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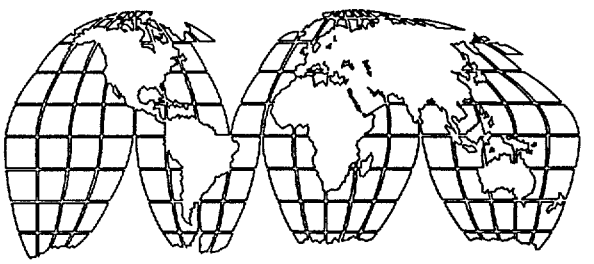

Sustainable Agriculture and the Environment:
Philippines Case Study

April 1994

U.S. AGENCY FOR INTERNATIONAL DEVELOPMENT

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Sustainable Agriculture and the Environment Philippines Case Study

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This Working Paper is one of a number of case studies prepared for CDIE's assessment of USAID Sustainable Agriculture and the Environment programs. As an interim report, it provides the data from which the assessment synthesis is drawn. Working Papers are not formally published and distributed, but interested readers can obtain a copy from the DISC.

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FOREWORD

This report on sustainable agriculture in the Philippines is one of a series of country case studies prepared by the Center for Development Information and Evaluation (CDIE) to evaluate USAID's assistance to environmentally sustainable agriculture programs in developing countries. Other countries studied in this evaluation are Nepal, Guatemala, Jamaica, Gambia, Mali. The country case studies are results-oriented in nature and seek to determine what difference USAID assistance programs have had on environmental and natural resources conditions.

The Philippines is included in the global assessment because of the pioneering work USAID and the Government of the Philippines supported at developing farm-level research methods that have generated and introduced environmentally sound agricultural practices for extensively farmed fragile upland areas in the country. The availability of good project documentation, extensive published research literature and an abundant array of official and private groups currently developing and testing environmentally sustainable upland farming practices make the Philippines a particularly "fertile" case study.

This study focuses on the period from 1983 to 1991 during which USAID implemented projects to develop and diffuse systems of sustainable farm production systems for hilly rainfed upland areas. The fieldwork was conducted in June/July 1993 by a four-member team of environment and economic development specialists. During their six-week stay in the Philippines, the team members worked in Manila and traveled to over twenty sites where USAID or other donors supported Philippine upland farming programs. The team met with over 120 individuals -- including 50 farmer cooperators and non-cooperators -- from a broad spectrum of government, and non-government organizations. The team also reviewed over 100 published documents related to upland farming in the Philippines.

CDIE wishes to thank the staff of USAID/Philippines for its support in planning and executing this study. CDIE also extends its thanks and appreciation to the scores of Philippine technicians, agencies and organizations -- public and private -- who cooperated in this evaluation.

GLOSSARY

ADB	Asian Development Bank
ASEAN	Association of South East Asian Nations
barangay	local village political unit
DENR	Department of Environment and Natural Resources
FSDP	Farming Systems Develpment Project (USAID)
GOP	Government of the Philippines
IRRI	International Rice Research Institute
MPFD	Master Plan for Forestry Development
MBRLC	Mindinao Baptist Rural Life Center
NEDA	National Economic and Development Authority
NEPC	National Environmental Protection Council
NGO	Non-Governmental (private voluntary) Organization
NRMP	Natural Resources Management Project (USAID)
PCARRD	Philippine Council for Agricultural Research and Resources Development
RRDP	Rainfed Resources Development Project (USAID)
SALT	Sloping Agricultural Lands Technology
UNDP	United Nations Development Programme
UPLB	University of the Philippines at Los Banos
USAID	U.S. Agency for International Development
ViSCA	Visayas State College of Agriculture

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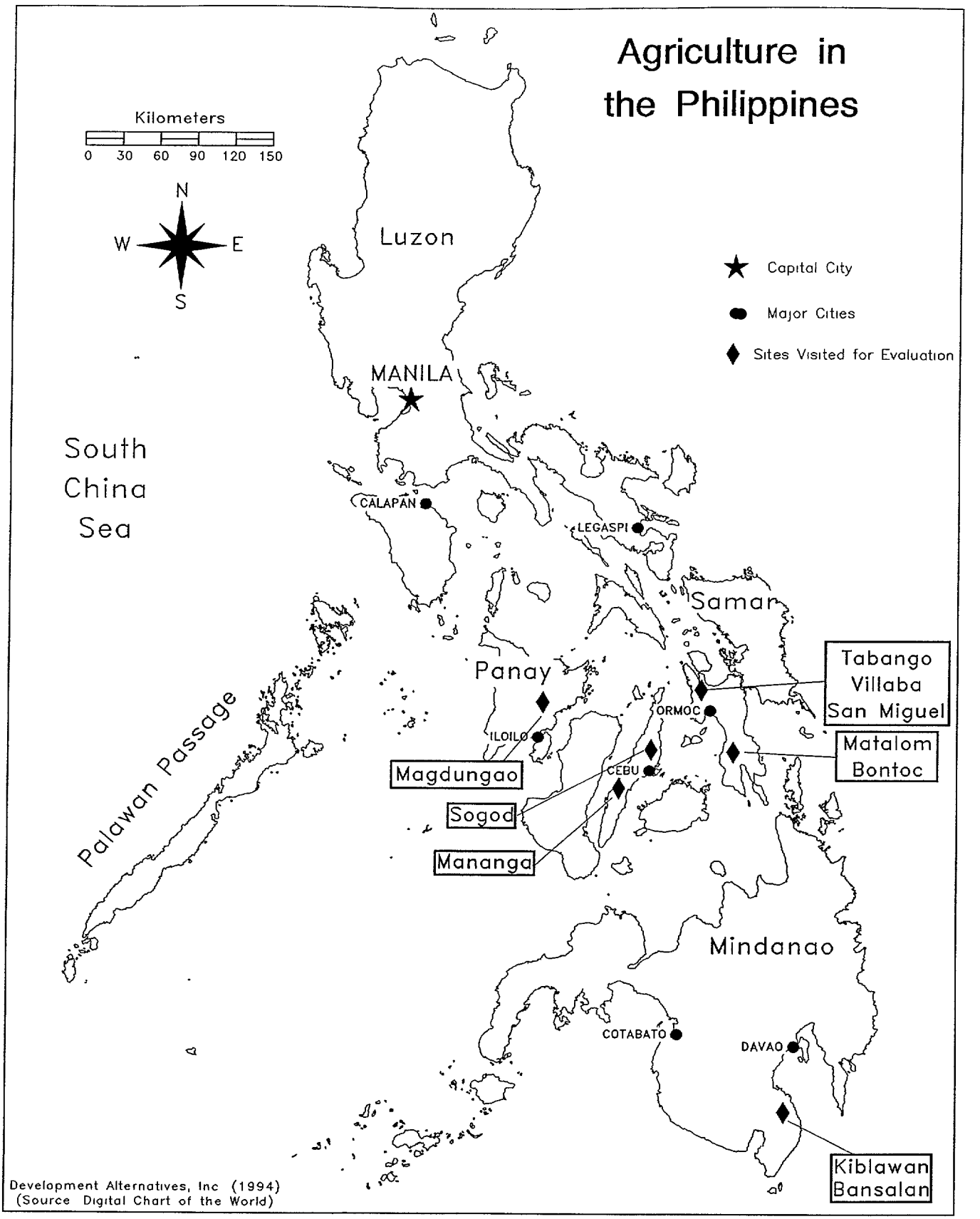
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CEBU
Palawan Passage
Tabango
Villaba
San Miguel
Matalom
Bontoc
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COTABATO
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Kiblawan
Bansalan
Development Alternatives, Inc (1994)
(Source Digital Chart of the World)

1. INTRODUCTION

USAID development assistance to the Philippines spans more than three decades. Over this period, the Philippines has become a living laboratory of scientific and social experiments generating a range of solutions to problems similar to those affecting many developing countries today.

This is particularly true in the agriculture sector where the Philippines has been host to the discovery, by the International Rice Research Institute (IRRI), of "miracle rices" that have staved off hunger for millions of Asians and countless more around the world. The Philippines itself has benefitted from the green revolution by increasing its own irrigated rice yields to meet domestic food grain needs and to release land and labor for other agricultural and non-agricultural activities.

In the social sphere, scores of Philippines non-governmental organizations (NGOs) have recently emerged to expand popular participation in the development process. The Philippines' brand of "people empowerment" promises the productive mobilization of human talent and resources for broad based social and economic development. These accomplishments do not come too soon. Severe challenges to sustained economic growth face the country, among them environmental degradation.

Nowhere are the environmental problems more clearly manifested than in the country's hilly upland mountain areas. Under the pressures of population that have forced farmers up the hillsides in search of more land to cultivate, these areas are rapidly losing their original forest cover. The results have been far-reaching: tragic flash floods that have claimed the homes, land and lives of thousands; damage from siltation to coral reefs, irrigation canals and hydro-electric power reservoirs; decline of potable water as rivers dry up and water tables fall; loss of forest habitats and the valuable wildlife species they contain.

The Philippines is solving these environmental problems partly through efforts to develop and introduce sustainable agricultural production technologies for use in hilly erosion-prone upland areas. The evidence suggests that these systems, if properly managed, can rehabilitate eroded and depleted soils, sustain agricultural output and productivity, arrest degradation of remaining forest habitats and enhance the socioeconomic well-being of limited resource farmers adopting them.

This evaluation examines the impact of two USAID projects, conducted during the 1980's and now completed, which have as one of their objectives the introduction of sustainable agriculture production systems to farmers cultivating sloping upland areas of the Philippines. The projects are the Farming Systems Development Project (FSDP) and the Rainfed Resources Development Project (RRDP).

Section 2 of this evaluation summarizes the problem of sustainable agriculture production in the Philippines uplands and the approach that USAID has taken to solve it. This section also summarizes procedures used to evaluate the impact and performance of USAID assistance.

Sections 3, 4 and 5 present findings of the evaluation. Sections 3 and 4 describe the nature and extent of impacts that were observed by the team, or recorded from other sources, and relate these findings to the FSDP and RRDP strategies implemented by the program. Section 5 presents evidence of sustainability of impact after termination of project activities and of the spread of activities beyond project target areas.

Section 6 summarizes lessons that the evaluation has drawn from implementation and performance of FSDP and RRDP activities aimed at sustainable agriculture management in the uplands of the Philippines. Section 7 summarizes those issues which the evaluation team felt could not be answered from the information available in the Philippine setting or which merit examination for their applicability in other country settings.

2. SUSTAINABLE AGRICULTURE MANAGEMENT

The Problem

Under continued population pressures, increasing numbers of Philippine farmers are moving into upland areas to clear them for cultivation of subsistence crops. Extensive upland farming is beginning to have serious environmental consequences and threatens the country's sustainable development. The most notable of these problems are:

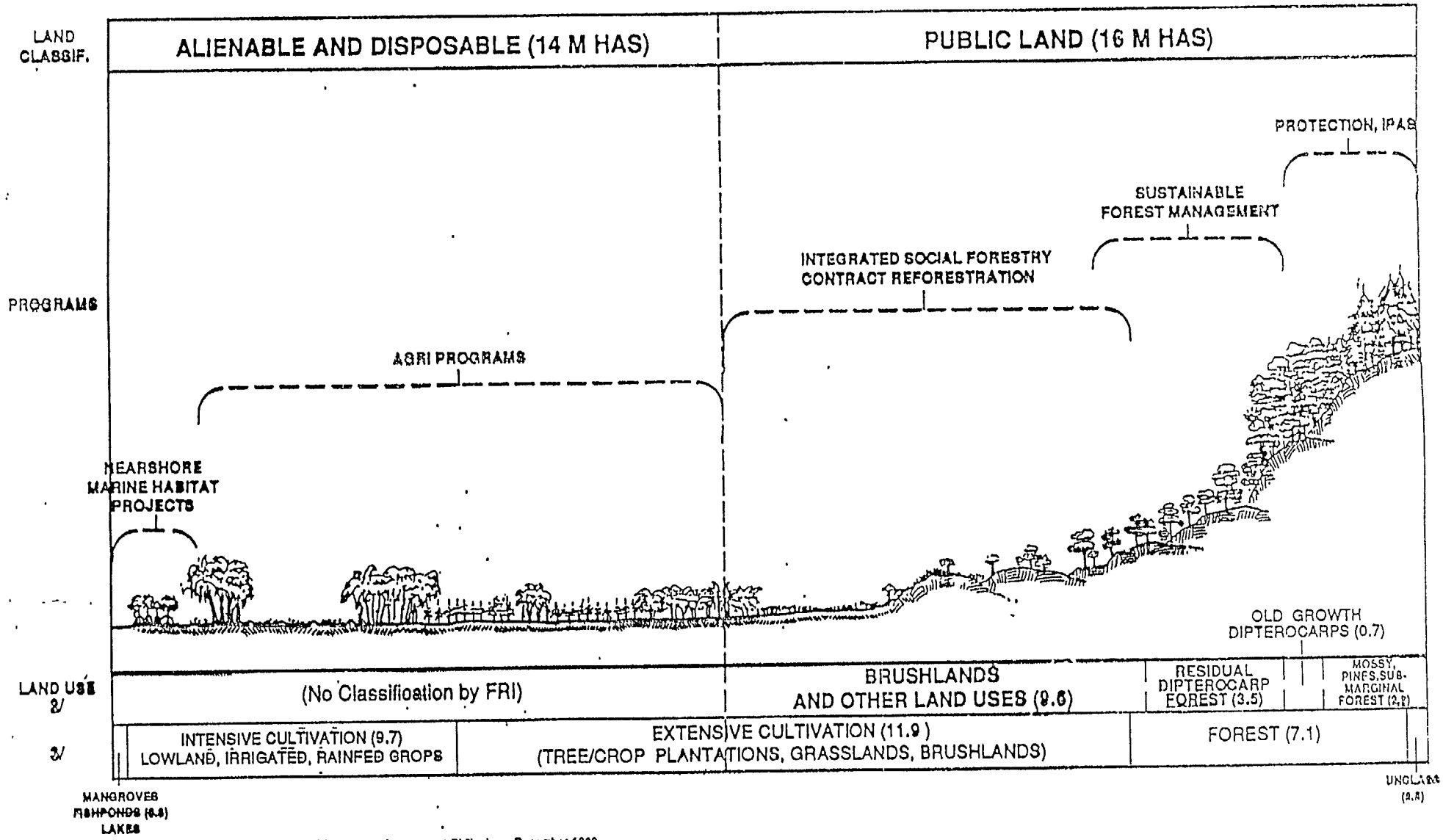
- Increased erosion leading to soil infertility, loss of water retention and low crop yields
- Downstream siltation of irrigation systems
- Reduced water availability and quality and increased incidence of water-born diseases (intestinal parasites and typhoid)
- Destruction of infrastructure and loss of life from flash floods
- Loss of wildlife habitat as remaining forested areas give way to slash and burn cultivation

The problem of soil degradation from upland crop cultivation derives from four factors (Sajise and Ganapin 1991, Garrity and Sajise 1993):

- The Philippines has few technical or social solutions to alleviate poverty and environmental problems in upland areas. Official attention has focused on lowland irrigated rice cultivation and ignored the gradual settlement of upland areas and their unique cultivation needs.
- Official responsibility for land use in upland areas is unclear. Lands of 18% slope or greater are classified as public lands to be administered by the Department of Environment and Natural Resources (DENR) while the Department of Agriculture supports research and extension needs on lands with slopes of less than 18%. The DENR is ill equipped to address agricultural concerns of cultivators on slopping public lands and the Ministry of Agriculture, which has more capacity, does not have the mandate to do so. (See Figure 1).

PHILIPPINES: Land Classification, Actual Land Use and Development Programs

(In Million Has.)



1/ Adapted from the USAID Sponsored Sustainable Natural Resources Assessment-Philippines, December 1989.

2/ From: Forest Resources Inventory FRI, (German Supported), 1987 which concentrated survey on area with Forest cover. Their reported estimate of old growth residuals was 988,000 has. Present figure is adjusted to 700,000 has. to reflect current estimates as reported by the Sustainable Natural Resources Assesment-Philippines.

3/ From: The (Phil) Enviroment and Natural Resource Management Study (World Bank), 1988; land classified according to land use i.e. forest, extensive cultivation etc.

- Because there is not clear title to sloping public upland areas, cultivators are essentially squatters with little sense of responsibility to manage the land in a sustainable fashion.

- Upland communities are characterized by greater degrees of poverty and illiteracy, making it difficult to transfer knowledge and provide services for more sustainable agriculture production. Reluctant to attract more families into upland areas, the government has been hesitant to expand social services in these areas. Even where the Government of the Philippines (GOP) has provided education, health, credit, and agriculture extension services, it is more difficult and costly in the uplands than the lowlands.

The USAID Assistance Approach

Before the 1980's USAID had focused much of its program and project support to the productive irrigated areas of the Philippines. USAID interest in developing the uplands was first articulated in its 1980 USAID Country Development Strategy Statement that identified small farmers in rainfed and upland areas as a major poverty group. Beginning with a $6.4 million -- $4.4 million USAID and $2.1 million GOP -- Farming Systems Development Project (FSDP), 1981-90, in the Eastern Visayas region and expanding nationwide with a $10.0 million -- $6.0 million USAID and $4.0 million GOP -- Rainfed Development Resources Project (RRDP), 1982-91, USAID and the Philippine government have supported the introduction and spread of hillside conservation farming practices aimed at managing sloping upland soils for sustainable crop production.

To address the problem of appropriate cultivation practices for upland areas, USAID directed funding to institutionalizing farm-level rain-fed agriculture research within national and local government research organizations through the FSDP. To promote the adoption of these practices, USAID also funded under the RRDP support for creating or strengthening of local government and non-government organizations both to spread technical information and to seek public or private suppliers of planting material, credit, and other inputs and services needed.

The target beneficiaries of FSDP and RRDP assistance were the impoverished settlers in the rainfed regions of the country, a group largely overlooked by government agencies and their programs. Both projects utilized a farming systems research and extension approach that emphasized farmer participation in all aspects of technology development and dissemination (Appendix B).

The Farming Systems Development Project (FSDP). The FSDP was the first project in the Philippines to undertake a farming systems research and extension approach to technology development in agriculture targeted to the people and problems of the sloping uplands. FSDP project activities were centered in the Eastern Visayas, one of the poorest regions of the country (See Box 1). To build regional research capabilities, the FSDP linked project staff with local GOP Department of Agriculture and Visayas State College of Agriculture (ViSCA) research programs.

Initially FSDP staff involved farmers only at the testing phase of technologies already developed under the project. After the midterm evaluation (Pilgrim, et al. 1989), however, farmers participated in technology development as well. Based on mid-term evaluation recommendations, USAID and the GOP redirected upland agriculture research activities to emphasize greater farmer involvement and to institutionalize the methodologies used in regional academic institutions and government agencies.

The FSDP introduced technologies directed to stabilize the environment before major efforts were undertaken to improve productivity and income. Involving poor farmers, however, limits interventions to those that are simple and inexpensive. FSDP project staff determined that hilly uplands farming systems are fragile (being characterized as on marginal soils, under the influence of erratic weather patterns, and managed by resource poor families). Increasing the cropping intensity may further exacerbate the problem. Three RRDP objectives were:

- development and dissemination of appropriate upland technology
- strengthening the FSR/E approach in the region
- institutionalization of the process into the Department of Agriculture and ViSCA

The Rainfed Resources Development Project (RRDP). The RRDP tested a grass roots approach to rural development in Philippine rainfed environments. Community development workers were employed by the project to live in target villages to help farmers express their needs and look to the government for services. This bottom-up approach contrasts with the traditional top-down model. The goal of RRDP was to develop rural institutional capacities and the policy framework to support community-based land and water resource management in settled rainfed upland and coastal agricultural areas. The RRDP stressed conservation of the soil and water resources of rainfed areas. The RRDP strategy:

- was based on proven technologies utilizing resource-efficient methods
- engaged local NGOs and local government agencies
- promoted greater reliance on local institutional and beneficiary competencies

========== Box 1 ==========

THE EASTERN VISAYAS REGION OF THE PHILIPPINES

The Eastern Visayas region of the Philippines (the islands of Leyte and Samar), where USAID began its upland agriculture research and development program support, is typical of many upland farming areas of the country. Eastern Visayas is one of the most economically depressed and natural resource poor regions of the country. Its upland areas are far from the country's main agricultural production centers and rather hostile settings for agricultural change (PCARRD 1993). Leyte and Samar land masses lie along a major "highway" travelled by destructive typhoons which roar through the country annually. Rain falls on an average of 193 out of 365 days leaving nearly 2,000 cm of precipitation annually.

The Eastern Visayan farmer is typical of upland farmers in the Philippines (Alcober et al 1984, 1987). Farmers have usually settled on their farms within the past 15 to 20 years. About half of the farmers are tenants or lack title to their land. An average family size is six where labor and cash are the most common constraints limiting production.

Corn or coconuts are the main crops but agriculture is highly diversified. Annual subsistence crops of corn, upland rice, legumes, and root crops dominate. Yields are low due in large measure to poor and degrading soils. Fields are typically fragmented involving some plots of permanent settlement with plow agriculture, but may include temporary slash and burn plots several kilometers in the interior. From 20% to 30% of annual income comes from non-farm activities. Rural Eastern Visayas families average $150 income per year (vs $240 in urban areas).

The annual population growth rate is 2.7%, with the population expected to double in 25 years, further aggravating the problems in the uplands. Defining the myriad of problems confronting rainfed areas reveals the strong linkage between population, growth, pervasive poverty and environmental degradation.

Increasing population density on the fragile, sloping hillsides has accelerated conversion from forest to brush land to cultivation of crops which in turn has reduced soil productivity, led to declining yields and land abandonment. Further, increased environmental perturbations from flooding and siltation of irrigation systems affect the lowlands showing that problems have to be tackled on a watershed basis.

========== End Box ==========

The research component of RRDP was coordinated by the Philippine Council for Agricultural Research and Resources Development (PCARRD), a coordinating body, where competitive grants were awarded to local institutions throughout the Philippines. The community based rural development process also used a farming systems research and extension approach with strong emphasis on farmer participation in developing and testing technologies specific to each rain-fed upland location.

RRDP Phase I (1982-87) focused on building capacity in the Department of Agriculture, local governments, and NGOs using project staff skilled in community organization. Phase II (1987-91) reflected the dramatic change in government from authoritarian to "people power" administration. Accordingly Phase II expanded the coverage of sites from 4 to 16 by adding 12 "micro-project" sites. To stretch project funds over so many additional project sites RRDP activities were expected to focus on only the most needed community problems. RRDP staff and farmers carried out rural community assessment to identify critical needs and plan programs to address them.

The agricultural research component of the RRDP focused on those cultivation practices incompatible with sustained agricultural productivity in hilly upland soils. In most cases these practices were extractive, short-term, and incompatible with resource sustainability. High erosion rates ensued, which reduced productivity (PCARRD 1993).

Research and extension activities throughout most of the RRDP upland project sites used on-farm testing to develop and disseminate appropriate management options (USAID 1992). RRDP established linkages with the local research and extension systems in formulating site specific technologies. Identified technologies were tested and fine-tuned with farmers before being recommended as cultivation packages. Community organizers harnessed local capabilities in setting up self-sustained rural enterprises to respond to project activities.

The Evaluation Procedures

To conduct its evaluation, the CDIE field team collected information on completed and on-going sustainable agricultural activities with FSDP or RRDP support for introducing practices to farmers, rural communities, and local NGOs. The team collected information from three sources:

- visits to twenty former FSDP and RRDP project sites to observe current socioeconomic and biophysical conditions and to verify information received from other sources

- direct interviews with over 120 individuals ranging from farmer beneficiaries to former FSDP and RRDP staff to government officials

- secondary data sources drawn from the extensive array of project documentation, evaluations, academic research, and consulting reports generated during and following FSDP and RRDP implementation

The evaluation focused on the performance of FSDP and RRDP efforts at fostering adoption of promising sustainable upland cultivation practices and the potential biophysical and socio-economic impacts that could be expected from widespread adoption of these practices. The degree, pace and nature of adoption of hillside cultivation practices introduced by FSDP and RRDP are taken as the major indicators of performance and impact for this evaluation. The evaluation's analytical framework is described in Appendix A.

"Sustainable agriculture" for the purposes of this evaluation is defined as production systems that evolve over time toward greater productivity, greater efficiency of resource use, and more environmental harmony. The natural capital stock -- soil, water and vegetation -- should not decrease in quality over time. At a minimum, future generations should be left no worse off than current generations. (Conway 1985, Harwood 1990).

One of the more relevant upland technologies, which was used as the framework for this evaluation, is the hillside cultivation of crops in alleys or terraces between contoured hedgerows of leguminous multipurpose tree crops. This system of hillside cultivation was popularized by one Philippines NGO as "Sloping Agricultural Lands Technology" (SALT) (Tacio 1993). SALT cultivation systems, with a range of adaptations SALT cultivation is described in Appendix C.

To provide rigor and objectivity to its analysis of FSDP and RRDP impact and performance, CDIE evaluators developed a series of indicators of adoption and ranked the evaluation field sites accordingly. With each site as a unit of analysis, the FSDP/RRDP performance indicators were related to the measures of rates of adoption to assess the causal linkages between the them. (Appendix A provides a more complete description of the evaluation methodology). Table 1 lists the project sites visited during the evaluation.

TABLE 1. SITES VISITED FOR THE CDIE EVALUATION

Site Name and Location	Funding Source & Implementor
Villaba, Leyte	FSDP - ViSCA and Dept of Agric (DA)
Tabango, Leyte,	FSDP - ViSCA and DA
Bontoc, Leyte	FSDP - ViSCA and DA
Matalom, Leyte	FSDP - ViSCA and DA
San Miguel, North Leyte	RRDP - Dept. of Agriculture (DA)
Sogod, Cebu	RRDP - US/Philippines NGO (CARE)
Mananga Watershed, Cebu	RRDP - CIDA, Canadian & local NGO
Kiblawan, Davao del Sur	RRDP - ENR & local NGO
Bansalan, Davao del Sur	MBRLC a US/Philippines NGO
Tacub, Davao del Sur	ADB - DENR and local NGO
Jose Panganiban, Cam. Norte	RRDP - DENR & local NGO
Marilog, Davao City	RRDP - DENR & local NGO (SeLF)
Bamban, Tarlac	RRDP - Local private firm (TREE)
Kalibigaho, Osminia	RRDP - DENR and local NGO
Masaraga, Albay	RRDP - Bicol Univ. Coll. of Agr.
Baciwa Watershed, Negros Occ.	RRDP - DENR & local NGO (NFEFI)
Mt. Canlaon National Park Negros Occidental	RRDP - DENR and local NGO (NFEFI)
Cosina, Bukidnon	RRDP - DENR & local NGO
San Miguel Baungon, Bukidnon	RRDP - DENR & local NGO
Magdungao, Passi, Iloilo	RRDP - DENR and local NGO

3. EVALUATION FINDINGS: PROGRAM IMPLEMENTATION

The evaluation considers four program strategies to be critical determinants of USAID program impact and performance:

- o institutional change
- o technology introduction
- o education and awareness
- o policy reform

The evaluation examined the changes in conditions that could be attributed to FSDP and RRDP implementation of these strategies.

Institutional Change

The USAID strategy for introducing sustainable agricultural management to the upland areas has involved changes in both government and non-government institutions. The FSDP and RRDP strategies were to build capabilities of GOP agencies to undertake applied research on location-specific problems in hilly rainfed upland areas and to foster non-government organizations capable of involving local families in introducing and supporting the emerging technologies. USAID assistance fostered five institutional changes during the course of FSDP and RRDP implementation:

- o the introduction of farm-based research activities into national agriculture production programs
- o decentralization of government research and extension programs
- o creation of regional NGOs to conduct community organization and technology diffusion programs
- o networking of research activities at the local to international levels
- o expansion of upland farmer self-help groups.

The FSDP and RRDP have helped integrate farm-based, site-specific approaches for upland cultivation technology development into Philippine research organizations.

Historically in the Philippines, agricultural development has been centralized and commodity based. Nation-wide rice and corn production programs of the 1970s and 1980s characterized this single commodity research and development approach to expanding crop output on irrigated lowland areas. Cash crops such as cotton,

coconut, sugar, and abaca followed similar patterns (Riggs, et. al 1989).

The FSDP documented that centrally managed single commodity package approaches were ill-suited to the multitude of conditions found in hilly upland environments (USAID 1989). FSDP findings also demonstrated that upland farmers were involved in more enterprises than agriculture. The answer to low production in the uplands was not a new variety or fertilizer as it was in the irrigated lowlands (Pilgrim, et al. 1989). Entirely new production systems were needed.

Through collaborative research arrangements with U.S. universities, the FSDP built Philippines research and development capabilities to carry out adaptive research on farmers' fields and to involve farmers in the design and testing of new technologies. (See Appendix B on "Farming Systems Research in the Philippines"). FSDP sponsored the preparation of training materials and courses for academic and government technicians in farm-level assessments of cultivation problems and rapid rural appraisals of community services and needs. FSDP advisors coached agricultural and social scientists in how to conduct multi-disciplinary research under "real-world" conditions in farmers' fields.

FSDP pioneered many of the applied approaches that now are standard procedures for conducting research on upland farming throughout the Philippines. Most Philippine research institutions -- whether government or academic -- now have farming systems research units where researchers from different disciplines work as teams to solve agricultural problems such as how to cultivate fragile hillside areas in a sustainable and profitable fashion.

========== Box 2 ==========

AGRICULTURAL RESEARCH IN THE PHILIPPINES

Agricultural research in the Philippines began after national independence in World War II and is undertaken by the national government, and state colleges and universities. Research focused on lowland rice, open pollinated and hybrid corn, sugarcane, coconut, grain legumes, and vegetables. The International Rice Research Institute (IRRI) has further reinforced commodity based irrigated lowland rice research.

While research projects emanated from commodity centers, verification and adaptive trials were carried out by the Department of Agriculture regional research stations and state colleges and universities. Corn breeding, for example, was initiated at UPLB with germ plasm coming from the International Center for Wheat and Corn in Mexico. Varieties were evaluated by a network of regional centers.

Prior to 1987, the agricultural research program was coordinated nationwide by the Philippines Council of Agricultural Research and Resources Development (PCARRD). Currently, PCARRD's functions are shared by coordinating bodies in each of the 12 regions as well as the new Bureau of Research, an organ of the Department of Agriculture to coordinate the regional bodies.

The Department of Agriculture primarily undertakes applied research. In 1993 the GOP reassigned technicians and officers to the regions. Prior to devolution the Department of Agriculture had 14,000 extension agents; roughly 70% have been turned over to local municipalities who are now responsible for their work assignments and pay.

========== End Box ==========

Regional agencies have been formed to coordinate and carry out rainfed upland technology development and dissemination.

Prior to decentralization in 1986, the Department of Agriculture designed research and extension programs in Manila for execution at the regional level while PCARRD did much of the research coordination and direction.[1] The site-specific nature of regional-focused research required decentralization of activities to give more planning and decision-making responsibility to regional staff and officers.

Today's decentralized Philippines public agriculture sector can be traced to the work of multi-disciplinary farming systems research teams begun in the 1980s. The FSDP adopted and promoted the farming systems research approach to help local institutions in the Eastern Visayas address cross-disciplinary research topics. The University of the Philippines in the Visayas (ViSCA) created a Farm and Resource Management Institute (FARMI) within its faculty in 1987 with FSDP funds.

FARMI is now an integral part of ViSCA and has its own funding. It has also been successful in getting grants from IDRC and PCARRD. FARMI consists of full-time staff of ViSCA funded from the core budget with nearly a dozen more professionals under joint appointments with FARMI and ViSCA academic departments.

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[1] Geographically, the Philippines is divided into three island groups -- Luzon, Visayas, and Mindanao. Administratively, the country is organized into twelve regions; each national government agency has a regional director. The basic political subdivision of the Philippines is the village (barangay) which has a captain as its elected leader. Municipalities, governed by mayors, make up the next largest political unit comprising a number of barangays. Municipalities in turn are grouped into 73 provinces each with elected governors.

FARMI currently is involved in 38 research projects and has become a model of a cross-commodity, cross-discipline approach at the regional level. FARMI staff serve as a link between on-farm project staff and the research station staff. The site staff perform adaptive research and technology evaluation functions while the research station ViSCA staff develop solutions to problems pointed out by the site staff. While FARMI has continued to operate since FSDP funding ended, its activities have been diminished because the government has budgeted much less money for staff and operations.

FSDP also set up the Visayas Agricultural Research Program Council (VICARP) as an inter-institutional coordinating agency to exchange research information and conduct joint planning among local government agencies and NGOs in the Eastern Visayas region. VICARP members are ViSCA (chairman), regional head of the Department of Agriculture, president of the Eastern Visayas University, and members of other universities. In some Visayas locations agricultural research planning now begins at the barangay level through meetings among the farmers who identify production problems. Similar meetings are held in local municipalities and provinces before moving to regional bodies such as VICARP before being passed to the national level where a national research and extension agenda is formulated as national policy.

Local (regional) NGOs have emerged in former FSDP and RRDP project areas that continue to carry out community development activities based on or incorporating upland conservation farming practices.

RRDP has helped directly and indirectly to increase the role of NGOs as change agents in the Philippines. Their methods are in harmony with the grassroots participatory development philosophy of the current government. (See Box 3.) Former RRDP staff have organized local NGOs with a regional focus to vie for national and international funding support for their conservation farming and other rural development initiatives. Several local NGOs launched with RRDP support have become attractive to donors as they operate on lower budgets, are experienced in field work, and have the necessary skills to undertake rural development projects.

RRDP Kiblauan site staff formed the Kiblauan Rural Development Foundation to continue work, after RRDP terminated, under a reforestation contract with DENR and two projects with the Asian Development Bank. Former Magdungao staff formed the Bundok Kalinga Foundation with funds from the Save the Children Foundation and UNICEF to train Department of Agriculture, DENR, and Department of Agrarian Reform technicians on community organization and participatory methods in nursery management, seed collection and land use planning. Former Marilog RRDP staff created the Settlements and Livelihood Foundation which has a number of contracts, one on

community forestry next to the former RRDP site and is financed by the Asian Development Bank.

========== Box 4 ==========

PARTICIPATORY RURAL DEVELOPMENT IN THE PHILIPPINES

Most Philippines NGOs have focused on welfare assistance and disaster relief. In recent years, many have shifted their attention to development assistance in response to growing rural poverty. Today, registered Philippine NGOs number in the thousands, and range from national affiliates of international organizations to small local community action groups of villagers and farmers.

Some NGOs have proven their ability to recognize and respond to local area needs with appropriate and timely assistance. The most successful NGO activities are usually short-term, involve intended beneficiaries in the development process, and respond to the felt needs of communities.

NGOs hire project staff in a wide variety of disciplines and give them training in community organization techniques. NGOs screen potential employees to ensure new staff are comfortable with and committed to living in rural areas. NGO staff live often for extended periods in the project villages, in contrast to government technicians, and learn local community problems and aspirations firsthand.

NGO staff serve primarily as community organizers holding frequent meetings where farmers are encouraged to voice their concerns and share their ideas on how problems can be solved. If the problems require government assistance, training or services, NGO staff will seek out help from the appropriate public agency. NGO organizers also arrange visits by village leaders to nearby sites where such technologies such as hillside conservation farming have been adopted to demonstrate firsthand how such changes have been developed.

USAID has supported the new government participatory development approach by providing assistance to registered local NGOs first under the RRDP and more recently through its Private Voluntary Organizations Co-Financing Project. NGOs under this program were encouraged to link their activities with government institutions such as the Department of Agriculture and DENR. USAID funded NGO Projects have focused in agriculture, health, and micro-enterprise development.

========== End Box ==========

FSDP helped create a national training and research network among government agencies and NGOs involved in upland conservation farming.

With initial FSDP support a U.S. university has helped set up a network on Conservation Farming in the Tropical Uplands (CFTU) in 1992. The CFTU sharing applied research information on conservation cultivation practices that will improve the long term viability of upland farming communities and their environments. The network's primary research base is Matalom, a former FSDP site in Leyte. CFTU members conduct joint research and share findings. The networks collaborating institutions -- IRRI, several national and regional NGO's and universities, the DENR, Department of Agriculture, ViSCA -- reinforce the on-going work of network members and enhance the sustainability of conservation farming research in the Philippines.

Village farm cooperatives have been formed and are supporting upland conservation farming systems in many FSDP & RRDP sites.

Farmer interviews and project records reveal that access to credit at affordable interest rates is one of the most persistent needs of upland farmers. Credit programs for subsistence upland farmers were almost nonexistent and money-lenders charged very high interest rates. Credit cooperatives have had a bad track record in the Philippines. During the Marcos regime credit cooperatives were formed in each barangay with the barangay captain as the head of the association. Diversion of funds was common in this highly political arrangement where barangay officials were "rewarded" for allegiance with funding support from the government.

RRDP set about to build cooperatives out of farmers' needs rather than government patronage. It helped create cooperatives in several project sites to provide a variety of services important to sustainable upland development. Cooperatives, in turn gave loans for crop and livestock production but eligibility for credit, was based on adoption of recommended upland conservation farming practices. The team observed several cooperatives formed under RRDP that were continuing to perform credit, marketing, watershed management and cattle fattening activities.

In Marilog and Mananga farmers have village cooperatives which operate a dry goods store that sells farm products. The profit goes to the cooperative members. To save members time and money to travel to the nearest urban clinic, cooperatives in Magdungao and Tagungong sell medicines from the Department of Health. Some cooperatives are registered with the Securities and Exchange Commission and have been capitalized through the Land Bank to offer loans to members. The Sogod cooperative has P 1.5 million line of credit for its 160 members to take out loans for cattle fattening. (See Box 4.) The farmers' credit cooperative in Tabango with 91

members, each of whom pays 20 pesos to join plus 10 pesos per year and another 20 pesos for an emergency fund, in exchange for access to production, home improvement, emergency (medical, funerals), or investment loans.

========== Box 4 ==========

SOGOD, CEBU: AN UPLAND FARMER CONSERVATION ORGANIZATION

One RRDP goal was to develop village organizations to receive and adapt upland technologies. The RRDP CARE project site in Sogod, Cebu Island, has achieved the most extensive institutional development linking families with communities and the region. Before RRDP, the local households had no community institution to link them with government programs. With few government agents and may dispersed farm households in the area little help was given or received.

CARE project staff form groups of about ten families to carry out the laborious tasks of undertaking soil and water conservation terracing on farm members' fields which included making walls and check dams of rocks and digging rain water diversion canals and soil traps. Ten family groups were formed in this way, and were given other roles as well -- maintaining a nursery of forest and fruit tree seedlings and conducting conservation training.

To sustain interest and involvement in hillside conservation farming, CARE organized the ten family units into a village cooperative association, offering loans for cattle fattening. Credit was used for vaccines, artificial insemination and feed supplements to the cuttings from the legume trees in the hillside hedgerows. The cooperative registered as an organization with the Department of Labor and was recognized by the Sogod Municipal Development Council as well as by the Department of Local Government to receive money from the municipal development fund. In 1993 the Sogod cooperative had 130 members, with each of the ten family groups represented on its Board of Directors or participating as elected officers. The Cooperative, received management technical, financial and marketing help for its cattle fattening operations from two regional NGOs.

========== End Box ==========

FSDP and RRDP sponsored an array of local training centers that promote upland conservation farming methods.

Hillside conservation farming practices involve a number of important steps but are simple to learn. Nevertheless, farmers outside participating FSDP and RRDP villages seldom pick up the

practices spontaneously. Those few who tried to adopt on their own often committed errors that led to poor results and eventual abandonment. The most common mistakes are poor contouring of hedgerows (allowing water run-off to form gullies), not using double rows or proper spacing plants (so a solid soil erosion barrier could form), and placing the hedgerows too far apart (so that terraces do not form).

FSDP and RRDP experience shows that farmer training in the basics of hillside conservation is essential to avoiding these mistakes and to the sustained practice of conservation farming. The most effective FSDP and RRDP sites are those where farmers received training in how to properly establish and management their conservation farming systems. FSDP and RRDP established training centers to fill the need. FSDP set up a farmers' training center in Villaba which now has been transferred to Department of Agriculture regional headquarters near Tacloban. FARMI trained thousands of farmers under the FSDP and continues to offer courses in its on-going field research areas. Less expensive training courses have emerged from several of the RRDP project sites which serve as models for courses still conducted by NGO's today.

There are also two regional conservation farming training centers -- MBRLC in Mindanao and World Neighbors in the Visayas -- complete with classrooms and demonstration farms that have developed and refined many of the conservation farming practices. Both these centers have been instrumental in spreading conservation farming nationwide and beyond. MBRLC offers one, two, and seven day courses plus a three month Sloping Agricultural Lands Technology (SALT) course for hillside conservation farming. In 1990 alone, 18,000 farmers and line agency staff received MBRLC SALT training.

Because it is relatively expensive to send trainees to these centers, some local NGOs have formed their own training programs. Local training centers are now operated by regional NGOs such as Bundok Kalinga Foundation in Iloilo with the farmers' cooperatives in Magdungao and Tagunong. Sogod and Mananga farmers receive training under the supervision of Mag-Uugmad Foundation in Cebu. The local training centers offer courses in tree nursery operation, reforestation, cooperative leadership and financial management as well as topics related to sustainable hillside cultivation.

Technology Introduction

FSDP and RRDP tested and introduced conservation farming techniques for hillside crop cultivation.

FSDP followed the farming systems research approach of baseline surveys and rapid rural appraisals to document local upland cultivation systems and social structures. FSDP and RRDP research teams discovered that upland farmers obtained less than

half of their income from farming and lacked labor as well as capital to carry out the more intensive patterns. Farmers also had highly fragmented farms with fields in both upland and lowland locations. Farmers preferred to diversify their production enterprises and use only modest levels of purchased inputs.

Early FSDP research identified the high rate of soil erosion, low water retention and nutrient depletion in hillside cultivation systems as major agronomic constraints. A major social constraint was the high labor requirements to clear fallow fields and weed crops. FSDP and RRDP staff tested the concept of enriched fallow -- planting contoured rows of leguminous trees and nitrogen-fixing cover crops to halt soil erosion and prevent regeneration of hard-to-remove brush during the fallow period. From early trial and error emerged a system of sustainable crop cultivation for hillside farming that has been popularized as Sloping Agricultural Lands Technology (SALT).

SALT is a low-cost conservation system that integrates soil erosion control measures with existing production systems to use land resources in a sustainable fashion. (See Appendix C.) SALT is a technique for harnessing rain water and solar energy to gradually rebuild soil fertility and water holding capacity. Over a few years, depending on slope and degree of erosion, soils in the alleys begin to level into terraces. SALT also improves soil organic matter through green manure from contoured hedgerows. Properly managed, the bio-mass of the leguminous tree hedgerows can help improve crop yields to levels that will more than compensate for the loss output on the land taken out of cultivation for establishing the hedgerows.

Typically, SALT is an agro-forestry scheme based on cultivation of food crops in alleys between hedgerows of perennial multi-purpose, nitrogen-fixing trees planted along the contours of cultivated hillsides. The hedgerows or vegetative strips are set four to six meters apart forming alleyways where annual or perennial crops can be cultivated. A simple surveying tool (an A-frame or water tube) is used to determine the correct contour.

The deep rooted trees or grass hedgerow species are planted in double rows close together within the row (trees 30cm apart) to form a living barrier to hold the soil above. The hedgerow takes up 20-25% of the field area and is pruned every 30-45 days. A well managed leguminous tree hedgerow produces 30 tons per hectare of green manure (wet weight) annually.

Properly established and managed SALT-based cultivation systems stop soil erosion. To work hedgerows must be laid out on contours to form a protective barrier to slow and channel water run-off. SALT systems use the erosive force of water run-off to leveling terraces that form between the hedgerows. Terraces slow down water movement allowing greater infiltration. Organic matter

builds up because the top soil is not lost, further improving soil fertility and water holding capacity. Organic matter makes more nutrients available that otherwise would be held by the soil.

Drawing on the SALT concepts FSDP and RRDP staff designed new cropping patterns and introduced new crop varieties as well as new crops into project areas. The projects established demonstration plots and sent farmers to training centers. Project staff helped locate farmer groups locate and distribute seeds for nitrogen fixing tree varieties and establish and operate tree nurseries. At some project sites, staff introduced livestock dispersal programs and forage crops. At some sites RRDP also promoted reforestation for stabilizing hillsides and for fuel or construction wood.

FSDP and RRDP trials, as well as those conducted by a range of government and local organizations in the Philippines, show that SALT-based hillside conservation farming practices meet the needs for soil restoration, sustainable land productivity, and improved economic livelihood. In addition to the beneficial environmental impact of erosion prevention, this upland farming system can reduce the land required for subsistence crops and increase the area available for generating cash crops and related farm enterprises. Variations of SALT cultivation include the planting of cash crops such as abaca and fruit trees in the alleys and/or hedgerows, the use of hedgerow trimmings as fodder for livestock, or the planting of trees specifically for fuel wood or construction timber.

Awareness and Education

The FSDP and RRDP conducted education and awareness activities for upland development aimed at all levels of clientele and employing a wide array of methods.

FSDP and RRDP have reached thousands of farmers, line agency personnel, and project staff with training in introduction, spread and use of upland conservation farming practices.

Both RRDP and FSDP engaged in a wide array of educational activities for their own project staff, line agency personnel (including administrators), farmer leaders, and farmers. FARMI developed and delivered eight short courses of 3-5 days each to over 500 line agency and project staff participants. SALT material was covered in a three-week farming systems research short courses, mobile training courses, a consultative conference for agricultural school administrators, and in the workshops on-farm research. SALT cultivation information was also part of in the FSDP and RRDP training-of-trainers and technology development courses.

The FSDP staff directly taught courses of 3-5 days each at the various project sites to over 1000 farmers on SALT practices

(vegetative contouring, hedgerow contouring, improved fallow, live much, plant propagation, and nursery management). In addition FSDP farmer-to-farmer courses reached an additional 1655 upland cultivators.

Over 15,000 extension agents and farmers at roughly thirty RRDP supported sites throughout the Philippines received SALT-based courses on agro-forestry management with modules on soil and water conservation with animal integration, multi-story farming, and fallow systems.

Earlier project reviews have given high ratings to FSDP and RRDP training activities from the standpoints of course content, methods of presentation, course materials, participant selection and caliber of resource personnel and appropriateness of the subject to the needs of the clientele (USAID 1987 and USAID 1988). Academic studies of FSDP and RRDP courses offered in regional training centers such as FARMI or at project sites using field staff or farmers also show that training investments have had good returns in terms of staff performance and farmer adoption (Pasaylo-on 1988 and 1989, de la Rosa 1991). One interesting evidence of the impact of training is the number of trained FSDP and RRDP staff who have used their skills to form their own NGOs or serve as trainers or researchers after completing their work under the project.

FSDP and RRDP produced an array of training materials but their use today in upland conservation farming extension, education and awareness programs is very uneven.

The evaluation reviewed an extensive collection of training materials prepared by FSDP and RRDP staff and consultants. Training materials aimed at audiences ranging from professional researchers to illiterate hillside cultivators are now available for easy adaptation and use in staff training as well as extension activities. The evaluation found, however, that these materials are used unevenly and in some cases not at all.

Information on SALT and related hillside cultivation systems are contained in a variety of training materials in the hands of both government agencies and NGOs. ViSCA prepared publications on SALT, agro-forestry, and watershed management. PCARRD also published scientific articles in its journals "Technology!" and "State of the Art" publications as well as information sources in "Philippines Recommends" series featured an issue on SALT (PCARRD 1987).

A review of the FARMI training reference collection revealed a poorly catalogued and yellowing collection of training manuals that showed no outward sign of regular use. Those ViSCA faculty interviewed revealed these materials were not a regular part of their course curricula.

Interestingly, outside the FSDP and RRDP project areas some of these training materials appear to have had greater acceptance. One NGO, the International Institute for Rural Reconstruction has taken SALT-based materials plus those from World Neighbors and made an "Agro-forestry Technology Information Kit" for use in training courses that have been given not only to Philippine government technicians but to trainees as far away as Nepal and Sri Lanka. The International Institute of Rural Reconstruction also has produced a "Resource Book on Sustainable Agriculture for the Uplands" jointly with the MBRLC and World Neighbors using information prepared by FSDP staff. The information is presented with many illustrations on all aspects of stopping upland soil erosion.

Community-based training courses offered at former project sites such as Kiblauan have produced posters and calendars but their use appears spotty. The Magdungao farmers training center in conjunction with the UPLB Institute of Environment and Sustainable Agricultural Management has produced a training manual on farmer training methods. The team members saw Department of Agriculture posters visualizing terraced hillsides at a regional airport.

FSDP and RRDP developed farmer-to-farmer training as a key method of increasing awareness and transferring knowledge about upland conservation farming practices.

FSDP and RRDP experience demonstrates that the extension of hillside conservation practices works particularly well where farmers are given the opportunity to learn from other farmers. Both projects have developed training and extension activities that enable hillside cultivators to see alleys, hedgerows and terraces being formed and conservation practices integrated with income generating enterprises. Most training programs emphasize a four-phased training process that includes: 1) farmer visits to demonstration farms; 2) group practical sessions where hillside conservation farming systems are established on a pilot farm; 3) follow-up technical help; and 4) periodic on-going courses on integrating hillside conservation with income earning farm enterprises.

Most FSDP or RRDP project sites sent farmer leaders to MBRLC or World Neighbors training centers to see demonstrations of SALT hillside conservation farming systems. The trip is necessary if no farmers have adopted SALT near to the farm community. However, it is much better, not only in economic terms but in effectiveness, to visit a nearby site. Today there are a number of local foundations and farmer groups where farmers serve as trainers enabling new cultivators to visit closer sites with more similar soil pH and hedgerow species.

After farmer groups were formed at a project site and SALT-systems demonstrated, FSDP and RRDP staff organized work groups to

establish SALT on one farmer volunteer's land. The establishment exercise became the training session for all participants. One limitation found in the training process was the availability of sufficient planting material -- seeds or cuttings -- to establish hedgerows on both demonstration and participants' fields.

RRDP training programs also emphasized leadership and management skills for greater control of their upland community development. This training in confidence building increased farmers' participation in group discussions and farmer meetings but also trained those that would be farmer leaders for new community-based organizations. Cooperative leaders also received financial management training. While FSDP and RRDP experiences demonstrate the value of involving farmers as trainers, there is only spotty evidence that this practice is followed by NGO's or government agencies in their upland conservation farming programs.

Former RRDP and FSDP staff, trained in conservation farming and community organization techniques continue to work actively in upland conservation and development programs.

One of the more subtle FSDP and RRDP outcomes have been the scores of Philippine staff employed by the projects who now are operating, work for or have formed their own NGOs and private consulting firms active in upland conservation and development work. These former Philippine FSDP and RRDP staff carried with them the training and hands-on experience that is helping make these NGOs and firms more viable. Other Philippine project staff now work for government agencies. The three staff who obtained FSDP scholarships for Master degree study are currently employed by the Department of Agriculture in the Eastern Visayas. They make up three of the five Master of Science degree holders in the Department of Agriculture regional office.

Decentralization of agriculture programs in the Philippines, has opened up positions for extension staff -- now called municipal agricultural workers -- in local municipal governments. Former FSDP and RRDP staff have also taken advantage of these opportunities. In Tabango three former FSDP staff are employed by the municipality. The mayor hired them because of their experience. The mayor of Passi, which includes the Magundao site, has hired a former RRDP employee as an extension agent.

The team met with former RRDP staff who are employees of the nation-wide NGO, Oriental Integrated Development Corporation Incorporated, based in Manila which is a subcontractor of a World Bank funded DENR project. A former RRDP consultant, has formed a NGO based in Cebu which specializes in upland projects focused on SALT and reforestation. Former RRDP staff have formed regional NGOs in Magdungao, Marilog, and Kiblauan.

FSDP and RRDP staff have successfully trained project farmers as "bare-foot" extension agents to spread information about conservation farming in their communities.

Early FSDP and RRDP experiences revealed that government services and technical backup were limited in upland areas because extension agents did not have the resources to travel to each community in a timely fashion. Accordingly the projects set up programs that have since been continued by regional NGOs to train farmers as nurserymen, model farmers and informal extension agents.

RRDP farmers were trained in preventative health care for animals in Tabango, Sogod, and Magdungao often without pay. The "payment" was said to be the new respect and satisfaction the farmer received from performing this service. In some projects farmers were paid to carry out these tasks. Government officials agree that farmer agents help them reach more clients with preventative animal health care messages. The farmer would get vaccines from the municipal or Department of Agriculture office himself. Many farmers became trainers in community centers. In Kalauan farmer trainers received P100 per day.

Policy Reform

Government policy toward upland conservation farming is largely one of benign neglect. AID assistance has been able to redirect only modest levels of GOP resources to foster sustainable upland agricultural practices.

In the Philippines, agriculture policy has been based on the "politics of rice". The government's first priority is to assure that the country has enough rice to eat at a "reasonable price". More recently government performance has been measured by whether or not the country has had to import rice.

The Philippine government also has yet to formally address the issue of assisting upland farmers directly "in situ", which some officials feel will only serve as a magnet to attract additional settlers into upland areas and put further strains of natural resources as well as social services. At the same time some social services, such as education have proven to be useful vehicles to get environmental messages to upland farmers. Moreover, education, to the extent it equips new generations with skills for a better livelihood elsewhere, serve as an important escape valve for the pressures of population growth in the uplands.

USAID is currently helping the Philippine government implement a more recent major policy shift toward providing upland cultivators with more secure access to upland areas. Through "certificates of stewardship" individual farmers, community organizations and small firms, are now gaining long-term (25-year) "rights" to

designated public upland areas for farming and forest products use if they can demonstrate the willingness and ability to use these lands in a sustainable fashion. The adoption of upland conservation farming systems such as SALT qualify farmers for land access under the program.

A shift in policy to account for upland cultivation needs is also manifested in a special line of bank credit for upland farming activities that the GOP launched in 1990. The program, administered by commercial as well as government banks, allocates funds for the diversification of agricultural activities among families living in upland areas. Performance of the program appears uneven so far, however, because of the functional literacy and collateral requirements which upland farmers and farmer associations often are unable to meet.

The GOP has begun to formulate a formal policy for upland conservation farming but the level of resource allocations still falls far short of needs. Incentive systems for sustainable production of upland areas are weak. Career, salary and support incentives for technical staff to work in upland areas are also modest.

Despite these short-comings, FSDP and RRDP have elevated the importance of sustainable upland farming to a point where SALT-based cultivation systems are now used as models for upland conservation technology dissemination by the Department of Agriculture and DENR. The Department of Agriculture has renamed SALT to HALT (Hilly Agricultural Land Technology). Extension teams from both agencies establish demonstrations of SALT in the various upland provinces throughout the country. Unfortunately both agencies have rigid concepts of the technology and extend it as a finished set of practices leaving little opportunity for farmer modification. Training, which is necessary for SALT adoption is not always linked to the on-farm demonstrations.

4. EVALUATION FINDINGS: PROGRAM IMPACT

The evaluation assessed whether the FSDP and RRDP goals have been achieved from three standpoints:

- Practices -- Did target groups change to more sustainable ways of farming upland hillsides?
- Biophysical conditions -- did these changes in farming practices lead to improvements in the biological and physical conditions of their land and water resources?
- Socioeconomic conditions -- did more sustainable land and water resource use improve the livelihood and well-being of project participants?

Impact on Practices

The team noted great differences in farmer adoption of the upland hillside soil and water conservation practices among the ten sites evaluated. The evaluation ranked "Adoption" rates on a four-point scale compiled from five qualitative criteria. The criteria, detailed in Appendix A of this report, are:

- percentage of target farmers adopting SALT-based hillside conservation cultivation practices in project areas
- percentage of potential hillside areas in SALT-based cultivation
- the quality of hedgerow establishment and maintenance
- the quality of soil nutrient management in alleyways
- degree of diversification among SALT-based crop, livestock, timber and other farm enterprises.

At ten of the project sites visited the evaluation team visually enumerated several hundred farm plots where SALT-based hillside conservation systems had been established. In each site team members made direct observations of the area and quality of contour hedgerows and gathered information about the extent of their management. The team also recorded information on the nature of crops cultivated in the terraced alleyways and on other types of farm enterprises -- livestock fattening wood lots associated with the hillside cultivation systems.

TABLE 2. RATES OF SALT-BASED CULTIVATION ADOPTION IN TEN PROJECT SITES

Indicators of Adoption	San	Bon	Mar	Mag	Kib	Tab	Mat	Sog	Man	Kin
% of farmers adopting	1	1	2	2	2	3	4	3	3	4
% of hillside covered	1	1	2	2	2	3	3	3	3	3
Technical execution	2	2	2	2	2	3	3	4	4	3
Nutrient recycling	0	2	2	2	2	2	2	3	3	4
Crop diversification	2	2	1	2	3	3	3	4	4	4
TOTAL	6	8	9	10	11	14	15	17	17	18

[a] Rating scale: 0=none, 1=low, 2=moderate, 3=high, 4=complete based on current adoption levels.

Project Site Names:

San=San Miguel
Bon=Bontoc
Mar=Marilog
Mag=Magdungao
Kib=Kiblauan
Tab=Tabango
Mat=Matalom
Sog=Sogod
Man=Mananga
Kin=Kinuskusan

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When the ten project sites were scored on the basis of the five adoption criteria, composite totals ranged from 6 (least adoption) in San Miguel to 18 (out of possible score of 20) at Kinuskusan, site of the Baptist Rural Life Center (MBRLC) (See Table 2.). The rankings indicate substantial variability among sites in each of these "adoption indicators" and in the composite scores. Adoption of SALT-based hillside cultivation is far from uniform and suggests that several determinants may be important. (These determinants are discussed in the sections on sustainability and replicability as well as Appendix D).

Farmers normally cultivate several small plots of land as a risk avoidance measure and in response to the availability of land to cultivate, the availability of family and "exchange" labor and the amount of cash on hand. Few farmers had established SALT-based systems on all the land they cultivated. Most had experimented on only one or two plots.

Many farmers continued to believe that oxen plowing was critical and that turning an oxen in a narrow hedgerow was difficult. The problem of catching the plough on the root systems of the hedgerow trees was another complaint voiced by some cultivators.

The FSDP and RRDP built on farmer labor-sharing customs (alayons) to introduce and support SALT cultivation practices.

FSDP and RRDP staff formed "alayon" village labor-sharing groups to establish SALT (Ly Tung 1992). "Alayon" is the Visayan term used for the Philippine custom of neighbors helping neighbors to perform community tasks such as building a house, repairing a road or restoring a typhoon-damaged school. NGO's promoted the alayon system in RRDP project sites as an awareness-raising and training mechanism to stimulate more farmers to adopt SALT. RRDP formed alayon groupings among ten or so neighboring farmers.

The RRDP arranged for the newest alayon group members or representatives to visit nearby locations where older groups were already using SALT cultivation systems. Once trained in SALT establishment the groups helped each member in turn at the laborious tasks of laying out contoured hedgerows and plowing and weeding alleyways. By working as a group, knowledge was shared so that the execution of the technology was of a higher standard. Some alayons also set up community nurseries to propagate hedgerow trees that were to be used by the members.

The evaluation team judged that outcomes of alayon formation are mixed across sites. Alayon formation purported to save time of the project staff, but much project effort was spent to convince farmers to join. In Matalom the alayon custom was revived by the follow-on International Development and Research Center project in

Matalom after the FSDP effort failed. The project staff visited each farmer individually to persuade each one to join. After several months' work with individual and community meetings, farmers developed sufficient interest to form alayons groups. There are now 26 alayons with 277 members and neighboring villages want to form their own.

SALT alayon groups appeared to be strongest in those projects where community organization and participatory development were sustained. After nearly eight years of continuous encouragement and support from CARE, alayon groups were molded into a community cooperative association at the Sogod RRDP project site. (See Box 5 "Sogod, Cebu: An RRDP Rural Participatory Organization"). In Sogod CARE effectively used alayon groups to apply social pressures to encourage farmers to fulfill their community commitments and be jointly responsible for repaying loans by members.

At the RRDP site in Kiblauan, 19 alayons were formed from 143 farmers. Each alayon elected a representative who attended monthly meetings of the village cooperative and farmers' association. Kiblauan alayons generated income by obtaining contracts from DENR to plant trees. Tabango alayons were strong in Omaganhan and Tabing where each alayon joined the Upland Farmers' Association. The association was utilized by the municipal agricultural officers to more efficiently introduce new technology.

Most farmers have modified the SALT hillside conservation farming model to suit site-specific land and labor conditions.

Both RRDP and FSDP assumed at the outset that SALT was a perfected technology and was introduced as a set of "cookbook" rules. Project staff later recognized that the pace of adoption accelerated when farmers were given more freedom to adapt the model to site conditions.

Upland farmers do not rely on agriculture alone; thus they will not accept technologies that demand "full time" commitment of labor. One of the features of SALT that farmers liked was that it still functioned even when greatly modified. This "resilience" of the technology allowed farmers to modify the system to meet their time and labor constraints.

Some farmers established hedgerows from seed which saved time over cuttings. Some left a weedy strip along the contour when plowing to eliminate hedgerow establishment altogether (Ly Tung 1992, Fujisaka, et al.in press). Some introduced slower growing multi-purpose trees or planted fruit trees which did not need extensive pruning. In Kiblauan the project discouraged coconut and banana from being planted on the contours but the team interviewed a local farmer who planted them anyway. Project staff claimed that these perennials were too competitive with crops grown in the

alleyways, but the farmer had sufficient land to grow both annual subsistence and perennial cash crops.

Most participating farmers diversified plant species in their SALT systems to give them greater ecosystem resilience.

At the outset both the FSDP and RRDP promoted giant Leucaena as the hedgerow species in SALT-based hillside conservation farming systems. Leucaena had many uses (fixed atmospheric nitrogen, grew fast, its leaves were suitable both as fodder as well as green manure, the wood could be used as lumber). In 1983, an insect pest of leucaena, the psyllid or jumping plant louse (Heteropsylla cubana), reached the eastern Pacific Islands area including the Philippines from South America (Waterhouse and Norris 1987). Related to aphids, the psyllid rapidly reproduced and caused Leucaena trees to wilt as it injected a toxin while feeding. Those trees on shallow soils could not recover and died, which included many planted on upland soils on SALT terraced lands.

Since no remedy was available to combat the pest, farmers who had transformed their hillsides into terraces strengthened by Leucaena trees had to abandon SALT cultivation. SALT adoption experienced a setback for several years until replacement hedgerow species became available (MBRLC 1991a). Those projects where there were follow-on activities introduced other tree varieties (e.g., Flemengia, Gliricidia, Desmodium, and Cassia) which are not hosts of the psyllid pest. Now farmers mix these species in their hedgerows or interplant fruit trees, timber species, and grasses to further diversify their systems and spread their risks of failure from pest attacks or weather. Livestock also do better when fed a diet of several fodder species.

Participating farmers integrated livestock production into SALT cultivation once they were familiar with the practice.

Several FSDP and RRDP attempted to introduce livestock raising into SALT cultivation systems because hedge rows produced an abundance of leafy matter through-out the year that could serve as fodder for stall feeding of goats and hogs. Livestock raising turned out to be attractive to farm families with relatively limited arable land or family labor.

Both FSDP and RRDP had livestock dispersal projects. The dispersal programs follow the method of providing a farmer with a female animal which the farmer raises and breeds, giving the program the first female offspring which is then given to another farmer under the same conditions. Animals, however, are only given to farmers who first have undergone training, built an animal shed, and had planted sufficient hedgerow forage trees. Kiblauan and Marilog projects dispersed cattle, Magdungao dispersed pigs, and Mananga and Matalom dispersed goats.

The most active livestock programs were in Sogod which had cattle fattening along with cattle raising programs (Burniske, et al. 1991). Both traditional and improved breeds were available, but improved animals were only given to experienced farmers. Cattle were force fed a food regime that brought them to market four months earlier than the normal eight months. The introduced breed gained a profit of 1800 pesos for each animal. Farmers prepared a special diet for cattle reducing the fattening period from eight to four months. The diet was made from napier, Leucaena, Gliricidia, Flemengia, and Sesbania fodder plus corn, coconut, and fish meal mixed with vitamins.

To offset the reduced source of hedgerow green manure with livestock integration, farmers were encouraged to recycle manure to the alleyways. Only Sogod and Mananga farmers were observed to follow this practice.

Nearly all participating farmers are growing a wide array of cash crops in contour hedgerows and alleyways.

The team was impressed by the rapidity with which farmers diversified into growing cash crops in hedgerows and alleyways after terracing their farm. The increased yields on terraced sloping lands allowed farmers to satisfy their subsistence crop needs on less land, freeing land for planting of fruit, vegetables, and industrial crops or spices. Increased production of food crops occurred despite the field area taken up by the hedgerows. The team was told that fruit trees yielded more on the terraced lands than they had on non-terraced lands. Fruit and timber trees, however, require more land area and less labor.

No one alley or hedgerow was the same as farmers inter-planted a variety of crop species in each terrace alleyway. The team recorded farmers planting mango, citrus, guava, jackfruit, papaya, pineapple, banana, coconut, passion fruit and santol fruit trees. They planted tomato, carrots, eggplant, squash, and malungay as vegetables in the alleyways. Industrial crops and spices seen were rubber, ginger, black pepper, mulberry, coffee, and cacao. Banana, pineapple, and mulberry were noted to be planted thickly in the hedgerows to serve as an erosion barrier. This practice saved pruning labor as these economic species replaced green manure plants.

Farmers also planted some alleyways to fruit trees which were at first inter-cropped with annual crops. Fruits mature at different seasons which is a motivating factor for farmers to plant many species in order to have generate year-round cash income. Farmers who had large land holdings planted a relatively greater share of their land to fruit trees.

Biophysical Impact

All farmers who had adopted SALT-based cultivation with at least a modest level of establishment and maintenance have rehabilitated and stabilized eroded soils on their lands.

Upland hillsides are often highly eroded before farmers begin to take preventative action by establishing SALT-based contour hedgerows. The seasonal but intensive rainfall that occurs in the Philippines greatly accelerates erosion. Experiments in MBRLC which compared terraced and non-terraced plots side by side demonstrated that terraced lands reduce soil loss from 14.6 to 0.25 mm of top soil (or 194 vs 3.4 t/ha) annually (MBRLC 1992). In non-terraced plots, rocks and parent material become evident after only a few years. Slopes terraced between hedgerows, however, retained the top soil. Garrity and Sajise (1993) reported vegetative strips reduced soil erosion annual rates from 20 to 1 t/ha on acid soils in Claveria, Misamis Oriental. The team noted that very few farmers had fully adopted the MBRLC model of SALT with zero tillage, double rows of multipurpose trees, and a green manure mulch to cover the soil surface at all times.

All of the project areas visited by the team had high annual rainfall levels of 1-2 meters. Terraces began to form behind the vegetative strips within the first year of establishment and most of the leveling occurred by the third year. If breaks occur in the vegetative barrier, farmers quickly repair them to minimize the damage. Crop yields reported by farmers steadily increase to levels that were experienced before erosion occurred (Tacio 1993). Organic matter levels increase which not only benefit soil fertility but also retain more soil moisture.

Green manure from contour hedgerows has been used to increase soil fertility in eroded upland areas.

FSDP and RRDP project staff introduced farmers to a range of multi-purpose tree species to plant on the hedgerows. At project sites with ample rainfall, trees grow quickly so that every three to four months farmers prune the leafy branches and lay them in the alleyways. After leaves dry and fall off branches are collected for use as fuelwood or for reinforcing the base of the hedgerows. The leaves are either incorporated into the soil or left on the surface to retard moisture evaporation and weed growth. Farmers report increasing their annual crop yields without the use of inorganic fertilizer, relying only on the green manure from prunings (Templeton 1993).

Socioeconomic Impact

Upland hillside cultivators in FSDP and RRDP project areas can increase their labor and land productivity by shifting SALT-based conservation farming systems.

Both traditional bush-fallow and project SALT-based cultivation systems are sustainable in terms of conserving soil quantity and quality over the long term if practiced properly. What differs is the area planted and the number of seasons cultivated under each system. The evaluation uses land and labor productivity changes as measures of the economic impact of changing from traditional bush-fallow slash-and-burn cultivation to SALT-based hillside cultivation systems. Quantitative measures of returns to farmer investments were not attempted because there are few cash costs associated with either of these cultivation systems.

Traditional bush fallow involves burning and clearing once every fifteen to twenty years to prepare an area for cultivation for up to five years before the land is again allowed to "rest" by restoring original vegetative cover that regenerates the soil. With plenty of open land to cultivate, farmers can shift from area to area in a long-term rotation cycle that permits one three-ton per hectare crop of corn annually for five years followed by taking land out of cultivation for ten. About 100 days of labor are required per hectare per year of cultivation. Land productivity of traditional systems -- five three-ton harvests from one hectare over a fifteen year period -- amounts to about one ton per hectare year. Labor productivity amounts to about 10 kg per day of labor invested in land preparation, planting and harvesting, net of land clearing.

The new SALT-based hillside cultivation practices introduced by the FSDP and RRDP involve the establishment of hedgerows only once, generally after the land has already had a few years of corn cultivation and normally would be allowed to "rest" again in bush fallow. The hedgerows used in these systems take about 30 percent of the land away from crop cultivation. Two three-ton corn crops a year can normally be harvested from the remaining 70 percent of the land, though farmers generally plant a legume crop as a second crop after corn. When adjusted to a per hectare basis the resulting yield is four tons annually on a sustained basis without interruption, a 300 percent increase over traditional bush-fallow hillside cultivation.

Labor requirements for SALT based crop cultivation are nearly triple those of traditional systems totaling about 300 days per year or one person year per hectare. Added labor requirements are needed both for hedgerow maintenance and for the additional crop cultivated each year. Added labor is compensated with more than a proportional increase in output generating a return to labor of

nearly 12.5 kg per work day, a 25 percent increase over the traditional system.

Studies vary on whether much additional labor is needed to establish hedgerows once as opposed to clearing of new land once every fifteen years or so. Clearly, contoured hedgerows require more skills to establish. For the purposes of the analysis in this evaluation, any increase in establishment costs is considered small when amortised over the long-run flow of benefits from SALT-based cultivation.

The evaluation concludes that, at "entry-level" SALT-based corn cultivation, improvements in land and labor returns from SALT-based hillside cultivation have a very strong positive economic impact on adopters and provide strong incentives for adoption. When the net gains possible from adding income earning enterprises such as cash crops or livestock raising are considered, the long-run socio-economic benefits of SALT-based hillside cultivation appear even stronger.

Many farmers adopting SALT have generated benefits for other farmers and landless through the employment their expanded farm enterprises have generated.

The team interviewed farmers in Tabango, Matalom, and Magdungao who stated that they hired either their neighbors or landless to help establish SALT but more significantly to help in pruning and caring for cash crops that were eventually planted. These farmers had reached a stage where income from market oriented enterprises was sufficiently profitable that the farmer could hire labor.

Some banks have begun to provide preferential farm credit to adopters of upland conservation farming systems.

No community-based cooperative or national bank gives loans for farmers to introduce SALT on their farmland. The team only heard about one case, in Bontoc, where a local religious NGO gave loans to farmers for this purpose. In Magdungao and Tagungong sites in Iloilo, the Land Bank offers credit to upland farmers who have established terraces on their farms. Farmers who have not adopted SALT are denied the opportunity to take out loans. The national corn production program gave loans for corn production in the uplands in 1990 only to farmers who adopted SALT.

5. EVALUATION FINDINGS: PROGRAM PERFORMANCE

While the current and potential impact of USAID support for hillside conservation farming in the Philippines, continues to be a matter of some speculation, there is clearer evidence from the evaluation findings about how well the program was conducted. Specifically, it is possible to ascertain how well the program performed from the standpoints of:

- Efficiency -- the private and social returns from program investments
- Effectiveness -- how benefits have been shared among program participants according to farm size, gender
- Sustainability -- the likelihood of program continuation after USAID funding has ended
- Replicability -- the scope for spontaneous and induced spread beyond the program areas

Program Efficiency

The evaluation attempted to look at efficiency -- in terms of returns (benefits) from program investments at three levels: the farmer adoptor of SALT-based cultivation practices; the USAID and GOP programs that introduced SALT and built the institutional capacity for its spread and support; and the local NGO or public agencies promoting SALT cultivation.

Returns on investments by farmer adopters. In discussing socio-economic impact in Chapter 4, the evaluation presented evidence on the relative gains in returns to land and labor from SALT-based cultivation compared to traditional practices. Based on the published research and field data, a conservative estimate of the present value of future private income flows from shifting to SALT-based cultivation from traditional rotational slash and burn practices, amounts to about US$ 400 per hectare. This does not include any estimate for external public benefits (e.g., reduced risk of flooding, better quality watershed).

It also does not include the considerably greater returns achievable by evolving from basic food grain cultivation to SALT based income earning enterprises like animal fattening, cash crops and wood-lots Per hectare yields for many of the cash crop upland systems are about 70 percent of those for lowland systems given that adjustments must be made for land in hedgerows that cannot be

put into crops. However, the long-run advantage of hedgerow systems in reducing the need for soil amending chemical fertilizers and for irrigation water partly closes the income gap between upland and lowland systems.

Returns on investments by USAID and the GOP. To calculate net income for all project beneficiaries, figures are needed on total acreage and total number of households covered along with farm level net returns data for traditional and SALT-based cultivation systems. Given, however, that a $400 per hectare return is a reasonable conservative measure of returns from investing in the basic food-crops using SALT cultivation, practices it is possible to estimate how much land must be covered to achieve a satisfactory rate of return for given USAID and GOP investments through the FSDP and the RRDP.

Total USAID and GOP investments in conservation farming through FSDP and RRDP activities total to about US$ 16.5 million. The introduction of SALT cultivation and the support of institutions promoting SALT includes all of the USAID and GOP $6.5 million investment in FSDP and the estimated $10.0 million USAID and GOP expenditures under the RRDP Agriculture component, the latter also supporting other component activities including upland infrastructure development, research and forestry as well.

Using a US$ 16.5 million figure for project costs against a US$ 400 per hectare present value of benefit flows to project beneficiaries suggests that the FSDP and RRDP must lead to the establishment of Salt-based cultivation on nearly 41,250 hectares of land to achieve a 1:1 "break-even" cost to benefit ratio. The evaluation team directly observed SALT-based cultivation systems on about 200 hectares of land at the FSDP and RRDP project sites visited and recorded information indicated a reported coverage of about 2,000 hectares at the time of the evaluation. Unless there has been considerable spontaneous SALT adoption, that an independent survey could validate, the evaluation must conclude that from the standpoint of private farmer participant income gains alone, conservation farming practices have not yet spread sufficiently to cover FSDP and RRDP investments.

Returns to groups fostering SALT-based cultivation. The above conclusion should not be surprising since SALT-based cultivation has yet to spread over more than a fraction of the estimated 9.5 million hectares of public upland areas where hillside farming is now, or could be, taking place. A critical development question is how efficiently NGO's can now pick up SALT-based cultivation practices and promote their spread. Given the sunk costs by USAID, the GOP and some donor supported local NGOs in developing SALT and systems for its introduction and support, the only additional costs are those associated with the operation of NGOs themselves.

These NGO costs are not great, particularly given that most have broad social goals and purposes that go beyond fostering SALT cultivation. I essence, the Philippines now stands poised to spread over a wide area technologies that not only have private returns attractive enough to involve upland households, but also additional external social benefits from better wildlife habitats, and better watersheds for irrigation and hydo-electric power. Interestingly, other countries in Asia, notably Sri Lanka and Nepal have begun to adopt SALT based cultivation into some of their national upland development programs, ahead of the Philippines where the technology was identified and tested.

This efficiency analysis then is very conservative, in no small measure because it excludes those recognizably difficult to measure public benefits that are beyond those realized by adopters. In fact, external benefits may far exceed private gains. For example, the contribution that SALT-based cultivation systems make to watershed maintenance, reduced soil run-off, lower irrigation system siltation and better potable water quality for downstream watershed users can far exceed the level of USAID investments in a single watershed alone. An extreme example is a signboard posted outside the city of Ormoc, Leyte: "Nature Can Become Violent when disturbed. 8,000 People Killed in Flooding, November 1988." Such flooding results for the deforested and denuded hillsides that have been cleared for unsustainable cultivation that SALT-based hillside farming could prevent.

Program Effectiveness

By targeting upland areas, FSDP and RRDP have reached the lowest income rural households as well as many ethnic groups.

The concentration of most FSDP and RRDP activities in upland rainfed areas has assured that those farmers reached would be in the lowest income groups nationally. Even well-to-do upland farmers are poor by the standards of average lowland irrigated rice producers. Because upland areas are mostly public lands, there was also little chance for project benefits to accrue to absentee landlords. Only indirectly, through less flooding, better watershed management and reduced irrigation system siltation, have relatively wealthier lowland rural households benefitted from project activities.

The limited expenditures for establishing hilly upland SALT-based conservation farming systems has also made these systems available to any farmer with land to cultivate. The major limiting factor for low-income farmers is the availability of family labor to invest in system establishment. The promotion of alayon labor-sharing farmer groups by project staff in many sites has overcome even this constraint. Training techniques such as farmer-to-farmer short courses and demonstration farming has helped projects

overcome the illiteracy barriers to transfer of SALT-based conservation farming systems.

A more serious equity issue arises when low-income upland farmers attempt to improve their systems by moving into cash crop or livestock production. Without close supervision and support over several years, as CARE provided to its Sogod site project participants, barriers to obtaining credit, plants and animal breeding stock and good market prices cannot be easily overcome.

FSDP and RRDP activities have reached tribal groups as well at several project sites -- the Kalauan and Marilog included Bula'an and Bagobo tribesmen, respectively. Independent of the projects the MBRLC introduced SALT to Kisunkusan ethnic hill tribes who practice slash and burn agriculture. Many adopters in these sites belonged to these minority tribes. Overall adoption among tribal groups has been low because tribal families live in very remote areas that are difficult for project staff to visit.

RRDP and FSDP have engaged rural women in active management and leadership of hillside conservation farming groups.

The RRDP included women in participatory problem solving and priority setting (Riggs, et al. 1989). Village women wanted more cash income earning opportunities close to their homes and families. FSDP and RRDP project staff at some sites worked to build cash crop cultivation and livestock fattening enterprises around SALT-based cultivation systems to respond to this interest and to engage women adoption. In Madungao the farmers' cooperative established a women's organization that became involved in getting better health care services for the village. Women earned money for the cooperative by catering training courses.

The team interviewed several women farmers in Matalom and Sogod who had adopted SALT. In Sogod during the dry season many of the adult males in the project area relocated for extended periods to Cebu to take jobs as wage laborers in construction, transportation or fishing industries. With many men away, farmer organization meetings participants averaged more than 60% women. Many officers of the community cooperative were women. The team visited Sogod during a livestock training course where most of the trainers and trainees were women.

Program Sustainability

The team identified five factors that appear to influence the sustainability of farmer interest in conservation farming. The ten sites were rated for each of these factors on a 0-4 scale. (See Table 3). The three sites with lowest SALT adoption, Bontoc, San Miguel, and Marilog (see Table 2), had the lowest total scores -- between 9 and 13 out of a possible 24. Kinuskusan, Sogod, and

TABLE 3. RATINGS OF FACTORS AFFECTING THE SUSTAINABILITY OF SALT-BASED CULTIVATION [a]

Sustainability Factor	Bon	San	Mar	Kib	Mag	Mat	Man	Sog	Tab	Kin
Technical advice	1	4	2	2	2	4	4	4	4	4
Technical training	3	2	3	3	3	3	4	4	3	4
Group organization	1	1	2	3	3	3	4	4	4	4
Planting material	1	2	2	2	2	3	3	3	3	4
Credit & markets	1	1	2	3	3	1	3	3	4	3
Total score	7	8	11	13	13	14	18	18	18	19

[a] Rating scale: 0=none, 1=low, 2=moderate, 3=high, 4=complete based on current adoption levels.

Project Site Names:

San=San Miguel
Bon=Bontoc
Mar=Marilog
Mag=Magdungao
Kib=Kiblauan
Tab=Tabango
Mat=Matalom
Sog=Sogod
Man=Mananga
Kin=Kinuskusan

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Mananga again ranked high along with Tabango with scores ranging from 21-23. Tabango rated higher than Matalom, because of the existence of more developed village organizations.

Motivated and competent project staff are a key to sustaining community SALT-based conservation farming programs.

FSDP and RRDP experiences show that several crop seasons are required before farmers master the complexity of SALT-based hillside conservation farming systems. The evaluation team observed at work project staff with a wide range of community organization, agriculture communications and practical farming skill in the sites visited. Project and non-project sites with the greatest technical support were Kinuskusan, Mananga, Tabango, and Matalom. The project staff in these sites were agriculturalists with community organizing skills.

The project staffs at other sites were motivated but less technically equipped to address many of the agronomic problems associated with sustainable hilly upland cultivation. They lack the ability to give sound advice to older experienced farmers and to gain their respect and participation. Tending to draw on book knowledge they learned in school, project staff at these project sites failed to respond to many farmer questions in a manner that encouraged the spread of SALT-based cultivation.

Sustained farmer involvement tracks closely with skills of project technical staff. Sites strong on organizational but weak on technical skills were Kiblauan, Magdungao, and Marilog. Sogod was intermediate. In San Miguel the project was run by researchers who were technically competent but did not offer training programs and were more comfortable in setting up demonstrations and research trials. Bontoc staff lacked both technical and organizational skills. RRDP staff had limited technical skills compared to FSDP which had staff better trained in adaptive research. FSDP staff, however, were relatively weaker in social organization skills.

Evaluation team interviews suggested that it is easier to teach a technical person in social organization skills than vice versa. The FSDP project in Tabango was so successful because its municipal agricultural officers were well founded in adaptive research and knew the SALT technology. They also had been trained by FSDP in community organization and skills to relate to farmers. In the field they demonstrated both technical and social skills and easily gained the confidence of the farmers. FSDP experience at the Matalom site was similar. Two other FSDP sites which were unsuccessful had staff weak in either technical (Bontoc) or social organization (Caray caray) skills. Several RRDP sites (Kiblauan, Magdungao, Marilog) had highly motivated staff who convinced farmers to adopt SALT but on-farm execution was weak because staff did not have technical backgrounds.

Farmers adopt and continue to follow conservation farming practices where they have been exposed to SALT-based cultivation through training programs.

On-farm demonstrations and model farmer visits play a vital role in enabling farmers to conceptualize the SALT technology. Farmers learn that they must use a surveying method such as the A-frame or water tube to establish true contour lines rather than eye-balling which, when done by untrained farmers, ends up as a straight line. Farmers also can see how the terraces form behind the hedgerows and how dense the hedgerow plantings must be. Visits to see on-going cultivation in farmers' fields are more convincing if not more informative than demonstrations prepared by project staff. Farmers not only learn better from other farmers, but they will be able to see how SALT can be integrated with income earning enterprises such as cash crops or livestock.

Evaluation team interviews with model farmers and farmer training quickly revealed how comfortable they were with talking to strangers and picking up knowledge. Tabango and Matalam farmer trainers had traveled to Cebu and Mindanao for project sponsored training and demonstrated they had absorbed what they learned. Many were respected leaders in their communities and consistently reported that they had several visits weekly to their SALT-based farms by neighboring cultivators.

Farmer trainers produced an information multiplier effect with no visible sign that messages deteriorated in accuracy as they were passed on to other cultivators. In fact, when combined with the farmer trainers' own testimonial to SALT workability plus their innovative adaptations, training messages from model farmers may very well have improved in convincing more new farmers.

Farmers who are trained to use the A-frame made level contours, but in a number of sites untrained, spontaneous adopters had assumed, by viewing neighboring farms, that the hedgerows were laid out straight across the slope but not on the contour. Not all farmers are willing to attend training sessions in spite of house to house visits and farmer meetings called by technicians. Those farmers who had planted hedgerows in non-level rows said they had no time or need to attend training sessions, feeling that they could see how the technology was performed and attempted to copy it. It is apparent therefore that farmers need to be trained as a pre-requisite to adopting SALT. In Sogod and Mananga farmers constructed additional SALT techniques such as drainage ditches, soil traps and gully barriers are routinely constructed by farmer in classical textbook fashion.

SALT-based cultivation is greatest where there were active farmer organizations and community cohesion.

The RRDP in particular emphasized that farmers should form organizations to better receive new technology (Riggs, et al. 1989). The farmers would, through participatory methods, become more involved in testing technologies that were introduced via groups where farmers collectively evaluated them and supported the necessary services. Such organizations set up local farmer training centers and are particularly active in Sogod and Tabango and encouraged formation of the self-help teams.

Many farmers have independently established SALT on their farms but these are the exceptions rather than the rule. Farmers become more motivated if they join a work team of 10 members or so and formed by location. The work team not only provides additional labor but also entails a training component as the execution of SALT benefits from the collective wisdom of 10 farmers. Matalom, Sogod, Mananga had the best working teams. However, without constant stimulus by the technician the work teams tend to dissipate as seen in Magdungao, Marilog and Kiblauan.

SALT-based cultivation is most extensive where there is a plentiful supply of inexpensive hedgerow planting materials.

In a country such as the Philippines where there are few seed companies, the government needs to provide ready access to hedgerow seed, seedlings or cuttings. Unfortunately government programs are generally spread too thin limiting funds for developing nurseries of these materials. Farmers who adopt SALT are prone to plant cash crops in the hedgerows or alleyways and said they would do more planting if they could get more seed. Local farmer organizations may develop village community nurseries for this purpose. In Sogod, Matalom, Tabango, and MBRLC with both communal and individual nurseries, farmers planted mainly Gmelina and mahogany in hedgerows and in alleyways, particularly on the alleyways which came to look like wood lots. In some areas wood lots were made to Leucaena and underneath planted to coffee and cacao.

If seedlings are available farmers will begin planting timber species in the steepest areas where agriculture is most marginal in order to prevent soil loss. Preferred areas for timber are along gullies or areas of enhanced erosion. Farmers know trees can help stabilize the landscape. The site with the greatest adoption of reforestation within contour hedgerow areas is Mananga where over 20 tree species are being planted including native and exotic species.

Access to credit and product markets stimulates both SALT establishment as well as integration of cash crops and livestock into cultivation systems.

The evaluation found several sites used the adoption of SALT-based cultivation as a condition for eligibility for participation in lending and marketing programs of farmer organizations. Loans

were not given for SALT-establishment alone but for the expansion into new crop or livestock enterprises that could be integrated into SALT-based cultivation systems.

There is a transition period of several years where income levels will be low as the farm is being converted to contour hedgerows, before soil regeneration and water conservation factors pay off. Unless there are motivating factors, farm families do not choose to endure this transition period.

Normally SALT-based cultivation systems are first planted to food crops for family consumption. Market incentives are not important. Gradually, however, farmers are motivated to experiment with cash crops and perhaps livestock which have local markets. In Tabango farmers have shown a tendency to diversify their cash crops so as to not oversupply markets and depress local prices. Because many FSDP and RRDP project sites were located some distance from major markets, scope for cash crop cultivation is limited, a factor that can be expected to limit the degree to which farmers seek to build and expand their economic base on SALT-based cultivation systems.

Program Replicability

The evaluation team assembled information about the fixed physical characteristics of project sites to identify determinants of spread or replicability of SALT-based cultivation systems beyond target areas. The evaluation found six factors, or characteristics, associated with adoption and rated each site on a 0-4 scale of importance for each factor. (See Table 4.) These rankings generally matched a similar ranking for levels of SALT adoption (Table 2). Those sites with least adoption -- San Miguel, Bontoc, and Marilog -- were also those with the lowest overall scores (11-12) and those sites with the highest adoption -- Sogod, Mananga, Matalom, and Kinuskusan -- ranked highest for the enabling factors as well (17-19). By looking at the ratings for each site it is noted that not all the factors must be met for adoption. In addition each factor does not necessarily have the same weight as other factors. But the team feels that in future projects focusing on soil and water conservation measures, greater adoption should occur in sites having these characteristics.

Farmers on eroded sloping lands with declining yields are more inclined to adopt SALT.

The team found that adoption of SALT as a preventive agricultural practice on non-eroded lands is rare. Farmers whose lands are highly eroded and with declining yields are more disposed to adopt SALT-based cultivation. Farmers detect effects of erosion by comparing the yield of corn from year to year on the same parcel. Farmers complained of declining corn yields in Sogod

TABLE 4. FACTORS AFFECTING THE SPREAD OF SALT-BASED CULTIVATION PRACTICES [a]

Replicability Factor	Bon	Mar	San	Kib	Mag	Tab	Man	Kin	Mat	Sog
Highly eroded land	1	2	2	2	2	2	3	2	3	4
Abundant labor	2	2	2	2	2	3	2	3	3	3
Low soil acidity	2	2	2	2	3	3	2	2	3	2
Little open domain	2	1	1	3	2	3	4	4	4	4
Few economic altern	2	2	2	3	2	2	2	2	3	2
Land access	2	2	3	2	4	3	4	4	3	4
TOTAL	11	11	12	14	15	16	19	17	18	19

[a] Rating scale: 0=none, 1=low, 2=moderate, 3=high, 4=complete

Project Site Names:

San=San Miguel
Bon=Bontoc
Mar=Marilog
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Man=Mananga
Kin=Kinuskusan

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and Matalom, two sites where erosion was worst. The most heavily eroded site was Sogod where bedrock was exposed as the top soils were washed away. Severe erosion was also present in Matalom and Mananga where rock outcroppings were common features on the hillsides. The least eroded sites were Bontoc and the lower villages in Matalom where farmers interest in conservation farming was minimal.

Non-acidic soils and high rainfall conditions are conducive to adoption of SALT-based cultivation practices.

The preferred fast growing, multipurpose, leguminous hedgerow tree species -- Leucaena and Gliricidia -- grow poorly in low acid soils of pH less than 5.5 (Garrity and Sajise 1993). Acid soils retard root growth needed if the hedgerow is to tolerate dry periods and not wash away during heavy rains. While some species -- Flemingia and Desmodium -- grow well in acid soil, they are less useful for fuelwood or construction. Weedy grass hedgerow strips rather than leguminous trees are preferred in the highly acid soils of Bontoc and Marilog (Balina, et al. 1991).

All the sites are in monsoon areas where heavy downpours occur causing excessive erosion. Annual rainfall between sites varied from 1-2.5 m. Lowest rainfall occurred in the Cebu Island sites of Sogod and Mananga -- both highly eroded. The sites differed in length of the rainy season from 5 months in Cebu to 9 months in the other sites. Longer rainy seasons mean more crop harvests per year of subsistence crops and subsequently more soil disturbance from tillage. Monsoonal rainfall intensities of 1-2 m per annum provides a high capacity for erosion. Farmers in lower rainfall zones would experience less erosion and therefore would be less interested in SALT (Carson 1990).

Farmers with abundant family labor are more disposed to adopt SALT-based conservation farming practices.

Adoption of SALT requires labor to establish and prune hedgerows. If the alleys are 5 meters wide there would be 2,000 meters of hedgerow per hectare. Six to eight person days per hectare are required for each pruning at recommended regular intervals of 45 to 60 days. Each stem has to be cut and placed in the alleyway. Lack of labor is one of the greatest constraints to SALT adoption. Farms with less than 2 hectares of land have enough family labor to manage the hedgerows, particularly if children are old enough to work and farming is the major occupation.

Farmers with limited open upland domain are more inclined to adopt SALT than those with opportunities to clear remaining open land or to cultivate low-land irrigated areas.

At some locations in the Philippines today, sufficient uncleared upland areas remain to support the practice of slash and

burn agriculture. Because the fallow regeneration period should last up to 15 years, a farm family needs access to over 10 ha of land to cultivate on a rotational basis. Each year new fallow land is cleared and burned releasing the nutrients needed for crop fertility and old depleted soils are allowed to "rest" and go fallow for an extended period of regeneration. With continuous encroachment, land available for extensive cultivation has steadily decreased to the point where fallowing is no longer possible. Farming at this point is more intensive and farmers become highly receptive to soil and water conservation technologies that can improve their upland farms. Farmers in Bontoc, Marilog, and San Miguel told the team that they did not adopt SALT-based cultivation because there were nearby unoccupied upland areas they could farm using slash and burn practices.

Some upland farmers also cultivate irrigated lowland crops. In fact their upland areas may be used only to absorb their labor during the off season, to graze cattle or harvest fuelwood. They do not have the time or interest in setting up or managing a SALT-based cultivation system. Farmers in San Miguel and Magdungao have significant lowland holdings in which they devote the greater majority of their time and resources. As the lowlands now are much more productive than the uplands greater priority is given to lowland rice and sugarcane than to upland crops. In Tabango some farmers had rainfed lowland parcels to which they devoted their attention in the rainy season.

The best and most frequent SALT adopters are those farmers with the fewest alternative livelihood activities.

Farmers know there is little economic return farming eroded hillsides. Without knowing how to overcome this problem, they will continue to look for other means of earning income. Farmers are most likely to adopt SALT where they find themselves with few other options.

The team found that where alternative opportunities exist upland farmers earn a significant part of their income from off-farm enterprises such as migrating to jobs in nearby cities in the dry season or engaging in seasonal harvesting of abaca or sugarcane. Others have trades as carpenters or fishermen. Once the farmland becomes highly eroded more time may be spent on off-farm employment. There may be less interest in SALT because the proportion of farm income from cropping may diminish to insignificance or that the farmer may be out of town during SALT training periods or during organizational periods.

Farmers in Bontoc and Sogod were absent for significant periods during the year and farming was of secondary priority to them. In Sogod most of the farmers were women as many men worked in nearby Cebu City. Even minimum wage for unskilled labor seemed preferable to farming eroded hillsides. Farmers in Bontoc seasonal-

ly work in abaca plantations. Farmers at some project sites worked in nearby urban areas during seasonal slack periods: San Miguel farmers went to Tacloban, Magdungao farmers went to Iloilo and Roxas Cities, Kiblauan farmers to Digos.

Long-term access to land was more critical than land ownership in the spread of SALT-based cultivation.

Farmers often are willing to exert the extra effort to establish SALT and endure the several years of lower than normal yields only if there is assurance that no one can claim or take away the land on which the have invested their labor. Land ownership is often cited as a major factor in SALT adoption (Laquihon 1989, Landhe, et. al 1989, Exconde 1987).

However, the team found enough examples of non-owners performing SALT-based cultivation to suggest that in the Philippine context being an owner-operator may not be as important as it would seem. With recent government policy changes, farmers have greater confidence that occupation of public upland areas may lead to ownership. The Certificate of Stewardship Contract process is an indication to farmers that they can get the right to farm public lands. There are many SALT-based cultivation systems in Mananga, Matalom, and Kiblauan on land this is not owned or has no stewardship certificate issued. Tabango was the only site with an active land reform program and the site technicians capitalized on this by seeking out farmers with new land title holders to undertake SALT-based cultivation.

6. LESSONS LEARNED

Several lessons emerge from this evaluation as guidance for similar programs in the future or in other country settings. Among the most apparent of these lessons are the following:

Conservation farming practices should be introduced first in upland locations with characteristics that make them the best candidates for adoption.

Programs seeking to introduce conservation farming systems such as SALT should select initial sites that have conditions most conducive to adoption. Farmers most willing to adopt sustainable upland farming practices are those in areas where there is little other land to farm, little nearby open frontier to use, or few available off-farm employment options. Locations that are promising candidates for adoption are those that show signs of heavy erosion. In areas where the land was still fertile and other employment options exist, sustainable upland farm management systems needed to have a strong cash enterprise linked with them to compete successfully with alternative uses of farmers' time.

Land ownership need not be a barrier to the practice of conservation farming. Farmers will adopt hillside cultivation systems employing technologies such as SALT on tenanted land as long as they have long term access and the landowner's approval. More secure land access (titles, land use certificates) do enable adoption, if only because government agents focus their efforts on land certificate holders. Of course, forest management requires even longer tenure. Sustainable farm and forest management systems do not spread where land access is disputed, or disputes erupt as a result of government programs.

Upland conservation farming systems require institutional capacity and follow-up for sustainability and spread.

Technical assistance, access to planting materials, vaccines for livestock, and credit for inputs are all needed to sustain upland agro-forestry systems. GOP technicians have been effective in some areas but ineffective or non-existent in others. Strong NGO support can make up the difference if adequately funded for sufficient time. Local NGO groups must have not only the motivation but also the communications, community organization and technical agricultural skills. Links with national and international conservation farming networks are also valuable in keeping up with a still evolutionary field of conservation farming.

Community or farmer organizations can go far in providing follow-up support but these also require continued support in financial and administrative as well as technical skills training. Spread has been most effective where farmers or farmer groups have begun to obtain credit, market products or produce hedgerow seeds and seedlings on their own.

Systematic hands-on training at all levels must be built into upland conservation farming programs.

Few farmers will adopt upland agro-forestry practices without training. Moreover, 1-day and 2-day lectures, practicums or "demonstration farm" visits may be useful for exposure and awareness raising but are insufficient for sustained practice of conservation farming. Sustainable upland conservation farming takes hold best where farmers are involved in hands-on establishment and management. Farmer-to-farmer training -- that may be as simple as learning while employed by other farmers in establishing sustainable upland agro-forestry systems -- appears highly effective for learning the skills of good hedgerow planting and maintenance and reforestation and forest management techniques.

Training for project staff should be considered not only for what it does to equip them to carry out the jobs effectively but also for what they may do in post project employment.

One of the interesting by-products of FSDP and RRDP activity in the Philippines has been the number of trained project staff who have since taken jobs in rural NGO's, consulting firms or government agencies performing functions that have continued to further project objectives and goals. Fortunately, the Philippines political and social setting has been conducive to such initiatives by former project staff. The availability of funding from other donor sources has also helped.

Upland farm and forest management systems need an "economic engine" for sustainability and spread.

Upland conservation farming prospers and spreads best where farmers and local communities have linked it to profitable cash enterprises, e.g. fruit trees, livestock raising, fish farming, or woodlots. Farmers can be encouraged to grow and market hedgerow seed and seedlings which enforces their own interest in SALT-based conservation farming while supplying planting materials for others. Where not integrated with cash enterprises, upland agro-forestry practices have been abandoned.

7. OUTSTANDING ISSUES

The evaluation leaves unanswered several important questions which will require further examination before it can be concluded that the Philippine experience at introducing sustainable hillside conservation farming systems is a workable model of environmental management. As pertains to the Philippines context itself, the evaluation has raised two areas of concern:

Does the current Philippine government decentralization policy help or inhibit the adoption and spread of upland conservation farming systems?

Developing, testing and disseminating SALT and conservation farming technologies is much more demanding that working in lowland rice production programs. Upland agriculture work is not like the 9 to 5 job that the city based irrigated rice extension agent and researcher enjoys but a harsher more sacrificing service with few amenities and rewards. It appears that special incentive systems are needed to attract and hold talent in upland agriculture and conservation farming extension and support programs.

While the "devolution" of DA and DENR staff to municipal governments is well-intentioned, it may have negative impact on the spread and sustainability of upland agro-forestry systems. Eroded upland areas, which could benefit most from agro-forestry systems, have municipal governments with such low economic bases that they lack the resources, (e.g., office space, equipment, vehicles) leadership or interest required to support the number and quality of DA and DENR staff needed. GOP staff devolved to municipal offices currently lack access to the support services of their former agencies. Some NGO's have begun to play coordinating roles among local and national agencies, for example, in watershed management.

Commercial farming vs. conservation farming policies .... what is the proper mix?

The GOP's five year plan for agriculture, (1993-98) has two broad goals: increased global competitiveness and increase people empowerment. In the agriculture sector this translates into increased food crop production in "key agriculture production areas" with expanded cash crop and livestock production on the balance of cultivatable lands.

Specifically, the 5-year plan calls for the increase of rice (palay) and maize production yields from 3.5 to 5.0 tons per hectare to permit the reduction of grain crop lands from 5.0 to 1.9

APPENDIX A

EVALUATION PROCEDURES

CDIE assessments of environmental programs are aimed at answering two central questions: "Has USAID made a difference?" and, if so "How well did it do it?" The central hypothesis of the environmental assessments is that USAID, through the right mix of program strategies, can impact on local conditions and practices to produce favorable long-lasting changes in the bio-physical environment and on the socio-economic welfare of cooperating countries. This Appendix describes the process used to test this hypothesis in USAID programs where promoting environmentally sustainable agriculture is an objective.

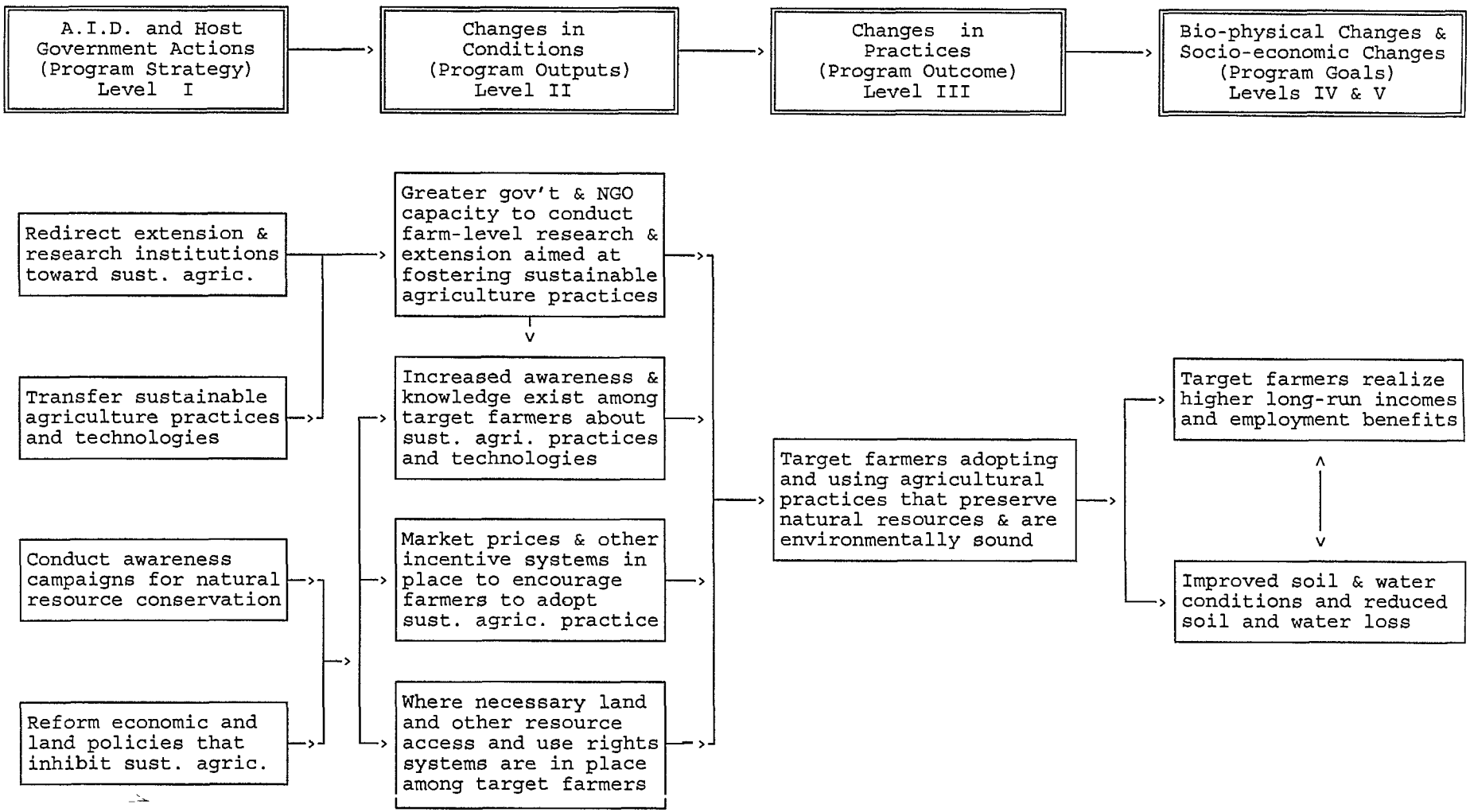
Impact - How much?

The assessment seeks to establish plausible association between USAID program strategies or activities and changes in environmental quality, natural resource management and socio-economic well-being. In answering the first question, "Did USAID make a difference?", the assessment has attempted to document what happened or can be expected to happen. In the Philippines the evaluation has gathered and examined "impact" information to determine whether the USAID FSDP and RRDP projects accomplished their goals of increasing sustainable upland hillside farm cultivation. The evaluation examines the relationships between environmental impact and FSDP and RRDP program strategies using a five-level analytical framework. (Figure A-1.)

In the analytical framework, Level I lists the "program strategies" that USAID and the Philippine government employed in implementing sustainable agriculture programs receiving USAID support. In the case of the Philippines FSDP and RRDP these strategies include: building farm-level research, training and extension institutions, introducing new sloping agriculture lands technologies (SALT), fostering awareness of hillside cultivation and formulating public policies that support sustainable upland farming.

At Level II, "program outputs" are the conditions that have resulted from implementing these strategies. They include: the staffing and equipping of on-farm research agencies, new training curricula, newly formed local NGOs, hedgerow plants, alley crops and management practices identified as suitable for sustainable hillside cultivation, changed policies and regulations affecting upland farming systems.

Figure A-1: Framework for Assessing USAID Sustainable Agriculture Programs



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The Level III "program outcomes" resulting from changes in Level II conditions are the adoption of SALT-based hillside cultivation practices and technologies by target farmers. Indicators of the adoption of SALT practices include numbers of farmers, share of farm land and degree of management of improved hillside cultivation systems.

Level IV and V "program goals" constitute the biophysical and socio-economic changes resulting from the adoption of Level III program outcomes or practices. Level IV and Level V goals can be viewed and mutually supportive.

For the purposes of the evaluation, Level IV "bio-physical goals" are the specific environmental objectives of the program being assessed, e.g., increased vegetation cover and improved soil conditions. Level IV indicators measure the changes in quantity and quality of soil and water resources that result from hillside cultivation practices adopted by participating farmers.

Level V "socio-economic goals" include sustainable increases in production, income, employment, and overall well-being of program participants. While access to income data is difficult, the continued involvement of beneficiaries in the program can be used as a "vote with their feet" proxy indicator of positive socio-economic impact.

Performance: How well?

In answering the second question, "How?", CDIE's primary concern is the **efficiency, effectiveness, sustainability** and **replicability** of the program.

Where data exist, the evaluation measures program **efficiency** by using monetary estimates of the flow of benefits to calculate an economic rate of return for those USAID and host government program investments to which benefits can reasonably be attributed. Because benefits occur into the future, their anticipated value must be annualized, adjusted to net out all costs incurred, and expressed as a discounted present value to compare to project investments.

To assess program **effectiveness**, the evaluation examines how well project sponsored technologies and services (e.g., training) are reaching intended target groups and whether there is equity or bias in access by participating target groups. Effectiveness indicators include trends in the patterns in delivery of services according to the make-up of target groups according (e.g., farm size, gender or socio-political status.

The examination of **sustainability** is important at all program levels (Figure A-1). For example, will new (Level II) conditions created with USAID assistance continue or will they be reversed? Will target participants continue to employ newly introduced (Level

III) practices? Will new (Level IV) SALT production systems thrive over the long-run? Will increased (Level V) incomes, profits and jobs continue after USAID and host government support is withdrawn? Evidence of sustainability includes the continuation of activities, regulations, price structures and institutions beyond the termination of USAID technical and financial assistance either on their own "internal" momentum or with host government or with other donor assistance. The principle measure sustainability is the number of farmers continuing to employ project promoted practices after USAID support had ended and the nature of added government and donor support provided USAID initiated activities. Indicators of bio-physical sustainability include trends in water run-off and in soil nutrient quality.

To determine the **replicability** the evaluation examines whether conditions and practices, promoted by the SALT program, have spread beyond the target areas and whether such spread is "spontaneous", occurring among participants by "word of mouth" or other means without further outside support, or "induced" by public, private or donor agencies which have picked up on an USAID supported concepts and introducing them elsewhere. Replicability indicators include number of similar activities supported by local or international agencies outside the program target area and population; number of participants outside the target area that have adopted in sum or in part USAID sponsored practices.

Data collection procedures

CDIE employs a variety and primary and secondary sources of data and information to construct the chain of events linking program activities and resulting observed effects and impacts, to examine major evaluation issues, and to identify lessons learned.

In preparation for the field work CDIE collected and analyzed relevant secondary data and information that are available in Washington or in host countries from a range of sources including project documents, technical reports, and special studies that are available with the Agency's Development Information System.

In the Philippines the evaluation team reviewed studies and reports conducted by host government agencies, private voluntary organizations, and international institutions. The team was fortunate to discover a number of comprehensive surveys and reports that had just reached completion as part of the preparations for the new five-year plan in the Philippines and for the recently held UN Conference on Environment and Development. Because acquisition of primary data was also called for, the assessment team also visited a number of FSDP and RRDP field sites to make visual confirmation of changes that have occurred since USAID support began and to conduct key informant interviews as part of its primary data collection.

The rate of SALT adoption was determined for each of the ten sites which the evaluation team visited. "Adoption" rates were calculated on a four-point qualitative scale of ranking compiled from four qualitative criteria. The criteria are:

- Share of target farmers adopting SALT-based hillside cultivation practices in project areas.
- Share of potential hillside areas in SALT cultivation
- Degree to which hedgerow establishment and maintenance practices were followed
- Extent of diversification of SALT-based crop, livestock and tree enterprises

The evaluation team collected data from farmers at the ten sites to examine how extensively they adopted and how well they executed erosion containment practices and adopted soil fertility enrichment techniques. The evaluation examined possible determinants across the ten project sites for their relationship with rates of adoption based on project reports, site visits, an interviews with key staff and farmers.

The SALT-based cultivation sites varied in physical features and socio-economic conditions as well as in the level and composition of program interventions aimed at fostering adoption. Physical features and socio-economic conditions examined at each site include:

- Physical features
  - Rainfall patterns and rainfall levels
  - Soil acidity
  - Degree of erosion and slope
  - Amount of nearby uncleared forest or uncultivated lands
- Socio-economic conditions
  - Land access and tenure
  - Farm size and farm fragmentation
  - Degree of market development and credit availability
  - Availability of family and local labor
  - Employment opportunities in lowland cultivation and off-farm labor markets
  - Degree of social cohesion and sense of community

The evaluation was able to control for most of these physical features and socio-economic conditions by selecting ten sites for analysis here that were relatively homogeneous in these features.

APPENDIX B

FARMING SYSTEMS RESEARCH AND EXTENSION

The "farming systems research and extension" approach to agricultural technology development, adaptation, and dissemination has evolved independently in several locations across the globe during the 1970s (Shaner et al. 1982). In the Philippines it began as an outgrowth of the "Green Revolution" in rice cultivation with Richard Bradfield's attempts to further increase crop production by adding more crops per year on the farmers' land. The photoperiod insensitivity bred into the modern rices allowed year-round cropping. Farmers found methods of intercropping and relay cropping as well as crop rotation as a means of more efficiently utilizing the resources of sunlight, soil, and water in lowland systems.

Bradfield's experiments attempted to discover a scientific basis behind the successful intensive cropping systems. These intensive systems were already highly developed in the favorable irrigated regions of Asia but the concepts have since been applied throughout the world including non-irrigated growing areas where the Green Revolution rices did not fair well.

Targeting rain-fed regions would required an approach to technology development different from the single commodity based methods traditionally followed in crop research. The cropping systems program of the International Rice Research Institute (IRRI) was one of the first in the early 1970's develop farming systems research and extension to spread the Green Revolution to unfavorable environments (Zandstra, et al. 1981).

USAID drew on early IRRI cropping systems program experience to fund many upland agriculture development projects in the 1980s. Nearly all these projects were based on a an approach to farming systems research and extension that had eight basic characteristics:

1) **Farmer orientation.** Small farm families are usually targeted for technology development. Management conditions of this group are identified, relevant technological solutions are proposed, and tested under local resource conditions.

2) **Farmer involvement.** Farmers become part of the team in designing, implementing, and evaluating new technologies.

3) **Location specific.** Technologies are developed for a particular location which is defined in terms of agro-climatic and socio-economic terms.

4) **Problem specific.** Research includes describing the site

and identifying the agronomic and socio-economic problems of the area that can be addressed.

5) **Systems orientation.** The farm is seen as a production system and all of the components of which are studies for their interrelationships.

6) **Multi-disciplinary research.** Agricultural and social scientist cooperate in teams to identify problems and solutions for achieving greater production and well-fare on the entire farm unit. A complementarity emerges when each team member sees the same farm through their own eyes and thus a greater knowledge base emerges.

7) **Farm-level testing.** Technologies are tested and evaluated in farmers' fields, often in farmer managed trials before they are recommended for extension.

8) **Feedback and evaluation.** Extension agents feedback to researchers the reactions of farmers to new technologies and identify the next generation of problems for research and testing.

The commodity-based cropping systems research has expanded to include livestock and even agro-forestry systems as part of upland agriculture research systems today. In both the cropping and farming systems approaches the farm and the systems of enterprises taking place on that farm become the focus of study. Farming systems research programs often need eight to ten years to show results given the period required for early rapid rural appraisal and diagnostic work to identify problems, then the slower on-farm testing and adaptation that is required in upland areas where only a single crop often can be grown. The approach remains one of the most important tools used for identifying sustainable agriculture production systems in USAID programs today.

APPENDIX C

SLOPING AGRICULTURAL LANDS TECHNOLOGY

Two NGOs are responsible for the development and introduction of Sloping Agricultural Lands Technology (SALT) in the Philippines. The Mindanao Baptist Rural Life Center (MBRLC) in Davao del Sur introduced sloping agricultural land technology in 1971 (MBRLC 1992) and the World Neighbors in Cebu introduced similar practices a few years later. World Neighbors developed SALT from practices used in Latin America.

Both NGOs sought a common set of erosion control practices borrowed from alley cropping -- the technology of planting perennial, leguminous, multi-purpose trees closely together to form hedges along the contour called hedgerows. A distance of 4-6 m between hedgerows provides alleyway space for the cultivation of annual or perennial crops. The deep-rooted leguminous trees hold the soil above the hedgerows, and the alleyways form terraces.

Hedgerow tree species

The multi-purpose hedgerow tree of choice is Leucaena leucocephala. Being deep rooted Leucaena can recycle leached nutrients which in effect mimics a tropical rain forest, the dominant ecosystem being replaced by slash and burn agriculture. Leached nutrients in a tropical rain forest are recycled by entering the root system deep in the soil and moving up to the leaves and eventually back to the soil through leaf fall.

As this erosion control system embodies both agriculture and forest plants it is claimed to be an agro-forestry technology. A multi-purpose tree such as Leucaena fixes atmospheric nitrogen (converts plentiful atmospheric nitrogen into forms the plant can take up) and recycles soil nutrients. Its leaves can be used as a green manure and its branches as fuel wood. Therefore it serves both agricultural and silvicultural purposes. The use of a green manure is derived from organic farming practices stressing organic fertilizer rather than synthetic inorganic sources.

A USAID-sponsored project in Hawaii has introduced the giant variety of Leucaena to Asia over several decades which is very popular as it is a fast growing species with many uses to the small scale farmer (Brewbaker, et al. 1982). Other nitrogen fixing leguminous tree species also can be used. After the mid-1980s, when an outbreak of an introduced insect pest the psyllid Heteropsylla cubana (Waterhouse and Norris 1987), MBRLC recommended Leucaena be replaced by Desmodium rensonii, a fast growing perennial legume, on

one row of the double row system and by Flemingia macrophylla (whose large leaves degraded slowly and formed the permanent soil mulch) on the second row.

Gliricidia sepium is also used but established mainly from cuttings as flowering only occurs in limited latitudes. MBRLC staff found out that the smaller leafed Leucaena diversifolia has a greater resistance to the psyllid than the preferred giant Leucaena leucocephala. The initial use of Leucaena leucocephala as essentially a mono-crop hedgerow species was a valuable lesson in biological diversity, one of the tenants of sustainable agriculture. The dependence of the contour hedgerow technology on Leucaena leucocophala, and its subsequent susceptibility to this introduced insect pest, was a severe blow to this method and almost meant the demise of the technology. But the appearance of natural enemies has increased and farmers have shifted to more resistant species to an extent that the pest problem has, for the most part, subsided.

System Establishment

The first step in SALT system erosion control is contour plowing. Farmers in many sloping upland areas do not contour plow and for various reasons still plow up and down the slope. Even a skilled farmer cannot plow a level furrow along the contour without utilizing surveying methods based on an A-frame or water tube device. These leveling technologies are newly introduced into the Philippines and have to be mastered by farmer adopters.

The two most common surveying methods of establishing a level contour line are the A-frame or water filled hollow tube. An A-frame is an old method based on an H-frame by the Romans and adapted into an A-frame by the time of Thomas Jefferson. The A-frame was perfected by World Neighbors for use by small scale farmers on sloping uplands (World Neighbors nd.). An A-frame is made with three poles, two legs about 2 m long are tied at the top with the ends spread out. A third pole about a meter long is tied half way up the poles forming the shape of the letter A. A plumb bob made from a rock hanging on a string from the apex of the A-frame is used as a level. The A-frame is placed on level ground and the cross bar is marked with a notch half way across. A plumbers' level can be used as well, but the A-frame is made entirely from local materials.

The levelling method starts by anchoring one leg of the A-frame at one edge of the field and swinging the second leg on a pivot up and down the slope stopping at the place where the plumb bob string touches the notch on the cross bar or where the plumbers' level, placed on the cross bar, shows level. The water tube method is best for rocky fields. The water tube consists of a narrow hollow plastic tube (4-5 m long) kept filled with water. One

end of the tube is held in place and the other end is stretched and moved up and down the slope until the water does not spill or descend in the tube indicating a level place.

The contour is made laterally across the slope. The farmer places a stake at each levelling. Additional contour lines are made 4-6 m apart, closer when the slope is steeper. Each terrace should be formed for each vertical drop of 1-1.5 m. However, hedgerows narrower than 4 m apart shade out the alleyway crop and hedgerows wider than 6 m apart prevent terracing. Contours can be quickly marked off and sown (2 people, 1 day) but it takes 6-8 person-days to prune.

The hedgerows, average 1 m width, stabilize the soil while erosion forms terraces where crops can be planted in the alleyways. The hedgerows are planted to multi-purpose trees or to grasses. The choice of hedgerow species is determined by the needs of the local farmers. The branches and leaves of multi-purpose trees can provide fuel wood or biomass as organic fertilizer, respectively. Leguminous species also fix nitrogen to improve soil fertility directly. Subsistence annual cereal crops (corn and upland rice) as well as legumes (mungbean, soybean, and peanut), and root crops (cassava and sweet potato) are normally grown in the alleyways as food. Erosion was further limited by placing, in every third alleyway, perennial crops to minimize erosion from rain splashing.

Each hedgerow is made of two rows of the perennial tree placed 30 cm apart. The double row system provides better soil holding properties than a single row. The hedgerow system, however, takes up field space and is very labor intensive to manage. The double-row hedgerow will take up 20-25% of the field area and pruning every 30-45 days takes 6-8 person days each time.

System Performance and Management

Soil erosion is exacerbated by splashing raindrops and fast running water. The erosive splashing effect of raindrops could be stopped through crop residue mulch covering the soil surface in the alleyway. A benefit of a mulch comes not only from increased soil fertility but from greater water holding capacity from due to the soil humus. Fast running water is stopped by hedgerow tree vegetative barriers and absorbed by a more porous soil encouraged by enhanced earthworm activity.

Contour plowing is one way to allow greater water infiltration but a high organic matter soil will hold more moisture. The crop residue mulch further prevents water loss from evaporation. With zero tillage, earthworm populations build up and their tunneling turns under crop residue in the same fashion as a plow but with less soil disturbance.

The degree of erosion suppression was also measured on sloping land on the research farm of the MBRLC and contour hedgerows with zero tillage and a green manure mulch is almost zero. A similar study in Claveria in Northern Mindanao where the alleyways were plowed with a moldboard plow with two croppings per year the erosion was reduced ten fold from 200 tons/ha soil without contoured hedgerows to 20 tons/ha with hedgerows made of leguminous trees or native grass or a combination (Garrity and Sajise 1993).

There are some differences between MBRLC and World Neighbors in the technology they each teach. The MBRLC stresses the need to place hedgerow cuttings on the alleyways not only as a green manure but also as a mulch to conserve soil moisture. To do this the farmers are asked to practice zero tillage. An insulating mulch is made from hedgerow prunings and is a further step in erosion control by stopping rain from churning up soil from raindrop splashes. The mulch suffocates weeds.

World Neighbors, on the other hand, allows tillage by plow but would ask the farmers to construct canals on the uphill side of each alleyway at the base of the terrace wall. The contour ditch canals are directed uphill to allow maximum infiltration and minimal scouring action from fast run-off water. Farmers are also encouraged to construct soil pits along the canals to trap soil.

System Economics

Hedgerows should be placed less than 6 m apart. If further apart there would not be sufficient biomass to adequately improve soil fertility. The legume-based hedgerow would generate 30 tons/ha of green biomass (wet-weight) per year. The MBRLC staff shun the use of grasses such as napier on the hedgerow as they want to see nitrogen fixing legumes in their place. They maintain that these legumes produce a superior livestock feed than napier or other grass. World Neighbors on the other hand recommend the use of grasses such as napier as forage.

Studies by MBRLC showed yield increases in corn production from a base of 1.2 t/ha with no fertilizer or green manure to 2.5 t/ha with Leucaena green manure and 4.4 t/ha with commercial inorganic fertilizer (100 kg N, 50 kg P, and 50 kg K/ha).(MBRLC 1992). These results show that conservation farming with green manure nutrient recycling does not produce a maximum yield of almost four times the yield without inorganic fertilizer but a more sustainable yield double that from eroded soil and at no cash cost.

Costs and returns were computed from a 1 ha demonstration farm. The period 1980-89 showed low initial income (rising from $160-600/ha) as it takes several years for the conversion as in converting from conventional to organic farming (Tacino 1993). The average annual income for a farmer near MBRLC is $200 with farmers

having more than 1 ha. The results showed that those farmers adopting SALT can potentially triple their income from corn production after the transition period, in this case from 1984-89.

MBRLC has developed three farming systems based on SALT. The first is SALT-1 which is the planting of subsistence crops in the alleyways. SALT-2 is the planting of forage crops for livestock. SALT-3 is the planting of cash crops such as fruit and timber trees or vegetables. Farmers first master SALT-1 before moving on to SALT-2 or SALT-3. The Department of Agriculture has copied the SALT-1 technology and renamed it HALT for Hilly Agricultural Land Technology. The term has not caught on as most farmers are familiar with the term SALT.

APPENDIX D

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Leonardo D. Angeles, Forester and Exec Dir. PWPA
Ricardo Santiagor, Senior Vice President, Paper Industries Corporation of the Philippines, (PICOP).
General Pedro Dumol, private tree farmer

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