach programs, particularly in the village schools, the future institutionalization of these activities without outside guidance or financial support remained in question.

B. Credit and Land Title

Two other entities were of critical importance to the success of the Plan MERIS program: the Agrarian Reform Institute and the Agrarian Bank of Peru. The Agrarian Reform, which took place in Peru during the 1970s overshadowed all other activities in the agricultural sector. The Agrarian Reform affected Plan MERIS project outcomes because of the structural changes it brought about and because it drained resources away from other important activities such as agricultural research and extension. It was also important to project operations to the extent that a significant portion--twenty percent--of potential Plan MERIS project beneficiaries' land tenure status was affected by the new Agrarian Reform legislation. Peasants most directly touched by the Agrarian Reform were those who had been working either on latifundia expropriated by the state and then subdivided into smaller plots, or those who colonized previously unincorporated

land which thus came to be administered by the Agrarian Reform. For these Plan MERIS beneficiaries, the Agrarian Reform not only determined the economic viability of a given farmer's plot of land by virtue of the size of the subdivision he was awarded, but also the legality of his title which determined the nature and quantity of credit he could receive from the Agrarian Bank. Although the requirements for land entitlement were more clear for those farmers under the Agrarian Reform than for minifundistas whose property fell outside of the legislation's boundaries, nonetheless, obtaining title which the Agrarian Bank would consider satisfactory for credit was a cumbersome and costly juridical process whose delay caused the exclusion of many small farmers from access to loans.

Several governmental organs were responsible for carrying out the agrarian reform, which was officially deemed completed in 1973 but was still adjudicating titles as late as 1983. Nominally, the Direccion General de Reforma Agraria y Asentamiento Rural within the Ministry of Agriculture was in charge of the policy. But the entitlement process actually took place in the Agrarian Court System or the Fuero Privativo Agrario (FPA) (as opposed to the common court system).1/

A complicated bureaucratic system in and of itself, the Agrarian Court System not only dealt with the subdivision of former haciendas into individual peasant plots, but also adjudicated properties which were designated as various forms of cooperatives (including both production and service cooperatives which worked in conjuction with previously existing peasant communities (comunidades).

Moreover, tribunal processes were made that much more difficult by the presence of numerous interest groups exerting

1/ Peter S. Cleaves and Martin J. Scurrah, Agriculture, Bureaucracy and Military Government in Peru; Ithaca, 1980, Chapters 5, 6 and 7.

pressure on the policy bargaining process.2/ As a result of the slowness and complexity of this policy-making process in the court system, many peasant beneficiaries of the Plan MERIS project were denied credit by the Agrarian Bank because they did not have official title under the Agrarian Reform to qualify for a loan. Such a title would generally require cadastral surveys and lengthy legal procedures. Because of theapparent lack of coordination and communication with Agrarian Reform representatives, it was only in the last two years of the project that a temporary certificate of possession was developed by the Agrarian Reform to satisfy the conditions of the Agrarian Bank in granting credit to non-titled farmers. Coordination with the implementing agents of the Agrarian Reform should have taken place before the Project began in order to avert these difficulties.

The other institution with which Plan MERIS needed to coordinate policy was the Agrarian Bank. The question of entitlement to land was pivotal in the Bank's ability to dispense credit to small farmers. The difficulties confronting potential beneficiaries of the Agrarian Reform with regard to land title procedures have already been discussed. These were, however, only twenty percent of the beneficiaries of the Plan MERIS program. Even greater legal and financial obstacles faced minifundistas who were working land not under the Agrarian Reform. These farmers' only recourse was to even more costly, complicated legal processes in order to prove title. The complicated hierarchy of title status and its correspondence to different levels of credit granted by the Agrarian Bank has been described elsewhere.

Although the Bank agreed in 1982 to recognize provisional certificates of land possession as qualification for credit for production purposes, this was a long, drawn-out resolution to a

2/ Cleaves and Scurrah chart the proliferation of competing representative interest groups stimulated by the corporatist Velasco regime which tried unsuccesfully to manage and control them. Several, such as the National Agrarian Confederation - encompassing agrarian production, campesino communities, and associations of individual farmers and landless peasants - the FTAP (Federacion de Trabajadores Azucareros del Peru - Federation of Peruvian Sugar Workers), and the CCP (Confederacion de Campesinos del Peru - Campesino Confederation of Peru), played an important role in the adjudication of tenancy issues well into the Morales Bermudez period. See Cleaves and Scurrah, chapter 5.

problem which should have been worked out between the Agrarian Bank and the Plan MERIS staff on a national basis before the project was ever begun. Moreover, the very choice of the Agrarian Bank as the credit granting institution might have been called into question had these preliminary negotiations ever taken place. Indeed, the degree of risk aversion demonstrated by the Bank was not evident just in its reluctance to grant credit to minifundistas without clear title to their land. This reluctance also hinged on the Bank's assumption that the small farmer was, in general, not credit worthy because his plot was too small to be economically viable. This attitude brings under scrutiny the entire use of credit for such a peasant population. In any case, given the willingness of USAID and the GOP to use credit as an instrument of technical assistance in this project, it should have been made clear from the start that the institution selected to dispense that credit be willing to take unusual risks in order to do so; especially in view of the fact that the Project Paper intended the credit component to be directed at beneficiaries not otherwise eligible for credit from existing sources of credit. The choice of such an institution should have been based on in depth pre-project negotiating in conjunction with a thorough social and institutional diagnostic analysis of the project context.[3/]

The other significant set of institutions with direct relevance for Plan MERIS were the Departmental Corporations (CORDES) which function at the local departmental level. (There are 24 departments and one constitutional province in Peru.) Although the extent of their power within a rapidly

3/ Indeed, alternative institutional arrangements for credit approval might have been appropriate here. For instance, precedent did exist for the establishment of a credit committee at the regional level, made up of representatives of line ministries and local government, in addition to other relevant institutions, to set the norms for the dispensing of credit. This model was apparently used successfully by the Linea Global project of the Inter-American Development Bank in an effort to avert the domination of the credit granting process by a single institution such as the Agrarian Bank.

changing politico-administrative system remains uncertain, the CORDES have discretionary budgets from the National Treasury and have been legally empowered by the Law of Corporations passed in 1981 to act as a filter for all financial investments made at the departmental level in Peru. As yet unenforced, this law may turn out to have little impact in reality. Informants seemed confused as to the potential ramifications of such legislation, but if it took effect, the Departmental Corporations would wield considerable power at the regional level. Although there were very small scale irrigation works being carried out under the auspices of CORDEJUNIN and CORDECAJ (in Cajamarca), no systematic coordination existed between these activities and those of Plan MERIS.

The impact of the potential power of the Departmental Corporations has not been lost on Plan MERIS leaders. In Junin, they have entered into an agreement with the CORDEJUNIN (Departmental Corporation of Junin) to extend Plan MERIS operations to eight additional subprojects in the region, spending approximately 14 billion soles. Bureaucratically, this arrangement makes sense for Plan MERIS personnel as it ensures their continued employment and participation in irrigation projects in the Huancayo area. And, as mentioned earlier, the replication of AID-funded activities by a locally-controlled body could be considered a sign of institutionalization of the Plan MERIS model. But CORDEJUNIN's continuation of Plan MERIS activities also meant the institutionalization of many of the design and implementation errors contained in the Plan MERIS project. In particular, CORDEJUNIN was planning the construction of irrigation canals without any prior arrangements for agricultural technical assistance. CORDEJUNIN officials argued that, in contrast with Plan MERIS, CORDEJUNIN did not possess a self-sufficient special project status through which it might provide its own technical assistance. This was all to the good, they asserted; they emphasized that an agreement would be worked out with the appropriate GOP institutions to supply these services. But no steps have been taken in this direction. Moreover, it is unclear whether the capacity to provide these services exists within the GOP at this time. Until the agreement with CORDEJUNIN, Plan MERIS' relations with the Departmental Corporations were, for most of the life of the project, only informal.

C. Project Organization and Management

INAF/Plan MERIS' own internal structure was also important in shaping project impact. In particular, the extreme centralization of project administration made the Plan MERIS program less efficient in its operation and less responsive to the requirements of its target clientele. Below, a brief review of the structure of administrative responsibility is followed by a discussion of the implications of the high degree of centralization for project activities.

INAF was created by the Organic Law of the Agrarian Sector in January, 1981 as a semi-autonomous autarchy within the MOA to plan, execute and supervise multi-purpose projects in the agricultural sector--especially those with international donor funding. Within INAF, projects dealing with small- and medium-scale irrigation are funneled through the bureaucratic vehicle of PEPMI (Proyecto Especial de Pequenas y Medianas Irrigaciones - Special Project for Small and Medium Irrigations), created in December, 1981 to encompass, at present, three groups of projects. These were: Plan MERIS I, financed with funds from AID and national GOP funds; Plan MERIS II, financed with funds from the German KFW; and, Linea Global de Riego No. 2, with funds from the Inter-American Development Bank. Both the funds from foreign sources as well as those from the national public treasury which go into these projects are filtered through the Prime Minister's office and then go directly to INAF, bypassing much of the red tape in the MOA. INAF thus has considerable autonomy in the disbursement of funds. Relatively speaking, the deconcentration of authority within the MOA to INAF and other such autarchies gave it the capacity to move money quickly. It also created the possibility for more responsive action with regard to the lower echelon staff of INAF/Plan MERIS, and, in turn, to the intended beneficiaries of project activities. Unfortunately, the principle of decentralized management was not applied to the internal administration of INAF or Plan MERIS. Concentration of authority in the center was a major source of difficulty in project implementation. Control of virtually all key project resources and operations resided in the central Plan MERIS office in Lima. Although project monies were allocated on a regional basis, the regional representative offices were unable to disburse funds without Lima approval. For example, this was so for all staff salaries and equipment, and even the purchase of office supplies required central headquarters sign-off.

The effects of this rigid centralization of authority in the Lima office were exacerbated by the remoteness of most of the sub-projects even from the regional headquarters--and by the fact that Lima personnel made only infrequent visits to the field. The result was a low level of flexibility and understanding by the Project planners of changing field conditions; this was broadly perceived by field personnel as Lima's insensitivity to client's needs.

This centralized style of management only reinforced the already existing schism between engineering personnel and agricultural development staff. The core of central headquarters employees were engineers, whereas those agronomists present in the Plan MERIS operation were staff stationed in the sub-projects. The combination of centralized administration and an emphasis on engineering affected nearly every phase of the project.

In planning, for example, the engineering bias was reflected in the heavy weight placed on the physical aspects of the feasibility studies, largely at the expense of reliable socio-economic or institutional data. It has been suggested by one AID consultant that the physical aspects of these projects were over-planned and that more simple formulae could have been applied as effectively, and certainly more efficiently, in terms of cost criteria. More resources could then have been shifted to analysis of the socio-economic data provided in the feasibility studies.

In implementation, the centralization and engineering orientation nearly bankrupted operations at the regional and sub-regional level toward the end of the project. Lima's failure to develop and fund yearly budgets in a timely manner sapped field staff almost totally of operational capacity. Not only had local personnel not received salaries because of budget shortfalls in the operations categories, but they also had received no money for gasoline with which to travel between and within sub-sites; nor did they have sufficient funds to pay for minimal inputs for field trial demonstrations to support extension work. This problem, of course, can be directly traced to the GOP's extremely limited resource availability.

Overcentralization in Lima also resulted in staffing levels in the field sub-project sites which were too low to offer the necessary services for sufficient technical assistance to small farmers. In light of this personnel shortage, the regional office policy became one of rotating sub-project staff from one site to another after initial activities had begun. Thus,

although a sub-project began with a full complement of social and technical personnel, by its second year its staff was often reduced to one technician or social worker charged with supervision of all Plan MERIS activities in the sub-project. Admittedly, though, this rotation was also a function of the perception by technical assistance staff of some particularly remote postings as hardship assignments. Thus, staff frequently did not stay in a sub-project site long enough to become part of the community; this was a major obstacle to the institutionalization potential of project operations in any given area. This should also be contrasted to examples of successful irrigation schemes in other parts of the world. One much touted "success story" is the case of the National Irrigation Authority in the Philippines. This project apparently promoted sustained community participation in irrigation canal construction and maintenance. It also promoted appropriate farming techniques successfully through the installation, over a five year period, of organizers who lived in the community, gaining the confidence of villagers while catalyzing their participation in the NIA program.3/

This is not to say that Plan MERIS regional and field staff were not an extremely dedicated group whose commitment in the face of severe shortages was nothing short of impressive. Indeed, many instances could be found in which field personnel paid for supplies and inputs out of their own pockets in order to carry on essential activities. Still, there were several ways in which the Plan MERIS project was conceived and implemented which prevented the successful institutionalization of those operations which would, in the long run, prove beneficial to small farmers and which would be adopted by them on a continuous basis. Indeed, despite the high level of field staff commitment, project outreach to the community it sought to serve was problematic. The following examination of the institutional aspects of project-beneficiary interaction elaborates upon the difficulties which attend efforts to make project benefits sustainable among small farmers in the Sierra.

Focusing on institutional issues at the community level, several critical questions emerge. What are the prospects for the institutionalization of project benefits within the community? That is, what institutional or organizational capacity is in place to carry on the activities begun by the project? What is the structure and nature of community

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3/ Frances Korten, "Building National Capapcity to Develop Water Users' Associaitons: Experience from the Philippines," Mimeo, 1981.

participation in those institutions; and finally, who is benefitting from the project intervention and its continuation? Taking into account the diversity of the pre-existing political, social, cultural and organizational contexts in which the Plan MERIS program operated, the following section will attempt to address some of the queries posed here.[4/]

Factors of beneficiary participation in project design, implementation and evaluation were important in assessing potentialities for sustained participation and the development of institutional capacity at the community level. Evidence suggests that early and significant beneficiary participation in the project and pre-project activitites bodes well for other forms of expression of interest and of responsibility on the part of villagers later on.

In Plan MERIS, such levels of participation were not attained. Initiative for project implementation and conceptualization came from the government, not the community, although interest may have been expressed previously by a given village in having resources to construct irrigation canals or improve existing ones.

Moreover, the design and planning phases of the project were carried out with only minimal consultation with local farmers. Although attention was given in sub-project selection to socio-economic criteria, the principal basis for site selection were the physical characteristics. These decisions were made exclusively by Plan MERIS engineers and USAID

4/ A methodological caveat must be mentioned here. Because the Plan MERIS project was not even physically completed at the time of this evaluation, conclusions drawn about "sustainability" (sic) and "institutionalization" are made on extremely shaky bases. Even five years hence, data on these sorts of questions may not yet exist. The most this analysis can offer, then, is to try to identify those conditions that we can assess as most or least likely to lead to sustained participation in project-induced benefits. Again, in the Philippine case, for example, the communal assistance program of the National Irrigation Authority implemented the participatory approach in every stage of assistance: feasibility and site selection pre-construction; construction and operation and maintenance, affording a high level of interest and participation of local beneficiaries all along the way.

personnel. Thus, valuable information about characteristics --both physical and socio-institutional--of the areas to be irrigated which could have been provided by local villagers was not incorporated in plans. In addition, an excellent opportunity to involve beneficiaries early in the project development process was foreclosed. This one-sided planning process probably helped preclude high community participation levels later on; it also generated sources of conflict which created impediments to timely canal construction in the first phase of the project. In several instances, farmers who had not been consulted previously could not be persuaded of the merit of the irrigation canals and refused to allow them to be built on their plots because the total area available for cultivation would be reduced. These problems caused construction delays and unforeseen detours. Korten reports that such inefficiencies were averted in the Philippines by the inclusion of the farmers into this early planning stage. The engineers walked the field with the farmers, asking them to help identify the best placement of irrigation canals; they also held joint meetings in order to plan the project step by step. Confusion and conflict about the goals and benefits of the irrigation scheme among villagers were thus minimized.

In Peru, the pattern of low participation continued into the construction phase of the canals as well. Although one of the goals of the project paper was to generate employment opportunities within the communities, on the average only 50% of labor was provided by workers from the community on canal construction. Indeed, occasionally, some of the local labor that was used was taken to construct new projects rather than remain in the village as a local resource. As a result, the potential for fortifying local capacities was not fully realized by this policy.

VII. STRUCTURES OF LOCAL PARTICIPATION

Despite the limited involvement of local farmers in the early stages of project development, structures for peasant participation do exist wherever the project is operating. The standard mode of participation has been the water user's association, or "irrigators' committee" which, as indicated in the body of this report, existed in every sub-project. In most communities it was made up of approximately 10 members representing, on the average, 30 families who lived within a set radius of the cuartel, an area division which corresponded to traditional land categories used by the community for centuries in its internal regulations. In other, larger,

communities these committees were organized on the basis of proximity to individual secondary canals. In many cases, the irrigators' committees themselves were simply superimpositions on already existing regulatory and representative bodies which had supervised irrigation activities on a smaller scale. To the extent possible, Plan MERIS personnel sought to utilize these existing organizations rather than create new ones. This would preserve community customs and also strengthen possibilities for communal adherence to project norms. These committees were chosen by community members themselves.

Representatives of the committees were then selected to serve on a larger Commission or Junta of Irrigators which might govern the irrigation behavior of the entire community or several communities in an adjacent area. This Commission was headed by a president--who might also serve as the tomero (the one who turns on the water); it also included a vice-president, treasurer, secretary and two at-large delegates. The relationship within communities and between committees and commissions varied from one community to another. In general, the committees seemed to be truly indigenous and reasonably representative, but in areas with higher levels of social stratification, the commission was likely to be headed by a more affluent mediano farmer category whose interests might not coincide always with the majority of minifundistas in the community. In addition, despite the over-representation of women as de facto heads of farms in the absence of males who were pursuing off-farm employment opportunities elsewhere, females were under-represented on irrigators' committees in most communities.

Generally, the committees organized labor for canal irrigation, water distribution, and canal cleaning and maintenance. Depending on the strength of their ties to other community institutions, the committees might levy fines for non-compliance with irrigation regulations or maintenance responsibilities. But in addition to serving a regulatory function, they also acted as interest mediators and articulators, airing complaints and registering them through petitions to higher authorities such as the Plan MERIS office. In one case, a commission of irrigators appealed directly to the Ministry of Agriculture to resolve a problem regarding a blocked intake on a main irrigation canal.

Committees might also supervise the administration of user-fee systems. In many cases, no fee was being assessed but was reported likely to be instituted in the future. In other instances, fees were collected by the tomero; either annually

or by turn. Sometimes irrigation turns were used as payment for day labor on canal maintenance or some other communally beneficial activity.

The degree of autonomy of these committees vis-a-vis Plan MERIS also varied considerably. In some cases, the Commitees themselves selected a vigilante (water master) and/or a tomero chosen from among their own ranks. In other cases, the Plan MERIS would designate a vigilante and/or tomero to be paid by the government to supervise water distribution. (This mirrored the pattern in those older irrigation sites where a vigilante was appointed and paid by the DGA local representative in the Water District). In some cases where the vigilante was government appointed, the goal seemed to be to provide a transition to local control, but in other situations, the presence of a public (probably through the DGA) vigilante to oversee local water distribution is likely to continue. The vagueness of future arrangements made sustained community involvement in the irrigation program more uncertain.

The relationship between Irrigators' Committees and local community leadership was also linked to project effectiveness. In general, the working hypothesis that where communal organization was strong, Irrigators' Committees were most effective, held true. Sanctions against non-compliance with maintenance duties or time limits on water use were most easily enforced among communards who were well integrated into a social and political system which they had accepted and understood all their lives. In these cases, there seemed to be considerable overlap between the community leadership and that of the Irrigators' Committee. Municipal offices such as the position of Mayor, for example, often interlocked with these committees.

It would seem that areas with strong communal traditions were more prevalent in the Huancayo sub-project region than in Cajamarca, and limited investigation suggested that the former region displayed greater strength among users' organizations than the latter. Interestingly, as evidenced in Huancayo, there seems to be little correlation between a greater level of relative prosperity and effectiveness of the irrigator committees. For example, agricultural production capacity in Chicche, in the Mantaro highlands, is severly limited by its elevation, and encouragement of pasture cultivation seemed the best development strategy in connection with irrigation provided by Plan MERIS. Although production levels in this area left a great deal to be desired, communal traditions were

strong and irrigation committees were effective in operation and maintenance activities.[5]

Despite the relative strength of the communal institutions in Chicche, though, results of irrigation were not particularly favorable due to the difficulties imposed by the harsh climate. Irrigators' Committees functioned well, but farmers were discouraged from using irrigation for all agriculture because of the marginal results they achieved for irrigated crops. (It should be noted, however, that good results were being obtained in irrigated pastures.) The beneficial effects of well organized users' groups, then, are obviously limited by the natural benefits improved irrigation can or cannot bring.

Irrigators' Committees, furthermore, often proved ineffective in resolving conflicts over water--even where strong community organization structures existed. In highly stratified communities, committees might even become pawns in local power struggles. As mentioned earlier, for example, informants in La Huaycha reported that larger landowners were able to intimidate or hoodwink small farmers into relinquishing their "turn" for water in exchange for negligible favors. This was possible not only because the small farmer did not perceive the value of his water rights but also because the local Irrigators' Committee was subject to the dominant power structure within the community, which afforded special privileges to affluent farmers. In many cases, these powerful

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5/ Enrique Mayer, "Uso de la Tierra en los Andes: Ecologia y Agricultura en el Valle del Mantaro del Peru con Referencia Especial a la Papa," Centro Internacional de la Papa, Lima, 1981). In his discussion of the preeminence of communal domination of land tenancy and agricultural decision making, Mayer concludes that the degree to which the community organizes agricultural production is greater in the communities which are in higher zones rather than lower elevations and is reflected in land tenure ownership patterns. Though he concedes considerable variability within elevation zones, he finds that there is a graduated scale of privatization, which, by and large, coincides with decreasing elevation, although at equivalent elevations we find variations in the degree of communal control of decision making with regard to production. These differences seem to reflect the patterns of demographic density, the intensity of the agricultural systems and the historical circumstances which have weakened the communal structure.

APPENDIX G

EFFECTS OF IRRIGATION ON SIERRA WOMEN

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I. The Setting

In the Peruvian Sierra, the family is the fundamental institution on which agricultural production has traditionally been based. Unlike the Selva and the Costa regions, where large haciendas and agribusinesses geared for export production are operated primarily by men, the Sierra continues to rely on the family unit for the administration, production, and local marketing of agricultural goods.1/

Having traveled throughout the Cajamarca and Mantaro Valley districts in the northern and central Sierra, the team found this observation to be accurate. The constant presence of women and children along the roadsides and in the fields, carrying loads of fuelwood, pasturing cattle, preparing land for cultivation, tilling soil, tending to field crops, drying corn, selling agricultural produce, spinning wool, washing clothes, etc., is evidence of their importance to Sierra agriculture. Likewise, women are members of community cooperatives, owners of land in their own right (typically of extensions of 1/4 hectare or less) and often are, because of migration and off-farm employment by the males, the de facto heads of households, making all economic decisions. In the daily ferias, the early morning markets where small amounts of goods are traded or sold, one sees almost exclusively women peddling potatoes, ollucas, and fruits. In the weekly markets, at least 50 percent of the sellers are women and children.

In small communities in the Mantaro valley, between 40 and 50 percent of the men work in jobs such as mining, as laborers in Lima or Huancayo, and in factories and milk processing plants. Typically, they leave their farms in the care of the women. 2/ In Cajamarca, a similarly large percentage of the men seek off-farm employment. Thus, while the men are working away from their farms, the women are forced to head the households. When men are present, however, women typically assume a secondary role.

1/ See Sara-LaFosse, Violeta, "Valor del Trabajo de la Mujer en el Agro y en la Produccion Domiciliaria para la Industria de Confecciones", 1981, Lima.

2/ ibid.

This role, however, is of no less importance in the area of agricultural production. Women are usually charged with looking after the cattle, helping out with seeding and harvesting and marketing in the ferias, while also looking after the children, clothing and food. But, when they are present, men will usually make the major economic decisions for the farm and the household.

II. The Benefits of Irrigation

A Women on Medium and Large Land Holdings

Inasmuch as the oldest of the Plan MERIS sub-projects are only three to four years old -- and the bulk of them are two years old or less -- the socio-economic impact of irrigation on the beneficiaries, specifically the women, is still not fully evident. The one immediate impact which may have an exclusive effect on the women, however, is the physical proximity of water provided by the irrigation system. Women, simply put, have less distance to walk to collect water for their household chores and for livestock. Based on conversations with some 15 to 20 Sierra women, the team can only make certain assumptions and assertions about the likely longer-term impact on the project. Only one fact, however, is clear: with irrigation there is a potentially reliable source of water where there has not been one before. Many of the beneficiaries, though, have yet to accept the fact that the availability of water is likely to be dependable.

To date, the majority of farmers have tended to utilize irrigation primarily on their pastures, rather than on their crops; they apparently prefer, at this time, to take risks on their less delicate crops. Even with the short period of time that irrigation has been provided by Plan MERIS, it is already evident that the pastures are improved through the application of water. This fact, furthermore, has been accepted by virtually all of the farmers interviewed. Better pastures for feeding cows and sheep and, at least for some farmers, the availability of credit for the purchase of additional animals, have helped improve the general welfare of the family as a whole. Farmers are able to sell their milk to the regional milk processing plants and receive a cash income.

For example, one woman in the Namora subproject, Cajamarca, experienced a more stable and improved income through livestock. She had recently bought a radio and built an addition to her home; she was also keeping two liters of milk

per day for her family's consumption. This woman, whose husband owns eight hectares of land -- and is, therefore, considered a medium- to large-landowner -- reported that irrigation has helped her standard of living. Her own personal workload, however, has increased because of the additional responsibility of tending more cattle; but, her family's general welfare is improving.

The presence, with irrigation, of a dependable source of water also appears to have made home gardening of vegetables another feasible means for the women to improve their families' welfare. Another woman in the same community of Namora said she and her husband were trying to grow a variety of hortalizas (vegetables) for the family's consumption. This family, which lives on four hectares of land, was able to purchase the necessary seeds with credit made available by the Agrarian Bank. She also indicated that the availability of water has improved their lives.

Farmers with at least three to five hectares of land, generally known as medianos or medium-sized landholders, appear to be deriving the greatest benefits from irrigation. In addition to the presence of water, credit is reaching them. And, with credit they can purchase seeds, fertilizers and pesticides, as well as more cattle. Thus, the general welfare of the entire family in this group appears to be be improving.

In the Chingol subproject, an isolated site in Cajamarca, a woman and her husband said their production of corn and potatoes has improved since the project began. They own 13 hectares of land. The husband previously worked off the farm but is now working on his land together with his wife, since irrigation has made agriculture a more viable, secure source of income. They own several farm animals and can cultivate approximately 3/4 of their 13 hectares. They also have several hired hands who help them with the manual labor. As a result, the woman no longer has to bear the double burden of both running the household and working on the farm to produce food for the family's consumption.

One can speculate, however, that an improved general welfare for the family may not necessarily mean an improved welfare specifically for the women. Nevertheless, irrigation should bring a change in the women's roles in agriculture. If irrigation increases the attention that men give to agricultural production and keeps them present on the farm, it is likely that the women's roles in the household and in farm management will change from what is typical of the Sierra.

With the return of men to the land, women will generally no longer be making economic decisions for their households, farms, families or themselves. In other words, irrigation may reinforce the patriarchal position of men in the community.

In addition, as agricultural activities are increased through irrigation, it is likely that the tasks associated with women will also increase. For example, with additional farm animals, women have greater responsibilities. Or, as the area under cultivation increases, women and children, who traditionally take part in the planting and harvesting of crops, when labor needs are high, will probably be required to help out to a greater extent.

B. Women on Minifundia and on Small Landholdings

While Plan MERIS has had a positive impact on women on medium-sized landholdings, 80 to 95 percent of the small farms in the Sierra are not in the *medianos* category but, rather, are *minifundios*. These are usually defined as comprising 1/2 to 1/4 hectare of land or less. Most of the farmers living on the *minifundios*, furthermore, do not have title to their land. 3/ Although 1/4 hectare should be enough land to support either a cow, several sheep, a donkey or a few pigs, few *minifundistas* have ever accumulated enough money to be able to purchase any animals. *Minifundistas* tend to be the poorest, and the least educated; and, when women, are often single or widowed. Women of the *minifundios* typically look old and weary after the age of 18 or 20, by which time they usually have had several children.

Without title or documentation to their land, most *minifundistas* find themselves ineligible to obtain credit. Furthermore, those who are eligible for credit frequently do not want it because they fear that they will lose their land should they default on the loan. Although there is a misconception among many small farmers that the Agrarian Bank will repossess their land, it is so widespread, despite denials by the Agrarian Bank, that it has become a controlling perception. Consequently, *minifundistas* as a group are buying few seeds and fertilizers for their crops and are unlikely to make any longer-term improvements on their land. The latter is

3/ Plan MERIS officials state that 80 to 95 percent of the rural population of the Sierra are *minifundistas*, and that 80 to 90 percent of the *minifundistas* have no title to their land.

particularly true of the majority, which, without the necessary assurance of access to the land represented by a clear title, are reluctant to make any capital improvements.

Most of the Sierra women who live alone are either landless or live on minifundios. To assess the impact of irrigation on the minifundista women at this stage of the project is even more difficult than on the medianos. At this early stage, the only apparent impact is the availability and proximity of water; its impact to date on minifundista incomes and on the position of women in this group appears to be negligible. This observation is in keeping with the finding that, to this point, the project impact on minifundistas in general is limited.

For example, one woman in the Apata sub-project, in the Mantaro Valley, lives on 1/4 hectare that is irrigated; she also has a second, slightly larger, plot that is not under irrigation. She claims that her corn and potatoes are better on this larger, rainfed plot. She also stated that the presence of water on the smaller plot has not made a difference since, in her opinion, it was uneconomical to farm it in the first place. However, she was convinced that her husband, who works as a hired hand on other farms, would be able to find more work because of the increase in land under cultivation as a result of irrigation. To provide enough for her family, this woman tends the rainfed farm while her husband works as a temporary laborer. She also tends a small grocery shop and works on the construction of the canals under a food-for-work plan.

Furthermore, irrigation has not, in general, changed the lives of other minifundista women who do not have the time, resources, or the assistance to dig an access canal to their plots. A wide-spread view among this group is that the benefits obtainable from irrigation are not sufficient to justify the explicit or implicit costs of digging an access canal. For example, an old woman in the Chicche sub-project, Mantaro, who farms a 1/4 hectare plot in the irrigated area, said she has no help to build an access canal to her plot. In fact, her main source of income, like that of many others in her position, does not come from the land. Rather, it comes from washing clothes for relatives and neighbors, which provides S/1000 (approximately 85 cents) per day plus a meal for each day she does washing.

II. Conclusions

In those areas where the project has been most successful to date, the general well-being of women is improving along with that of the entire family. The project, however, has been most beneficial to farmers on medium-sized farms, where farmers have, in addition to a reliable source of irrigation water, access to credit for capital improvements. This group, unfortunately, represents only a small fraction of the project's potential beneficiaries.

The types of benefits currently attributable to the Plan MERIS project are: a more stable and secure income, as with the medianos on 13 hectares in the Chingol sub-project who reported improved corn and potato production; a higher level of income, as with the family in Namora who recently added on their home; and, improved nutrition levels, as with the woman in Namora who is growing vegetables and legumes for her family's consumption. It should be remembered, however, that the bulk of the benefits have accrued to only a small proportion of potential beneficiaries.

As the effects of irrigation-induced improvements become more widespread, it is likely that a change will occur in the role of women in farm management and agricultural production. As the men are drawn back to their farms because of improved opportunities due to irrigation (and, possibly, worsening conditions in the Peruvian economy at large), women will no longer be heads of households making all economic and management decisions for the farm and family. Thus, if irrigation increases the attention that men give to agricultural production and keeps them present on the farms, it is likely that the role of women in household and farm management will change will change to a more patriarchal pattern.

Where the Plan MERIS project appears to not be nearly as successful -- among the minifundios and small farms -- there has been no apparent change in either the status or the role of women. Farmers in this group are not seeing improvements in their crops because of a lack of credit, technical assistance, and other related problems. Because of the lack of economic opportunity on the land, there is a greater tendency for the men to migrate. Women in this group, therefore, have greater economic and family responsibilities due to the high percentage of absenteeism among the men. But, they have these responsibilities in the context of a much lower economic status than is true of the mediano women.

APPENDIX H

REFORESTATION IN PLAN MERIS: The Cajamarca Experience

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Within the Plan MERIS project in the Cajamarca region there are seven sub-project sites that have reforestation components. They are:

Subproject	Area Reforested
Santa Rita	68 hectares
Carahuanga	31 " "
Namora	130 " "
Chingol	134 " "
Carrizal-La Grama	24 " "
Tabacal-Amarcucho	5 " "
Cholocal	4 " "
	396 hectares

The subprojects are divided, geographically, into two groups: Santa Rita, Carahuanga, and Namora are close to Cajamarca; the other four subprojects are southeast of Cajamarca a distance of some 130 kilometers, in the valley of the Rio Crisnejas.

Ecological Conditions: The subprojects in the vicinity of Cajamarca are located at elevations of 2,800 to 2,900 meters above sea level and receive annual precipitation of 850 to 1000 millimeters. The climate is cool and moist, giving rise to dense natural vegetation. Climate in the Rio Crisnejas valley, on the other hand, is warm and dry, supporting sparse, thorny natural vegetation. Approximate elevations at these subprojects are 2,000 to 2,200 meters above sea level, and precipitation averages less than 500 millimeters per year.

Purpose of Reforestation: At all of the subprojects, the principal purpose of reforestation is to protect irrigation canals built under the project. The canals, constructed of concrete, begin at convenient water intakes along permanent streams and run at a gentle downgrade along valley sides, periodically releasing water into lateral canals from which it reaches cultivated fields.

Trees are not planted right on the canal banks. Rather, they are planted in bands of variable width on slopes usually above, but sometimes below, the canals. The function of the

trees is to hold soil so the canals are both supported from below and protected against silting from above.

Site Conditions: Sites selected for reforestation tend to have moderate to steep slopes, sometimes exceeding grades of 80 percent. The sites are usually rocky, with thin, fragile soil and sparse native vegetation.

Plantation Establishment: Plantings are established by hand as machinery is not available and most sites are so steep and rocky that use of machinery would not be practical. Trees are planted in individual holes 30x30 centimeters square and 40 centimeters deep. Holes are spaced between 2.5 and 3.0 meters apart. This relatively close spacing was selected to attain dense tree cover in a few years.

Planting stock is approximately one year old and comes mostly from local nurseries operated at forestry centers (Centros Forestales - CENFORS) under the Forestry and Fauna Institute (Instituto Forestal y de Fauna - INFOR). Plan MERIS has established its own small nurseries where there are none from CENFOR.

It takes about 15 man-days to plant approximately 1200 trees per hectare. This means that a laborer plants roughly 80 trees per day, at an average daily wage of S/.1,600 (approximately U.S. $1.50).

Plantation Maintenance: At the Cajamarca sites, brush is cleared from around each hole at the time of planting. No clearing or watering occurs after planting. Areas where survival has been poor are replanted.

At the Rio Crisnejas valley sites, brush is cleared at planting and, if necessary, again during the first year after planting. Young trees must be watered several times during the first year and perhaps during the second year. This means that these plantations require more total labor than do the ones at Cajamarca sites. Also, labor at Rio Crisnejas sites is required during the dry season, whereas at Cajamarca the entire labor requirement comes during the wet season, when the trees are planted.

Species: The plantations near Cajamarca are primarily of Eucalyptus globulus, the most commonly-planted tree in the Sierra, and Pinus radiata (Monterrey pine). This tree has succesfully adapted to the southern hemisphere and has become the backbone of the forest industry in Chile and New Zealand.

Cupressus macrocarpa has also been planted fairly widely near Cajamarca and small amounts of Casuarina sp., Pinus pseudostrobus and Pinus ayacaruita have been planted on a trial basis. No native species are being planted near Cajamarca.

Native species are being planted in the Rio Crisnejas sites, particularly Caesalpinea tintorea, known as "taya" and "molle", and Schinus molle. Exotics planted in this area include Eucalyptus citridora, E. globulus, Casuarina sp., Cupressus sp., and small numbers of minor native species. No pines have been tried here, as it is much too dry for them.

Success of the Plantations: The plantations near Cajamarca have been successfully established. Survival rate of pine and eucalyptus exceeds 90 percent and cypress survives nearly as well. Some of the pines turn yellow and partially die back after planting, but most overcome this. Eucalyptus plants sometimes get off to a slow start, but most recover well.

Because Plan MERIS has been able to prevent grazing in its Cajamarca plantations, natural herbaceous and shrubby vegetation regenerates rapidly. The combined presence of the trees and the native vegetation makes for a nearly continuous ground cover which controls soil erosion rather effectively. That, of course, is the principal purpose of having the plantations. They, therefore, fulfill their purpose and, additionally, provide future sources of wood, wildlife habitat and esthetic appeal, as well as other benefits.

Plan MERIS, on the other hand, considers the plantations in the Rio Crisnejas valley to be failures. Overall planting survival rates are only about 50 percent and the high labor requirements for both establishment and maintenance also detract from success. The trees which survive best are the two native species, "taya" and "molle", followed by Eucalyptus citridora. Eucalyptus globulus and Casuarina show very poor survival.

In spite of poor survival of the trees, the plantations at the Rio Crisnejas sites may be performing their soil conservation function fairly well if control of grazing is allowing native vegetation to regenerate adequately. However, if failure of the trees makes it impossible to control grazing (people may feel there is no point in keeping livestock out of the plantations if the trees are dead), the plantations are not really providing their intended benefit.

Plan MERIS, therefore, intends to try to convert the reforestation component at these sites from one that uses timber trees to one that uses fruit trees. The idea behind this is that farmers will be more willing to care for fruit trees than for timber trees.

Public Reaction to Plantations: Public reaction to the plantations, according to Plan MERIS personnel, has been mixed. At first it was difficult to control grazing and it was necessary to hire guards to prevent livestock from getting into the plantations. Now, however, herders voluntarily control their animals and there is little damage to the plantations.

Most of the trees have been planted on public or communal land, rather than on private holdings. While a few private landholders have welcomed plantations, many have been reluctant to allocate any part of their small holdings to trees.

Although there is some awareness that plantations will provide firewood, construction materials, and other products, these benefits appear to be under-appreciated, perhaps because they lie several years in the future.

Subsidiary Activities: Plan MERIS is beginning other soil conservation measures in conjunction with tree planting. These include: digging infiltration canals across planted slopes with high erosion hazard, building check dams in gullies and, beginning soon, terracing slopes before planting.

ANALYSIS

Overall, in the Cajamarca region, the reforestation component of the Plan MERIS project has been successful. Closer to Cajamarca, success consists of attaining good survival with pine as well as eucalyptus. The plantations that are two years old are becoming noticeable on the landscape, attracting attention and approval. The trees and success in controlling grazing, thereby allowing native ground cover to proliferate, really do conserve soil.

Much of the landscape around Cajamarca is eroded and is continuing to erode. Standing in the Plan MERIS plantation at Namora, one looks out on a panorama of exposed slopes and fields being lost to gullies. The Plan MERIS work stands out against this as an example that even badly degraded sites can be reclaimed.

One thing that would have improved the project near Cajamarca would have been experimentation with native species. South American walnut, an excellent timber tree, is common in the area, as is a native cherry known as "Capulin". Both of these species might have reforestation potential.

The markedly superior performance of native species in the Rio Crisnejas sites constitutes a measure of success for the reforestation project there. Although exotics, especially eucalyptus and now pine, have been and will probably continue to be the backbone of forestry in the Sierra, they are not the complete answer to all the regions's forestry needs. Dry, interAndean valleys can best be protected from erosion by using native plants and controlling grazing. Similarly, at extremely high altitudes, native species can provide wood, shelter and erosion control.