SOIL AND WATER CONSERVATION PROGRAM
FOR NORTHEAST THAILAND
PROJECT OBJECTIVES, DESIGNS, AND STRATEGIES

A Report to USAID/Thailand

by

U.S. Soil Conservation Service and Thai Team

As a Component of

THE RAINFED AGRICULTURAL INTENSIFICATION PROJECT (RAI)

October 20, 1982

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POLITICAL TERMS AND MEASUREMENTS

Terms

Changwat	=	Province
Amphoe	=	District
Tambon	=	Canton/Township
Muban	=	Village

Currency Equivalents

US$1	=	Baht 23.00
Baht 1	=	US$ 0.04

Area Equivalents

1 rai	=	0.16 hectares (1,600 m^2), (0.4 acre)
1 hectare	=	0.25 rai (2.47 acres)
1 meter	=	3.3 feet
1 cu meter	=	1 metric ton
100 cc	=	1 meter

ABBREVIATIONS

DLD	-	Department of Land Development
KKTC	-	Khon Kaen Training Center
LDC	-	Land Development Center
MOAC	-	Ministry of Agriculture and Cooperatives
NERAD	-	Northeast Rainfed Agricultural Development
NESDB	-	National Economic and Social Development Board
PCC	-	Provincial Conservation Committee
RAI	-	Rainfed Agricultural Intensification
RFD	-	Royal Forest Department
RTG	-	Royal Thai Government
SMS	-	Subject Matter Specialist
USAID	-	United State Agency for International Development
USDA-SCS	-	United States Department of Agriculture - Soil Conservation Service
USLE	-	Universal Soil Loss Equation
VCG	-	Village Conservation Group
VSC	-	Village Soil Conservationist

ACKNOWLEDGEMENT

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We owe a debt of thanks to USAID for the efforts by Mr. Donald R. Mitchell and Mr. Det Trisahd to insure we had the support and facilities needed to carry out the project design. They both have a broad knowledge of the natural resource needs and the farmer status of the Northeast. They gave unselfishly of their time and energy to the team effort.

We would like to express special appreciation to the USAID secretarial staff of Khun Rarintip Smittipong, Khun Salilak Kosinanondh and Khun Vibul Chim Chome for their hard work, patience, and consideration of a "rushed" team. Khun Rarintip Smittipong spent long days and worked weekends typing complicated tables and many drafts.

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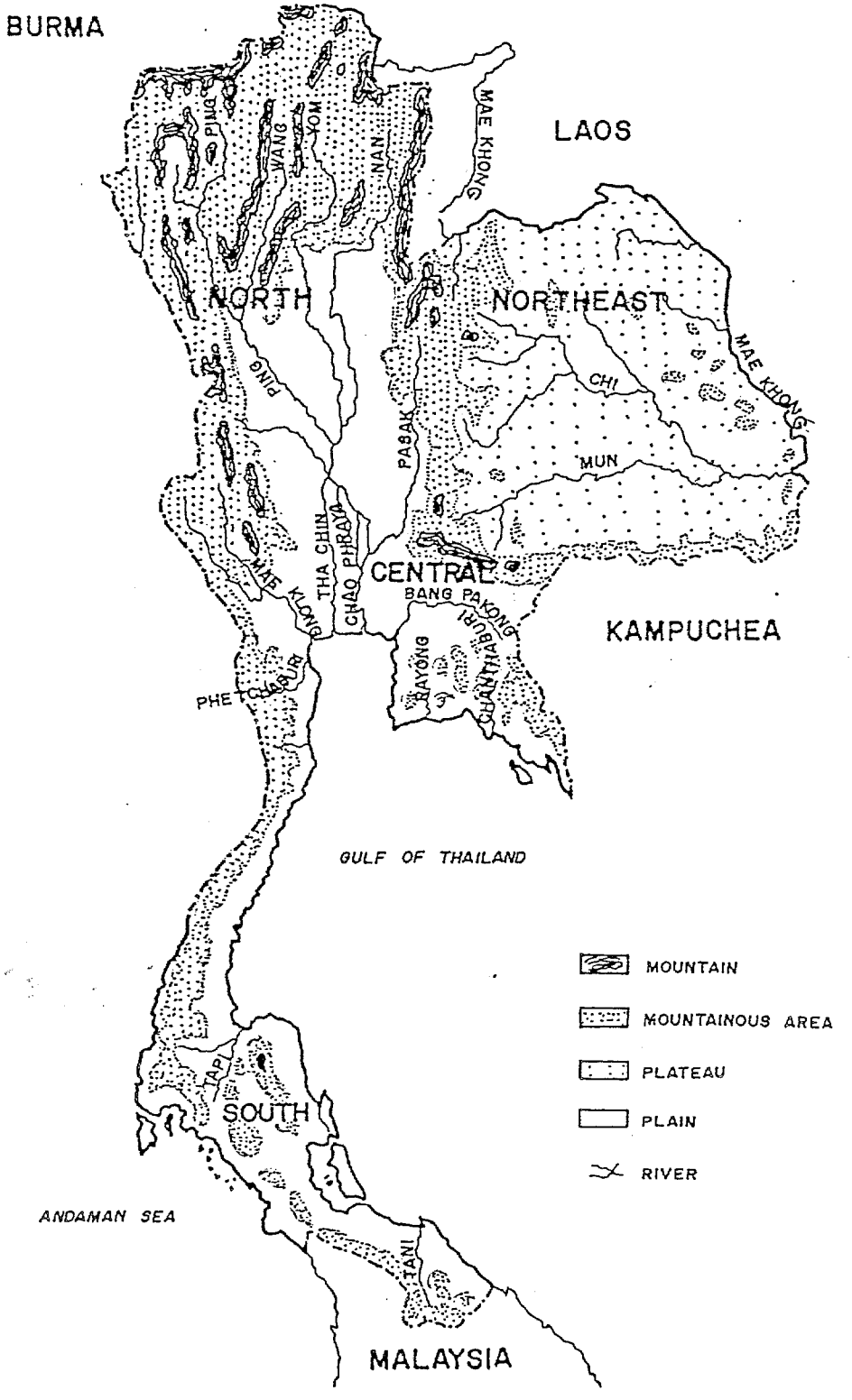


I. EXECUTIVE SUMMARY AND ISSUES

Executive Summary

Thailand is one of the world's leading exporters of agricultural produce--fiber and food crops. The value of these exports was over 40.0 billion Baht in 1979. This foreign exchange income, badly needed to finance the needs of the nation, is achieved at a cost to the resource base. With the exception of rice, an important part of these export crops are produced in the Northeast and has resulted in widespread deforestation. Much of the cleared land has been planted to cassava and kenaf--both stemy crops that provide little protection to the soil. It is currently estimated that an annual average of 14 tons of soil per rai is eroded from the 40 million rai of cropland in the Northeast. On some of the steeper slopes 40 tons/rai/year is lost. An acceptable rate of soil loss is considered to be about 3 ton per rai annually--a rate at which the soil base can be maintained productively with good farm practices.

Clearly, soil erosion losses in the Kingdom as a whole and the Northeast in particular, are so severe that action must be taken to protect the valuable resource base. The project envisioned in this proposal is designed to make a major impact on changing farming practices and installing appropriate soil conservation practices that will measurably reduce soil losses in targeted project areas.

The project, as planned, has a 5 year life, but it is expected that institutional capacity of the Department of Land Development will be sufficiently strengthened for the program to rapidly expand in the Northeast and the rest of the nation.

Over the life of the project it is planned that a 7-person USDA/SCS team, headquartered at the Khon Kaen Land Development Center will work with the Department of Land Development in providing a combination of classroom and on the job training for 60 mobile teams who will initially assist the

selected villages to plan and implement a village resource management program. A village soil conservationist, a village resident, will be identified, provided training and will work with the mobile team during planning and application of conservation program, but more importantly he will assist with maintenance once the practices are installed.

The major focus of project activities will be in the Lam Pao Dam watershed predominantly in the large sugarcane, cassava and kenaf growing area along the Khon Kaen - Udon provincial boundaries. The second project site will be the Lam Takong Dam watershed mostly in Pakchong district of Korat Province. Capacity of the reservoirs behind both of these dams is being reduced annually as the soil lost in the upper farm land washes into them.

USAID funding needed for the planned project is $1.9 million for technical assistance and training; $2.16 million for equipment and supplies. A cost-share program where the Thai Government pays 80 percent of the construction costs and the farmer 20 percent (mostly labor and in kind costs) will require 338.7 million Baht or 14.5 million dollars. It is recommended that these costs be provided under the USAID loan although these costs could be jointly borne by USAID and the RTG. During this period the RTG will have administrative and other project costs totaling 852.7 million Baht.

At the end of the 5 year project it is anticipated that villagers will have a resource management system in operation with a follow-up maintenance program on a total of approximately one million rai of farm land. Within the mini-watersheds it is expected that a measureable reduction of soil loss will be found. An increase in crop yields and subsequently an increase in net returns to the farmer will be noted the first crop year following application of the conservation practices. By year six, positive benefit returns exceeding all project costs, will be achieved. The internal rate of return over the 15-year evaluation period is estimated at percent and the benefit cost ratio of the 852.7 million Baht expenditure is 5.2:1.

Issues

1. The establishment of the soil conservationist's position is important for greatly reducing the discipline stratification. This would allow for one technical person to completely address the soil erosion problems and concerns on individual farms. Civil Service Commission approval of the Soil Conservationist position should be obtained before project authorization.

2. The transfer of a large number of existing DLD positions from LDC's and Bangkok to the mobile team sites is a necessity to train and staff the required number of mobile teams. The first 25 trainees should be selected from the current mobile units to the extent possible in order for them to have had as much field experience as possible. These employees should be identified in the pre-authorization period.

3. Cost share funds, regardless of their origin, are necessary to provide the financial assistance to the many subsistence-level farmers whose lands need protection from soil erosion. Source(s) for cost-share funding should be identified.

4. The project period must also represent a period of transition, where the use of DLD's heavy equipment in the construction of soil conservation practices will be replaced by private contractors and by the farmers themselves using small, garden-type tractors, animal-power equipment and hand-held tools.

5. Proper maintenance of applied conservation practices must be carried out at the village level under the direct supervision of the village soil conservationist.

II. INTRODUCTION

This project design presents the findings and recommendations of the Rainfed Agricultural Intensification Project team on the Soil and Water Conservation Component. The team consists of three USDA Soil Conservanion Service personnel; a Soil Conservationist, Economist, and Resource Conservationist; and two Thai Sociologists.

The mission of the team was to study the current national soil and water conservation programs, evaluate their effectiveness, and come up with ideas and recommendations for improving on the current program status. This effort was carried out in the 6 week period of September 12 through October 20, 1982.

Soil and water resource problems and needs of the Northeast were studied in the field along with researching many papers and studies which had been written on the subject over the past 15 years. The cropland erosion problems were found to be of frightening magnitudes and still accelerating. The soil loss, and the resulting drop in production, is one of the primary causes of the economic plight of the small subsistence farmer in the Northeast. This group makes up some 40 percent of the rural migrants to the Bangkok area each year.

The mission objective was to address the institutional capabilities of the Department of Land Development, and related departments in the Ministry of Agriculture and Cooperatives. Then determine their abilities and needs to develop and deliver technologies to meet the land and farmer needs in Northeast Thailand. The initial nine targeted project areas identified in this project will serve as a model and design for improving the soil and water conservation efforts throughout the Northeast and the Nation. The intent is to achieve a level of program success that will change the soil and water conservation project approach to a strong national program in which the government, public and the farmers understand and take pride.

The Team spent two weeks in the field studying resource problems, needs, on-going work, and accomplishments in the Northern, Northeastern and Eastern parts of the country. Team visits were made with:

DLD Land Development Centers and Mobile Units
Land Resettlement Projects
Land Reform Projects
Salinity Research Station
King's Royal Forest Project
Thai Danish Farm and School
Thai-Australian Northern Agricultural Development Project
Kaset Amphoe
NERAD Project personnel
Khon Kaen University
Village meetings
Farmers (220 were interviewed)

Two helicopter resource reconnaissance flights were made of the North and Northeast sections by the courtesy of the Border Patrol Police and the Royal Thai Air Force. The assistance and courtesies shown the team by DLD, USAID and others has been outstanding and enabled this project paper to be developed in a short period of time.

III. PROBLEM

A. Magnitude of Soil Loss

2 THE NATION REVIEW/feeling the pulse of Thailand Sunday, October 10, 1982

LOCAL & REGIONAL NEWS

Mostly farmers from Northeast

Economic difficulties force mass migration

BETTER JOB prospects and fast industrial developments attract more than 120,000 rural migrants – mostly from the Northeast – into Bangkok every year, according to a monthly journal of the National Economic and Social Development Board (NESDB).

The "Economic and Social Journal" said the mass migration was mainly caused by economic difficulties in the upcountry, particularly among farmers in the Northeast who make up over 43 per cent of the migrants.

It said the migration was mainly responsible for the birth of slums now sprawling the cities. There are now 336 slums in 18 districts of Bangkok with a squatter population of over 800,000, the journal said.

The journal, in its comprehensive report on rural labour, said 56.2 per cent of the over 120,000 people moving into Bangkok annually are "seasonal migrants" who are looking for additional income after their harvest season.

It quoted a report of the National Statistics Office (NSO) as showing that the number of rural migrants arriving in Bangkok in 1981 was registered at 122,267 with 84,295 of them being considered as part of the work force.

Though most of the migrants hope to remit their earnings to their families in the respective provinces, less than 60 per cent of them are found to be able to do so, it said.

The journal said 30 per cent of those who can afford to send home some money can do so at less than 500 baht at a time.

It gave two primary reasons for the failure: Firstly, most of the migrants have no income surplus because of the high cost of living and secondly because they cannot afford to raise their own standard of living.

The majority of the migrants, it said, normally are informed of job prospects before they set off for Bangkok. It quoted a report of the NSO as saying that 38.7 per cent of the migrants come to Bangkok at the persuasions of friends and 26.3 per cent make contracts through relatives and 24.2 per cent make direct contacts and another 3.8 per cent through job placement firms.

Only 0.4 per cent of the migrants contact the Labour Department for its job service, it said.

Of the 122,267 migrants moving into Bangkok last year, 43.6 per cent were from the Northeast, 34.3 per cent from the Central Plains, 13.9 per cent from the North and 8.2 per cent from the South.

It said the fertile lands in the North and South apparently explain their low number of migrants into Bangkok.

III. PROBLEM

A. Magnitude of Soil Loss

Soil erosion is Thailand's most serious natural resource problem. Soil, the foundation of agriculture, is being lost at an alarming rate. A Department of Land Development September 1980 publication, entitled "Soil Erosion in Thailand" indicates in the northeastern region, the rate of soil erosion ranges from 110 to 508 tons per rai per year on most crop land except lowland paddy where the rate of soil erosion was estimated at 5 tons per rai per year. Two and one-half centimeters of soil over one rai is equal to about 60 tons of soil. The above soil erosion rates indicate 5 to 20 centimeters of soil are being lost annually from much of the land in the Northeast.

This insidious loss of soil to the farmers in the Northeast is a problem that will keep them poor and unless adequately addressed. The farmers are poor and cannot afford commercial fertilizers to replace lost nutrients. As the top soil is washed away, organic matter is lost, the soil structure is destroyed and the ability of the soil to retain moisture is greatly reduced making rainfed agriculture even more dependent on rainfall patterns. Production per rai has decreased and is expected to continue to decrease as the massive soil erosion continues to take its toll.

The soil erosion problem is not confined to Northeast Thailand. Mr. Anunt Komes, the Director General of the Department of Land Development, Ministry of Agriculture and Cooperatives, in his Soil and Water Conservation Project Fiscal Year 1982-1986 Plan dated September 1981 points out:

1. Agriculture is important to the economic and social development of the country. Soil is the basis for agriculture. Good agricultural soils are being converted to urban uses at an alarming rate. Soils, poorly suited for

upland crops, are being cleared of trees to expand production. These areas produce some of the highest soil losses in Thailand. Soil loss has decreased yields and forced people off the farm and into the already stressed cities.

2. Soil erosion results in sedimentation of water courses and reservoirs. Sediment is costing the country millions of Baht annually in reduced reservoir capacity and clogged navigation channels.

The DLD Publication points out that 107 million rai, widely distributed throughout the country has rates of soil erosion ranging from a medium to a high degree of severity.

Table 1.1 Areas Affected with Soil Erosion in Thailand 1/

Degree of Soil Erosion	Area (million)	Land Use Situation
Very low	11,872	Forest, rubber, fruit tree, paddy
Low	9,028	Forest, rubber, fruit tree.
Moderate	2,591	New rubber, new fruit tree, upland crops, forest/upland crops
High	4,262	Upland crop, forest/upland crop
Severe	3,916	Upland crop, forest/upland crop, slash and burn practice.
Others	456	Water resources, rivers, shrimp farm, mangrove, beach, etc.
Total	32,125	

1/ Soil Erosion in Thailand, Department of Land Development, Ministry of Agriculture and Cooperatives, December 1980.

Over the past twenty years, over one million squatters have cleared and settled over 94 million rai of Royal Forest Department controlled lands. Most of this former forest land has severe limitations for rice and upland crop production. Because of Royal Forest Department Policy, the DLD is prohibited from assisting the squatters in establishing soil conservation practices. Observations made, during the September 1982 field study to the Northeast, showed wide spread soil erosion. Rate of soil erosion ranged from 20 to 50 tons of soil loss per rai per year on most land used for upland crops.

The average farm holding in the Northeast is about 25 rai. Rice is by far the most important crop of these farmers and all other crops are secondary though they may be more profitable. In recent years the expansion of kenaf and cassava production has moved into the cleared forest lands, while the rice land has remained intact. Fortunately the paddy lands have much less severe erosion, but the continued erosion of the uplands threatens paddies as the less fertile subsoil is washed down. Kenaf and cassava, popular upland crops, are stemy plants and do not provide adequate soil cover. Lands where these crops are grown have some of the highest rates of soil erosion in Thailand.

During the wet season farmers concentrate their livestock in upland areas causing over grazing and destruction of the vegetative cover. Soil erosion on these areas is severe. The team while visiting the Northeast made field observations and measurements utilizing the Universal Soil Loss Equation (USLE) Rates of soil erosion on over grazed pasture land ranged from 10 tons to more than 100 tons per rai.

Farmers, in an effort to meet family subsistence needs, have cleared steep forested areas for crop production. These slash and burn areas scar the hill sides over much of Thailand. Ten to 20 inches of soil

have been washed off from many of these hillsides. Farmers after a year or two must find new forests to clear as the productivity of these eroded hillsides will not meet their family needs.

Presently the resources dedicated to soil erosion control are totally inadequate. The approximately 90 technical people available to directly assist the 1.6 million farm families in the Northeast cannot begin to properly address the soil erosion problem. Farmers because of low incomes (many have negative incomes) need cost sharing assistance to help install conservation practices. Perhaps the most serious problem is the lack of public awareness about the urgency to bring soil erosion under control.

As Anunt Komes points out 90 percent of the country has been affected by soil erosion. Production per rai has decreased as soil erosion has increased. If soil erosion is allowed to continue at its present rate even new technologies may not be effective in meeting the nation's need for agricultural production.

Soil erosion represents a greater threat to the security of Thailand than any foreign power.

B. Institutional Capabilities to Meet Objectives of the RTG's Fifth Five-Year Plan (Strengths, Weaknesses, and Suggestions)

DLD has a good cadre of well trained, dedicated, and professional employees at the Bangkok and LDC levels. The department can be proud of its knowledge and data base on the nation's soil, watershed, land use, land capability, land classification, erosion problems, and overall resource needs. There appears to be enough support from all sectors to continue this level of quality and quantity of works at the national level.

There is a problem of technology transfer and use of information below the LDC level to on-farm application. The problem begins with lack of dissemination of technical information and know-how from Bangkok to the LDC's, and it worsens enroute from the LDC's to the farmer. Several reasons for the inability to get needed technology understood and applied are:

1. Approximately 49 percent of DLD personnel are working in position which have no direct contact with the farmers in the Northeast. This includes all levels except the LDC mobile units which actually do the conservation planning and application with the farmer. This should be reversed to have approximately 70 percent of the employees in direct working relationships with the farmers.

2. Services to the farmers are often performed in a top down, bureaucratic fashion. Such services remain a government effort with little farmers knowledge, appreciation, and participation. This was observed in the programs of the different agencies at the field level.

3. The civil service system places emphasis on the Bangkok and LDC management and professional level jobs. This causes them to be prestigious and much sought after, leaving little appreciation and continuity for the field jobs. Promotions are made in Bangkok, not in the provinces where the supervision is being performed. This issue needs to be resolved by both the DLD and Civil Service Commision.

4. There is insufficient monitoring and evaluation of costs versus benefits and of quality and quantity of work performed at the farm level by DLD programs studied by the team. Program managers need to develop and use this economic information in order for them to be effective managers of resources.

Other Donors

In the Northeast there are other donors to the resource efforts being addressed by the RAI project. The Thai-Australian Tung Kula Ronghai Integrated Project in the Chi-Mun rivers area is concentrating mainly on land resources in the flood plain. It is primarily a research effort in cropping patterns and land management.

The World Bank has a Rainfall Agriculture Pilot Project which is addressing farming systems and operations.

These two projects are developing information related to the RAI Soil and Water Conservation component in a helpful, but indirect manner. The team could find no donors or agencies which were addressing the soil erosion and land deterioration problem in the direct manner of supplying technical services to farmers in the form of conservation planning and application.

C. Farm-Level Problems and Constraints

The Northeast Thai farmer is faced with a large number of seemingly unsurmountable problems. He has little capital to invest in technology or innovations which would improve the crop yields on his farm. Even if he has baht available he is reluctant to try something new and untried. The willingness to apply conservation practices on his lands falls into this category. The proposed program has thus been built around the concept of working with farmers "on the ground" during the planning process, letting them provide "in kind" contributions during the application stage, and making follow-up visits by the village soil conservationist.

IV. ENVIRONMENTAL CONCERNS

The project addresses the soil, water, and related resource needs in Northeast Thailand. The planned resource management systems, applied in the form of best management practices, will have positive effects and benefits on the land resource base, water quality, wild life, air quality, and the overall living environment.

The project team could find no negative environmental impacts in the design and none are predicted from carrying out the project.

V. SOCIAL ANALYSIS

A. Social Soundness

1. Introduction

Thailand is a typical developing and agricultural country in which a great majority of its population live in rural areas. Among the four major regions in the country, the Northeastern region is the poorest and most populous. The region is well known for its having the highest rate of fertility, mortality and out-migration. This makes it the most strategic region in terms of national social, economic and demographic development.

Northeast Thailand has an area of about 170,240 square kilometers, or 33 percent of the national area. The Mekong River on the North and East, the Phanom Dongrak escarpment on the South, and the Phetchabun ridge on the West. The area has an average density of 92.8 persons per square kilometer. The lowest density is found in the mountainous northwestern part of the region, Changwat Loei, where it is about 38.6 persons per square kilometer (Figure 5.1). The highest density is in the central part of the region, on the Mun - Chi river basin. (Table 5.1).

Within the 16 provinces (Changwats) of the Northeast, there are a total of 193 districts (Amphoes), 3 sub-districts (King-Amphoes), 1,981 counties (Tambons) and 20,828 villages (Mubans) (NESDB, 1980). The average village in the region is comprised of 710 people and 105 families, most of whom live in a nuclear family.

Figure 5.1 Population density by province in the Northeast region of Thailand, 1982

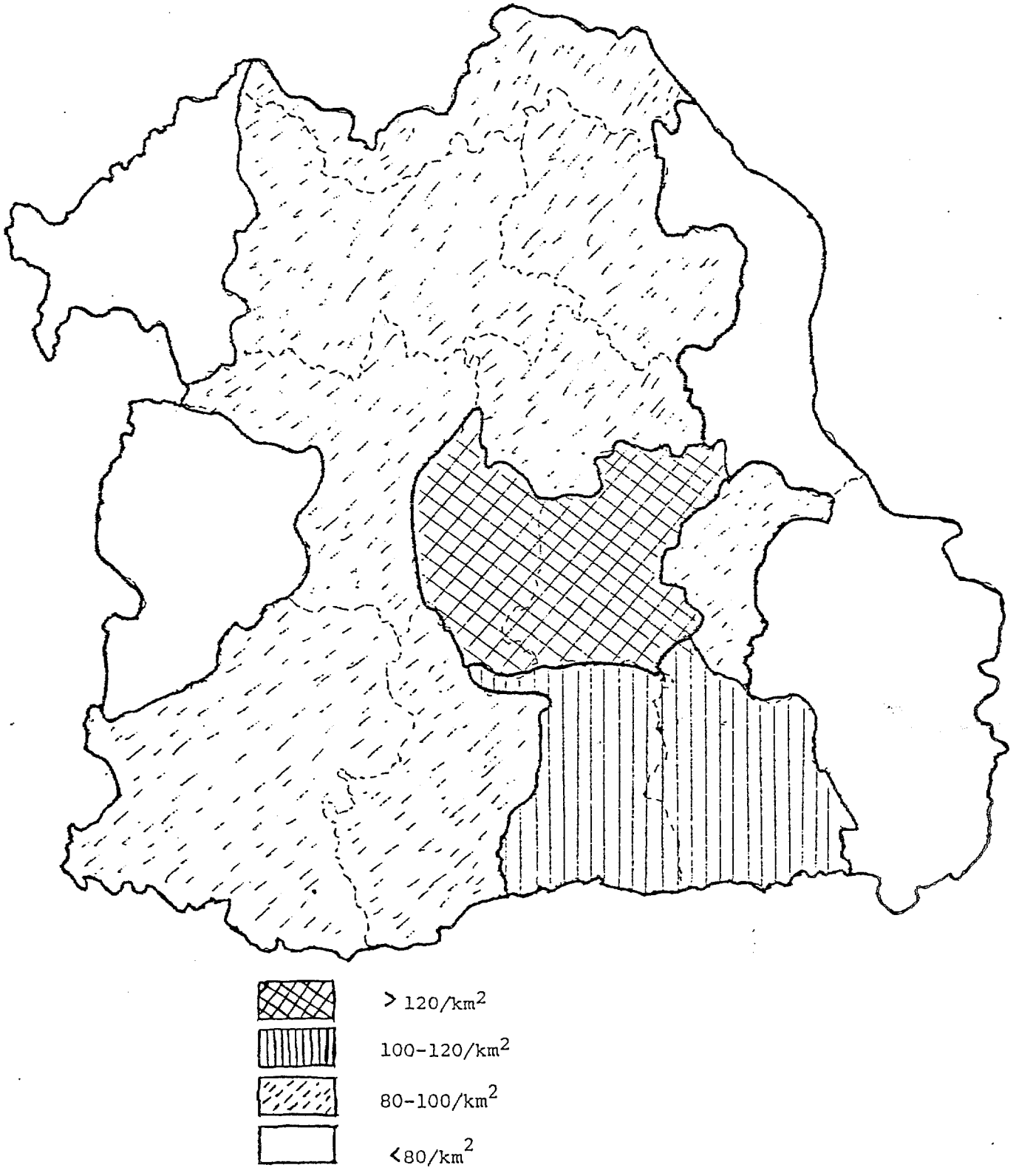


Table 5.1 Northeast Thailand Population, Percent of the Municipal Population, and Population Density, by Provinces, 1979.

Northeast Provinces	Population	Share of Municipal Population (%)	Population Density (per square km)
Northeast region	15,792,825	4.3	92.8
Kalasin	741,969	2.9	106.8
Khon Kaen	1,328,835	7.6	122.1
Chaiyaphum	839,384	2.4	65.7
Nakhon Phanom	745,390	3.8	75.7
Nakhon Ratchasima	1,886,192	5.9	92.0
Buri Ram	1,107,818	2.2	107.3
Maha Sarakham	751,657	4.3	142.0
Yasothon	451,901	4.1	108.6
Roi Et	1,044,411	2.9	125.8
Loei	441,127	3.3	38.6
Si Sa Ket	1,066,287	1.8	120.6
Sakon Nakhon	765,620	3.2	79.7
Surin	1,001,075	3.3	123.2
Nong Khai	661,090	3.7	90.2
Udon Thani	1,429,128	5.6	91.7
Ubon Ratchathani	1,530,941	6.0	81.1

Source: Ministry of Interior, Population Registration Data, 1979

2. Population

Approximately 85 percent of the population live in rural areas where agriculture provides the major source of income and constitutes about 75 percent of employment (Bank of Thailand, 1979). In 1971, when the population of Thailand was 36.2 million, the Northeast ranked second to the Central region in terms of percentage share of the country's population. But by 1972 rapid population growth in the Northeast had brought the region to 33.9 percent of the total population, while the Central region had 32.5 percent. The percentage share of the Northeast increased to 34.3 percent in 1980 (Table 5.2). However, it is estimated that the percentage share will be reduced by the end of the Fifth Five Year Plan due to the Northeastern region's high rate of out-migration. (Prasith-Rathsint, et. al., 1981).

3. Population Growth Rate

Among the country's four regions, significant differences in demographic trends have emerged with regional rates of natural increase diverging substantially from the fairly uniform rate of 3.3 percent per year in the mid 1960's. The crude birth rate has apparently not fallen over the past decade, and the rate of natural increase is high. The structure of the population is beginning to differ among the regions, with the dependency ratio remaining constant or rising in areas such as the Northeast, and falling sharply in the North (Table 3.3).

The population growth rate as of 1982 in Thailand was reported by the Institute of Population Studies to be 1.8 percent annually. In contrast, the rate of growth in the Northeast is 1.7 percent. Much of this decline has probably been due to a variety of social and cultural conditions that seem highly conducive to the adoption of birth control methods.

Table 5.2 Percentage Distribution of Population by Region 1971-1980

Region	Calendar Year				
	1971	1972	1973	1974	1975
	(%)	(%)	(%)	(%)	(%)
North	21.71	21.15	21.17	21.22	20.83
Northeast	32.55	33.87	34.26	34.29	34.28
Central	33.17	32.51	32.23	32.17	32.86
South	12.57	12.47	12.34	12.32	12.53
Total	100.00	100.00	100.00	100.00	100.00
Total population (1,000)	36,193	38,359	39,950	41,334	42,570

Region	Calendar Year				
	1976	1977	1978	1979	1980
	(%)	(%)	(%)	(%)	(%)
North	20.81	20.78	20.68	20.59	20.42
Northeast	34.23	34.27	34.27	34.25	34.26
Central	32.30	32.67	32.70	23.76	32.92
South	12.33	12.34	12.35	12.39	12.40
Total	100.00	100.00	100.00	100.00	100.00
Total population (1,000)	43,214	44,282	45,222	46,134	46,961

Source: Department of Local Government, Statistical Yearbook(s), Bangkok. Ministry of Interior, 1972-1981.

Table 5.3 Crude Birth Rate by Region, 1972-1980

Year	Region				
	Central	North	Northeast	South	Total
1972	2.92	2.59	3.47	3.73	3.10
1973	2.67	2.43	3.37	3.17	2.92
1974	2.70	2.40	3.18	3.25	2.87
1975	2.57	2.18	2.96	2.97	2.67
1976	2.62	2.21	2.97	2.98	2.70
1977	2.30	2.02	2.78	2.57	2.44
1978	2.26	1.91	2.55	2.37	2.30
1979	2.24	1.95	2.58	2.53	2.33
1980	2.14	1.89	2.54	2.54	2.29

Source: Health Statistics Division, Ministry of Public Health, "Birth Statistics", (Mimeograph)

4. The Poverty Problem

Poverty in Northeastern Thailand has been defined in a number of different ways. For instance, the World Bank has defined it with reference to the total household income from all sources with a particular figure being taken as the threshold of poverty. Government officials often equate poverty with remoteness of a segment of a populace from centers of services and marketing. There is something to be said for this definition: those who cannot avail themselves of access to markets, to secondary schools, to adequate public health services, to electricity, and so on do live lives that are deprived when compared with people who do have access to these services or markets, no matter what other characteristics they may have. Another cause of poverty that is commonly pointed to in the Northeast is inadequate water for both production and consumption purposes. Those who live in rainfed areas, outside of irrigation districts, and particularly those who are continually subject either to excessive flooding or drought are again deprived relative to those who have assured access to water. Regardless how the problem is defined, the Northeast is a poverty area.

Analysis of the poverty problem over time shows that the incidence of poverty in rural areas has declined substantially since the early 1960's from 61 percent in 1962/63 to 35 percent in 1975/76. (Table 5.4). Three reasons have been given for this decline: (1) the increase in total cultivated area; (2) the increase in agricultural prices accompanied by the ability of some of the previously poor groups to switch into more profitable crops; and (3) increasing reliance on off-farm income opportunities.

Table 5.4 Incidence of Absolute Poverty*
By Region and Location, 1968-76

	Poverty as percent of population			% of poverty group
	1962/63	1968/69	1975/76	1975/76
	(%)	(%)	(%)	(%)
Kingdom	57	39	31	100
Urban	38	16	14	10
Rural	61	43	35	90
Northeast	74	65	44	50
Urban	44	24	20	1
Rural	77	67	45	49
North	65	36	36	23
Urban	56	19	18	1
Rural	66	37	34	22
Central Plains	40	16	14	9
Urban	40	14	12	1
Rural	40	16	15	8
South	44	38	31	12
Urban	35	24	22	1
Rural	46	40	33	11
Bangkok	28	11	12	6

*The absolute poverty line is defined as $100/year/person in rural areas and $150/year/person in urban areas (1975/76 prices).

Source: "Income, Consumption and Poverty in Thailand", World Bank Staff Working Paper No. 364, November 1979.

5. General View of Villages in the Northeast

The typical Northeastern village is clustered with home sites and fields surrounding them. Some villages have houses scattered along the road while other are in blocks. Houses are built of modified Thai design, 1.50-2.50 meters above ground, and have one room or more, a kitchen and a large open area. Most villagers do not have toilets in their houses. The size of the house and homesite depend on the economic status of the owners. Some have well-defined homesites enclosed with a fence and planted with fruit trees. Most houses of lower income families are built of bamboo, using dried grass for the walls and roofs. The better off villagers can afford houses which are built of wood and concrete block. Livestock are tied under the house. Most homes will have a bed under the house for added comfort.

Only some households have vegetable gardens. There is no public market in the village, except a small store where household necessities and food are sold. Most of the villagers go to town or district centers for their supplies. The social centers in the village are the local temple, school, and village hall. Some small villages have no local temple or school, having to share with other larger villages.

Agriculture is the most important sector (91.0 percent) in the Northeast in terms of occupation (Table 5.5). Non-agricultural labor is in services, commerce, and manufacturing activities; 3.7, 2.3 and 1.4 percent, respectively.

Glutinous rice cultivation occupies most of the northeastern farmland, with only a small amount used for non-glutinous rice production. Almost half of the farmers now grow cash crops such as, cassava, kenaf, corn, tomatoes, sugarcane, peanuts and tobacco. They are also involved in livestock raising, silk-worm raising and silk weaving.

Many villagers still make many of their own utensils out of bamboo and rattan, weave some of their own clothes, and produce their own charcoal. Throughout the region, there are some villagers who are also able to supplement family income by producing such craft items as silk, rattan mats, and other utensils such as pots. There are also a growing number of villagers who are skilled mechanics, radio repair persons, carpenters, etc., although few such villagers make their primary income from the exercise of these skills. A major source of supplementary income for many farm famlies--perhaps most in the lower Northeast--are the jobs found in Bangkok and other places outside the region by villagers who become temporary migrants.

Table 5.5 Distribution of Northeast and whole Kingdom occupation in 1970

Occupation	Whole Kingdom	Northeast
	(%)	(%)
Agriculture	77.8	91.0
Mining	0.5	0.05
Manufacturing	4.3	1.4
Construction	1.2	0.3
Electricity	0.2	0.04
Commerce	5.6	2.3
Transportation	1.8	0.8
Services	7.7	3.7
Others	0.0	0.4
Total	100.0	100.0

Source: Population and Housing Census, 1970.

6. Sub-Regions and Farmer Profiles

The Northeast has been divided into three sub-regions; Upper-Northeast, Mid-Northeast and Lower-Northeast.

The Upper Northeast consists of Udon Thani, Nong Khai, Sakon Nakhon, Nakhon Phanom, and Mukdahan.

The Mid-Northeast consists of Nakhon Ratchasima, Chaiyaphum, Khon Kaen, Kalasin, Maha Sarakham and Roi Et.

The Lower Northeast consists of Buri Ram, Surin, Si Sa Ket, and Ubon Ratchathani.

In the Upper Northeast, a typical farm household is a nuclear family in which four of the six household members will be engaged in agricultural work. Most holdings are about 25 rai with the main occupation growing glutinous rice for the family's own consumption. In the rainy season lower paddies are flooded and planted first. Cultivation of paddies further up the slopes proceeds steadily as the rainy season continues, with the upper bunded fields often not being cultivated because of inadequate rainfall.

The Northeastern farmer keeps some chickens for the family's consumption and sale and has one or two buffalo which are used primarily for farm work, such as ploughing. Planting and harvesting rice uses family and exchange labor. Hardly any cash inputs are used, production techniques remain unchanged with the farmer using animal rather than mechanical power (except on irrigated land which is only 5 percent of the Northeast's arable land area), and the household continues to rely on family and exchange labor.

In the slack agricutural season there is an increase in non-agricutural activities such as house building, wood chopping, road construction, charcoal making, fishing, etc., all of which are important sources of cash income. The Upper-Northeast has the largest porportion of farmers growing nothing but rice, although in the Northeast as a whole about half the farm households are in a similar situation. They also have an absence of adequate services, and the long distances to main markets are the major reasons for their being unable to break out of what is basically subsistence environment, at least in terms of their farming operations.

In the Mid-Northeast, over half of the farmers now grow an upland cash crop such as cassava. However, the typical farmer still plants enough rice for the household's own consumption and, indeed, will continue to forego other employment and income opportunities in order to plant and harvest this rice crop. They make a net income which is about 45 percent higher than the corresponding income of a typical farmer in the Upper-Northeast mostly due to additional earnings from upland crops. Some of this is from non-farm employment. Contractors frequently carry out tractor ploughing of the upland areas. Credit from merchants and other middlemen, as well as from banks is frequently used.

In the Lower-Northeast, where much of the population is of Cambodian origin, households have been subject to much the same forces that have determined agricultural development in the rest of the region. To a large extent they have been able to diversify into upland crops (kenaf) and produce rice surpluses and market livestock. Most of the roads were built for military purposes, but they have also assisted upland crop development.

In addition to farming, other occupations bring in small amounts of income. These include gathering plants, boiling and drying salt, gathering wood, making charcoal, raising silk worms, fishing, making leaf torches, catching frogs, making lime from the ashes of snails and shellfish shells, etc. Normally, the household is involved in only one or two of these occupations. The Lower-Northeast has a long tradition of seasonal

migration, and at least one member of the household is likely to be away in the off-season, most probably in Bangkok.

7. Land Utilization

Apart from small amounts of land used as people's residences, temples, schools, and roads, most of the village's land is used for agriculture. Typically, the low lying land will be used for glutinous rice farming, mainly for family consumption. If there is some surplus it will be kept for the next year or sold. The upper land will be used for crops such as cassava, kenaf, maize, sugarcane, peanuts, and tobacco. These crops are the most important sources of cash income for villagers.

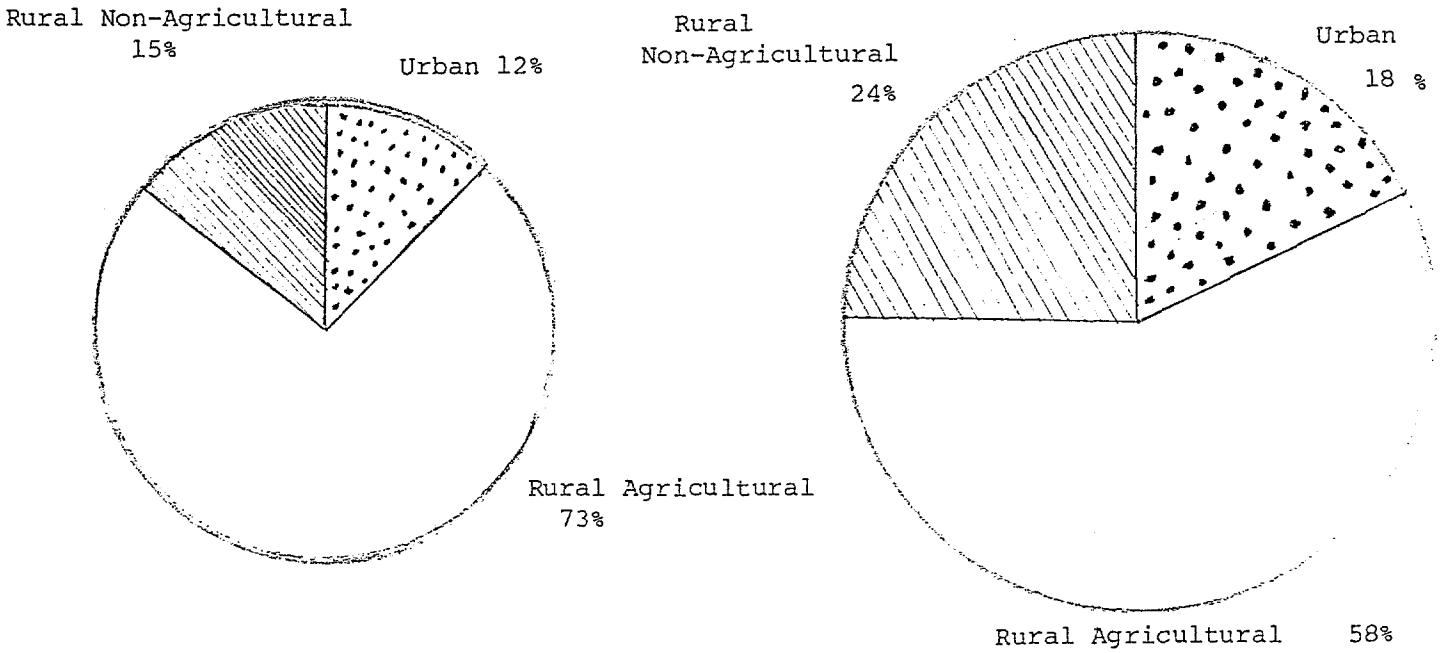
8. Rural-Urban Distribution

Since 1960, urban population has been growing at nearly 5 percent annually. The proportion of the country's population in urban areas increased from 12 percent in 1960 to 18 percent in 1976. Despite the apparently large percentage increase, because of its small absolute size, the rapid growth of urban population has had little impact on the size of rural population, and the majority of people in Thailand continue to live and work in rural areas.

The Thai population can be drawn as three large groups (Figure 5.2). The urban household, the smallest group, was 12 percent and 18 percent of the total in 1960 and 1976, respectively. The largest group, rural agricultural, was more than half of all households, 75 percent in 1960 and 58 percent in 1976.

The Northeast still remains overwhelmingly rural particularly when compared with the country as a whole. In 1976, 95.7 percent of the population of the Northeast resided in rural areas, and the agricultural households of the region accounted for 40 percent of all agricultural households in kingdom (World Bank, 1980).

Figure 3.3 Distribution of households
1960 and 1976



1960

469 Million Households

1976

782 Million Households

9. Sub-groups

Most of the Northeasterners speak the Northeast dialect and consider themselves to be culturally distinct from the rest of the country. The majority of the population belong to the Phaw-Thai (Thai-Isan) who migrated from Laos and the left bank of the Mekong River over the past few hundred years (KKU-Ford Cropping Systems Project, 1980). The Thai-Isan point to a variety of cultural practices which separates them from the rest of Thailand. They have, for instance, a distinctive language, a diet based on glutinous or sticky rice, minced meat, green papaya salad, and fermented fish. Their musical tradition includes use of the polyphonic mouth organ called the Khaen, and a type of singing as molam (Keyes and Thandee, 1980).

The Northeastern area is made up of five distinct sub-groups, the largest being the Lao-Wieng who live in the center and the Northeast of the region. The second largest group are the Thai Korat who constitute at least half of the population of Nakhon Ratchasima province. Furthermore, the region has nearly half a million Khmers in the southern part of the region, and 85-100,000 recent Vietnamese migrants who have settled in the towns or large villages. Lastly, there are Chinese merchants and Indian businessmen who are in most of the towns and large villages.

Mizuno (1968) in describing the inheritance pattern among northeasterners, stated that as a rule sons do not inherit farm land. Instead, they get bethrothal money and one or two buffalo or cattle. Sons marry out and daughters remain at home after marriage. The young men usually acquire land by marrying or by opening up forest area. The youngest daughter and her husband are expected to stay in the parents' home and look after them until they die. In turn, they then inherit the house and paddy land. However, if the amount of farm land available is large enough other sons may inherit shares as well.

The family system of the Northeast traditionally emphasizes both matrilocality and matrilineality. With this pattern, women become the

predominant force in the control of property in all activities. The division of labor between sexes is relatively minimal since either sex can do any job if necessary. Thai women have been regarded as hard workers because they work both in the family and outside. Apart from housework and farm work, they also feed and look after livestock. Within the household, women participate in making all important economic decisions and often actually control the cash available to a family. However, most important decisions are shared by both husband and wife, and men tend to dominate outside the family. In summary, the role is at least equally important, and possibly more importance, than that of men, as women tend to monopolize marketing of fruits and vegetables produced on the family farm, and of fish that are caught by the men.

10. Migration

The out-migration rate from the Northeast is much higher than the immigration rates. Piampiti (1979), for example, mentioned that during 1950-1970 the Northeast had a net loss of about 111,000 people most of whom are young and economically active. Thus, their destination, Bangkok and other big cities, have gained this economically active population at almost no cost of human investment. Besides, Northeasterners can initially be hired at a relatively low wage rate. The large amount of out-migration from the Northeast will be an important demographic issue facing Thailand over the next decade. It is likely that the more predominant pattern of intra-rural migration, especially in settling new areas, may be offset by rapid increase in rural-urban migration especially in seasonal and other forms of back-and-forth movement to regional cities. Such movements should increasingly involve Northeastern Thais (Goldstein, 1977).

11. Education

Almost every adult person in the rural Northeast has completed primary school (4 years), but less than ten percent have studied beyond the first four years. Usually the register head of household (the husband) has a slightly higher education than his wife. In 1977, a law on education was passed that requires at least 6 years of study. Informal discussions with villagers indicates that considerably more emphasis is being placed on advanced education today than just a few years ago.

From data of National Statistical Office (1981) it is indicated that the Northeast regional population in 1981 was 16,993,400 and the school age population (age 4-24) for the Northeast was 8,350,800. The percentage of school age population to the whole population was 40.9 percent for the Northeast in 1981 compared with 40.7 percent for the whole Kingdom. However, while most villages have their own primary school, other villages have to share one with nearby villages. There are 1,053 secondary schools, mostly in the province or district centers. The institutes of higher education are shown in Table 5.6.

Table 5.6 Institutes of Higher Education in the Northeast

Institutes	Degree offered	Number
1. University	Bachelor and higher	2
2. Teacher Training College	B.S. and higher teaching certificate	6
3. Teacher Training College	Higher teaching certificate	2
4. Physical Education College	Higher vocational certificate	3
5. College of Technology and Vocational Education	Secondary education certificate & higher vocational certificate	4
6. Vocational College	Higher vocational certificate	17
7. Agricultural College	High vocational certificate	8

Source: KKU/FORD Cropping System Project. 1981. "An Agroecosystem Analysis of Northeast of Thailand", KKU, Khon Kaen.

12. Income

Besides, growing rice for family consumption farmers in the Northeast clear some forest or use some other land to grow upland cash crops if it is available. Income from the new upland cash crops, usually kenaf and cassava, has raised the income of the typical farmer about one-third to a half. But, nonetheless, per capita income in 1977 in Northeast was only $112 as compared to the national average of $226. In addition, some villagers living near rivers and other bodies of water catch fish to sell and trade. There is also a surprising amount of wild plants, insects, snails, frogs, gingka, etc. collected to use as food or trade.

Buffalo and cattle serve as a savings bank for farmers. Therefore, the number of cattle and buffalo can be viewed as an indicator of farmer capability to cope with their socio-economic setting.

13. Health and Nutrition

The health status of Northeasterners can be evaluated by studying death rates in comparison to other regions. The Report of Health Statistics (1975) shows a higher death rate in the Northeast than other regions prior to 1973, but since then its rate has been the same as other regions.

Health in the Northeast is served by two major hospitals; Nakhon Ratchasima and Khon Kaen. Each province also has a hospital and at the sub-district level there are public health stations. Most villages, however, are only served by volunteer medical-care villagers, and by Medical Service Mobile Units. They also get some medicine from drug stores.

Malnutrition among Thais continues to be a health problem arising from low levels of income, lack of nutritional education, high birth rates, certain taboos, and customs resulting in their food habits (Kieatviboon, 1981). The degree of malnutrition varies from place to place

but, overall, most affected groups are the people in the rural area. In rural Northeast, the main source of protein and other vitamins is from vegetables and other non-animal protein sources such as fresh, fermented, and dried fish.

14. Mass Communication

Northeasterners lack continuing access to relevant printed media. To a considerable extent, information that might be channeled through publications reaches villagers through the medium of radio. Even the poorest households have one. Now that electricity has reached many rural communities, television is also beginning to find a rural audience, but only to a very small group who can afford a set. A lot of information flows in, out, and within the villages by word of mouth, being transmitted by officials, traders, and people who have worked outside the villages.

15. Target Beneficiary

The typical target client is a rainfed agriculture farmer who owns 25 rai (4.0 ha.) of land of which about 20 rai will be in paddy land. There will be about 6-7 family members including one or two grandparents. They will have one rai on which the home and a garden is located. Farmers on areas with upland will also have some cassava and/or kenaf.

Beneficiaries are located throughout the Northeast. The majority of family heads will have at least four years of schooling in the Thai educational system. Average household income is about $800-900, about half of which is from rice while the rest is mainly from handicrafts, off-farm wages and cash crops. Family planning is now practiced by over 40 percent of the households. The vast majority of villages do not have electricity, but over 90 percent of the households have a radio.

Most households are within 3 or 4 kilometers of an all-weather (at least gravel) road. Formal organizations exist within the villages (temple, school, development committees, farmer's organizations, and cooperatives). Over 40 percent of the household head's belong to at least one of these formal groups. Many households have also participated at one time or another in "development" efforts, often under the "tambon council" fund program in building village roads, repairing bridges, etc.

The farming enterprise is risky both for crops and animals. Drought or less than satisfactory weather often reduce production, and disease causes widespread mortality in livestock. Because most farmers often have only one buffalo, and this is the exclusive source of draft power, loss of this animal can spell disaster for the family.

B. Micro-Social

The majority of the six villages visited are farmers. They live in a traditional society. Technologies were simple and scientific skills and knowledge were limited. Production was achieved through human energy and domestic animals rather than mechanical equipment. Water buffaloes were the only source for powering tillage equipment. Animal manure was used for soil improvement and soil conservation as proposed and practiced today was unknown.

Technological development, the process whereby better machines, mechanical power, and new scientific knowledge, must be introduced into the northeast as fast as possible. One area of scientific knowledge which is very important and necessary is how to help farmer to gain insight on how to conserve and improve their farm land.

1. Socio-economic Overview of Target Population

The typical target population is rainfed agriculture farmer who owns the land areas varying from 4-30 rai. Their farms consist of paddy and upland crop fields. The percentage of households having full ownership title is very high. They will have 1-2 rai on which the home and the garden is located.

Glutinious rice is grown for local consumption but upland crops such as kenaf and cassava are grown for cash crops. Water buffaloes are raised by almost every family. The better off families also involved in cattle raising, silk worm raising and silk weaving. Many villagers migrate to Khon Kaen city, Bangkok, and other urban places in the dry season in search of extra income.

Some of the general characteristics of farmers in the six villages visited are include:

- Labor utilization in the field is flexible, most of farmers work as hard as they are physically able, though many are in poor health.

- The majority of the villagers have four years of education. Most of them could read and write when first out of school, but they have lost these skills.

- The vast majority of villages do not have electricity, but over 95 percent of the household have a radio.

- In the six villages visited there was no village markets. There were however some small shops or retail stores selling household necessities.

a. The Farmer Psychosocial Structure

Farmers when confronted with new opportunities either "accept" or "reject" depending upon the basic cultural articulation of social relations economic possibilities, and psychological or psychosocial factors. The government has had many development programs to raise the standard of living of the people. Over the years a great deal of effort has gone into these programs. Most, however, lacked the right method of communication to reach the farmer's needs. Sometime the farmer perceived a program in a very different light from that of innovators, but usually they have accepted government programs, only for a short term gain and have not understood the long term values.

An effective soil conservationist must understand farmers and the way they think. He must develop a working attitude of "with" them and "for" them to become a successful change agent in the community.

b. A Village Soil Conservation Group Should be Formed in Every Village Taking Part in the Project.

The soil conservationist, community development, and agricultural extention agent should cooperate in assisting in forming the village soil conservation group. This strategy will help the farmers realize and become aware of the soil erosion crisis and how it effects him and his family's future.

Most villagers are interested in gaining knowledge in soil conservation to increase their productivity. The civil servant should bring the concept of self-help and self-reliance in soil management to them. The civil servant should also help the communities establish a "grass roots" self help approach to conservation.

An important additional step that the civil servant should take is to recognise the social structure of the traditional village society and the role of elite people in the community. They should be invited to be advisors or members of the village soil conservation group. People such as the Kamnan (Tambon), teacher, and the abbot of the temple are obvious candidates as these people always have much influence on the local population.

2. Knowledge of Soil Conservation

Based upon field trip observations, it was found that the villagers have limited knowledge of conservation. Even though, they have experience in using chemical fertilizer or "market fertilizer", most of them felt that using it will make the soil hard. However, they didn't understand why and how to improve their soil. In regards to their plowing, most of them indicated that they always did it "up and down". The reason given for up and down hill plowing, was they have never done it any other way. They believe that this way of plowing, will ensure the rain runs off easily and their land won't be flooded.

The farmers indicated they grew kenaf to sell. Most did not use green manure crops or understand its value. Their normal planting practice is to plant the same crop, repeating it again and again in the same field.

Most of the farmers never heard of the words "bench terracing" "cover cropping" or "crop rotation". It is obvious they lack knowledge about conservation. However in the interest of increased production, they indicated a willingness to have more of any kind of knowledge that would increase their income, especially as it related to agriculture production. Increased conservation knowledge is one of their most urgent needs.

3. Constraints to Farmers Acceptance of Conservation Technologies

The acceptance of conservation by the villagers depends not only on how it is explained, but on demonstrations of how to do it. The most important thing to a villager is a secure food supply. He will not try a new practice if he feels it may threaten this basic need. Those who plan the conservation practices must take this into consideration.

During visits to the villages in the Northeast, it was observed that the villager who follows conservation technology had better production. Those who did not understand and rejected conservation had problems in both their paddy fields and upland crop fields. The reasons farmers fail to practice conservation are: (1) they do not relate to the future they think only about the present year cycle of crop production; (2) the villagers did not make good decisions in chosing crops for production. Many follow their neighbor and they feel the economic demand to produce cash crops.

The above reasons make it clear that the villagers should have knowledge both in conservation and an understanding of the need for investment in soil improvement. Conservation should be an investment for a more secure future.

4. Soil Conservation Benefits

In order to raise the standard of living of the Thai people, the Royal Thai Government developed the Fifth Five Year Plan. One part of the plan is to improve the quality of life of the rural people, who make up more than 80 percent of the the population. Most people in rural areas are farmers, so the Royal Thai Government's primary aim is to assist them in achieving a better life through improved farming. This program is designed to reach the grass roots of the nation.

Soil conservation is not a new concept, it has been promoted for more than 20 years. Soil conservation is a tool of the farmers to improve their cultivated land. The Royal Thai Government is only an agent in assisting the farmer. Technically, if the farmer does not understand the resource problem, the government must take on the responsibility to see he is informed. Soil conservation is a way to help farmers understand the problems of soil erosion and to conserve and preserve the land for future generation.

Even though, most conservation benefits are unseen in the short term their long term benefits make farmer investments worthwhile. Villagers sometimes find it difficult to recognize conservation problems. It is the civil servant's responsibilities to show the benefits. Conservation is valuable to farmers in making money from increasing production and in helping to insure future yields.

5. Problems of Civil Servant

In dealing with large numbers of farmers the civil servant will encounter many problems. The LDC officer, who works side by side with the farmer is faced with many demands, the same as any other government officers.

One common limitation of LDCs is a lack of manpower and mechanical equipment. There are too few officers at each LDC, and most of the equipment presently owned by LDC is either out of date or worn out. Because of the limited manpower, it is difficult for LDC's to expand their work to farmers and villagers who request assistance in controlling soil erosion.

There are other limitations facing LDCs, such as lack of budget for per diem, gasoline, etc. These limitations prevent LDC officers from giving the level of assistance they are capable of providing. There is a lack of a follow-up program and this has resulted in many conservation practice failing because the farmer forgets to provide the needed practice maintenance. The LDC officer does not have enough time for supervising and following up on conservation work. They should spend at least 25 percent of their working time for follow-up activities.

In addition to the above LDC limitations, farmers have their own belief which sometimes impedes conservation work. They may disagree or reject the LDC officer's knowledge. It is sometimes difficult to convince and get individuals or groups of farmers to accept conservation. However, informing and helping the farmer gain an understanding of the need for conservation is the best way to strengthen LDC capabilities and increase farmer participation.

The LDC should keep records of what it has done for a farmer and make an annual report of all their activities in problem solving. They should have official forms for records and reports that show progress in servicing farmers and progress in bringing soil erosion under control.

These records will be helpful in organizing/managing/and budgeting conservation work. The LDC should prepare informational sheets on maintenance for each type of conservation structure and distribute them among its staff for use in working with farmers. Visual drawings that are easily understood are needed.

To strengthen the LDC technical and service capabilities, the LDC officers need regular training and updating on new technologies. They need to maintain a high level of knowledge and skill. Training should take place at least once each year.

To help overcome some LDC staff limitations the LDC should cooperate with other government officers such as Kaset Tambon, Community Development worker, teacher and so on in carrying out conservation activities. There should be joint training sessions for the LDC staff, the Kaset Tambon, the farmers, the teacher, the community development workers, and the village headman. The training can be carried out both in the formal classroom or by field trips. Training programs should help LDC improve its limited technical assistance in servicing farmers.

6. Constraints to Project Success

Social analysis indicates the success of soil and water conservation, requires an action program to persuade both the administrator and villagers to accept and understand values and goals of soil conservation. Second, there must be agreement on, and understanding of the operation roles of both administrators and farmers. Third, the administrators must realize that they, their technical colleagues, and the whole sociocultural system within which their programs are carried out are necessary. The analysis of culture and society of the people toward whom the program is directed is equally important. Fourth, the program director must recognize that the social scientist will need to assist in helping farmers envision their conservation roles and goals.

An understanding of psychological motivation is basic to planned change, yet change depends on much more than the presence of adequate desire to try something new. Motivation for conservation change must be strong and should fit local cultural, social and ideological values of the people. So the soil conservationist must find out what motivates farmers in conservation and learn how to use this force in getting conservation on the land.

In order to achieve maximum success in the conservation assistance program, it is essential to realize that barriers to change are at least as prevalent within the innovating organization as within the target group. The soil conservationist should have the human qualities or the adaptability to adjust to strange conditions. This is essential for successful work.

Even though, they are very expert in their professional soil conservation training, this is not by itself enough to be expected they will do a good job. The major challenge is to know how to adapt scientific knowledge operating techniques to the people. These are the tests he must pass if he is to be successful. So the successful technical expert is the one who has learned to be local problem oriented, not program oriented.

VI. PROGRAM DESCRIPTION

A. Philosophy of Approach

The international conservation philosophy is for countries to know their land resource base and use each unit of land within its determined capabilities and treat the unit according to its needs. There is a worldwide recognition of the need for a protected land resource base to insure a sustained production of food and fiber.

This philosophy is shared by the RTG and its people. The success of the RTG in carrying out the Fifth Five-Year Plan's objective to reduce absolute poverty in the nation and to accelerate economic development is tied directly to the land. Northeast Thailand has 1.6 million farmers from whose ranks come over 50% of the nation's absolute poverty cases.

Poverty is on the increase as the farmers deplete their land by allowing the soil to erode causing loss in crop production. This situation is most pronounced in the rainfed areas where eroded soil has less plant nutrients and water holding capacity.

The philosophy of this project design approach is a "grass roots" one. It is evident from field visits and studies that most Northeast farmers are aware of their production problems and want to do something to correct them. Many of them realize soil erosion is affecting their production and others need to be informed. This project approach is to staff the mobile units of DLD with trained conservationists and technicians then give them the necessary resources and delegation of authority to do the conservation planning and application job needed on the ground. Work with farmers will be on a one to one basis on the land. They will be given alternative solutions to resource problems and technical assistance to apply the needed conservation decided upon.

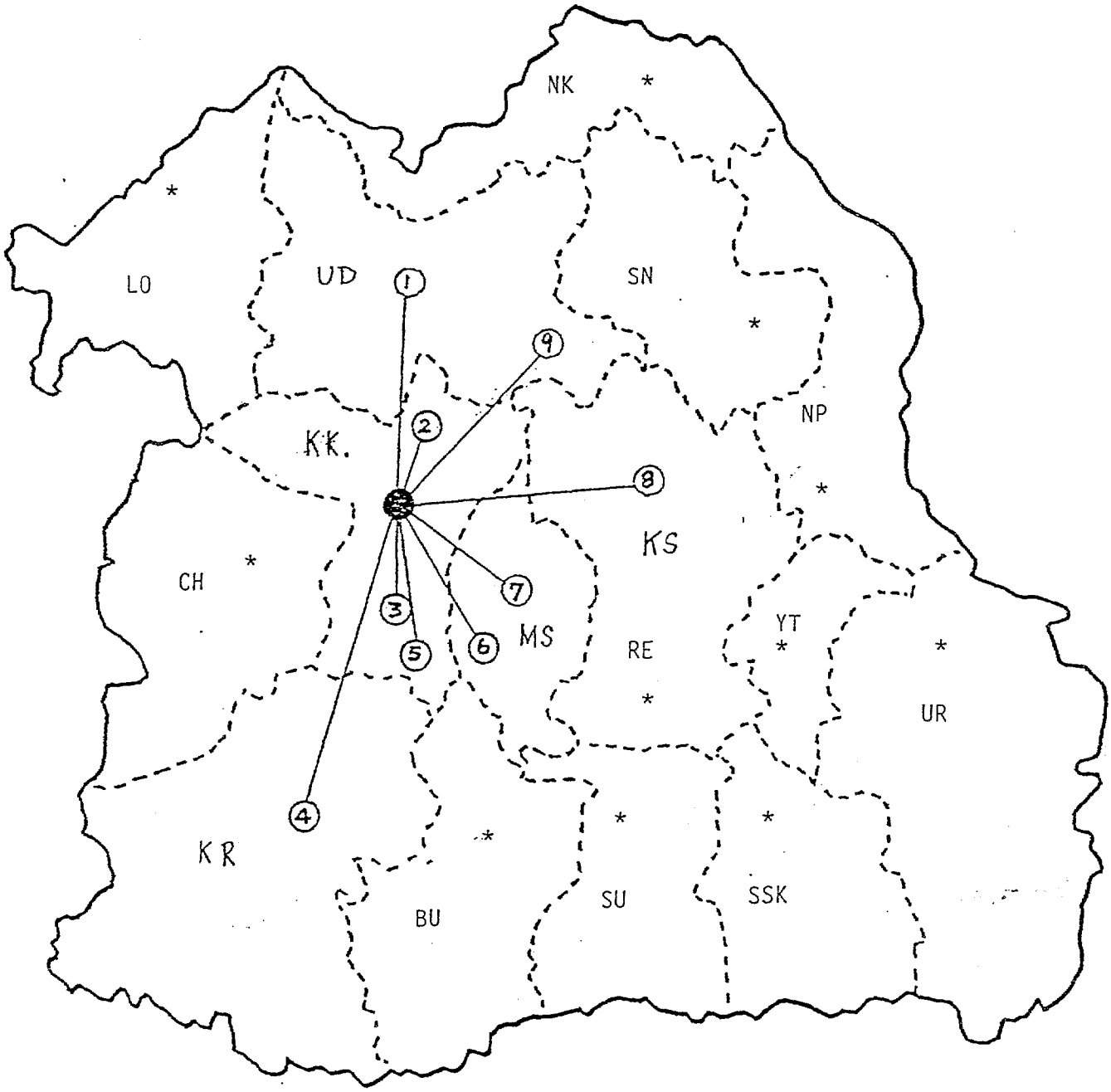
Since the financial situation of the small subsistence farmers is so bad, the strategy is to cost-share on basis of 80 percent for DLD and 20 percent for the farmer. This arrangement will be on all resource systems which have direct cost to the farmer.

The last, but one of the most important approaches,is to develop a follow-up program with emphasis on maintennce of applied resource systems. This will be done through a DLD temporary position at the village level.

The philosophy is to make the villagers aware of conservation and its benefits. Then help them to develop their own conservation plans with pride in applying and maintaining them.

The application strategy is for LDC chiefs to select target areas for accelerated resource conservation planning and application. Criteria used for selecting targeted areas will be the degree of erosion taking place and the willingness and ability of the villagers to address soil erosion problems. Soil capabilities also will be an important factor in deciding target area priority. The general location of the first target areas are shown on following maps.

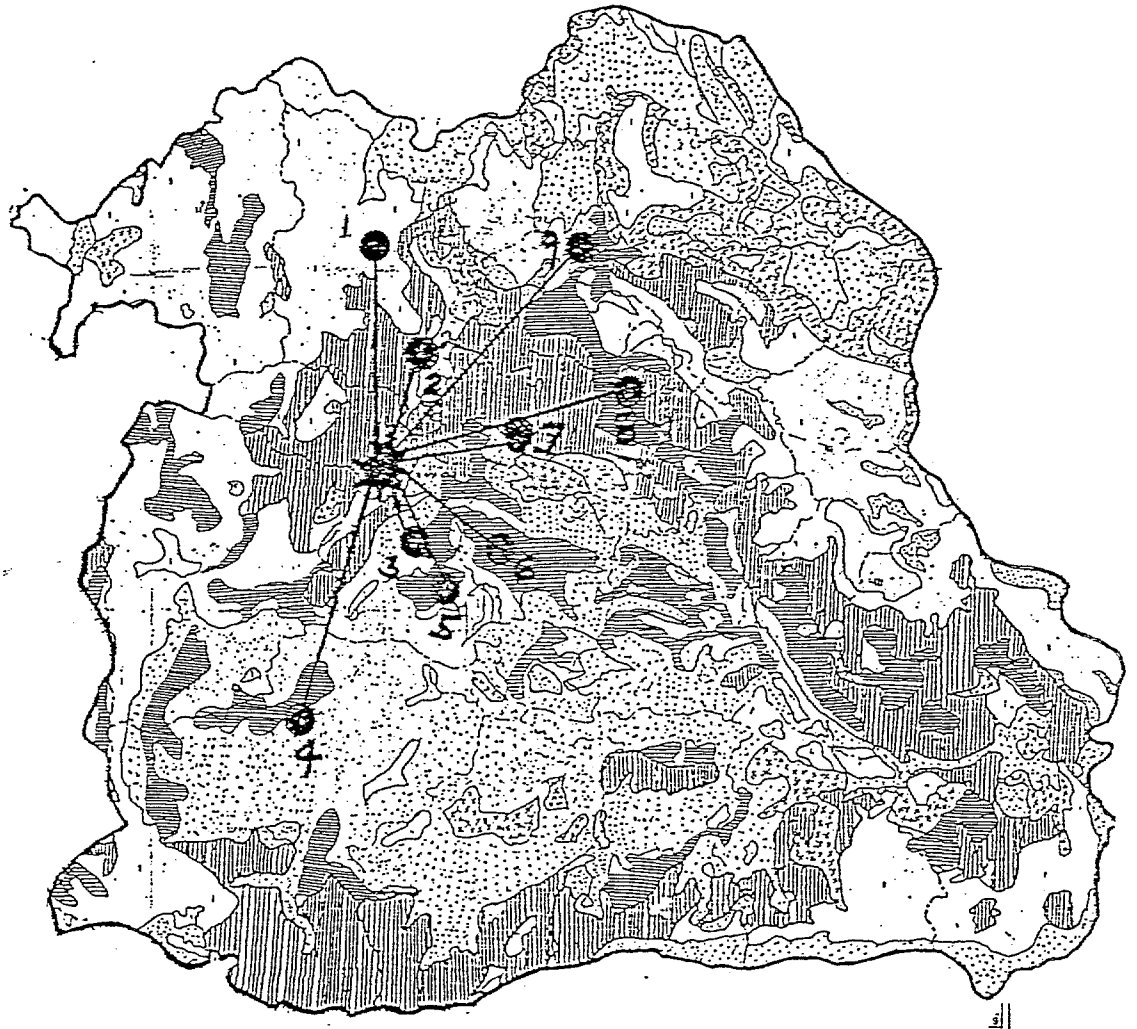
Figure 6.3 Initial Target Areas



0 - Changwats with target areas selected
* - Changwats with target areas to be selected

KR - Korat (Nakorn Ratchasima)	UR - Ubon Ratchathani
KK - Khon Kaen	YT - Yasothon
UD - Udon Thani	NP - Nakhon Phanom
KS - Kalasin	SN - Sakon Nakhon
MS - Maha Sarakham	NK - Nong Khai
BU - Buri Ram	LO - Loei
SU - Surin	CH - Chaiyaphum
SSK - Si Sa Ket	RE - Roi Et

Figure 6.4 Initial Target Area Locations
in Relation to Soil Erosion, 1980



			approx. area	
			Rai	o/o
Very slight	0.01 – 1.00	Ton : rai : year	118,721,990	37.02
Slight	1.01 – 5.00	Ton : rai : year	90,276,175	28.15
Moderate	5.01 – 20.00	Ton : rai : year	25,912,308	8.08
Severe	20.01 – 100.00	Ton : rai : year	42,620,676	13.29
Very severe	100.01 – 966.55	Ton : rai : year	39,157,090	12.21
Miscellaneous			4,561,761	1.25
Total			321,250,000	100.00

This map was prepared under the erosion investigation team comprising of technician from various divisions of the Land Development Department, 1980.

[Rai = 0.16 Hectare]

B. Personnel and Organization

The objective of the RTG's Fifth Five-Year Plan to reduce poverty in rural areas has strong support from the Soil and Water Conservation Component of RAI Project. One of the most important ways to approach this is to protect the soil resource base and maintain and increase its productivity. Institutional and organizational constraints are discussed in Section III-B of this project paper along with the need to establish a technology transfer system at the farmer level. The project design calls for reorganization of DLD physical resources in order to obtain the farmer technical delivery system. The present DLD staff in the Northeast is made up of the following positions:

LDC Chiefs	- 8	
Mobile Unit Chiefs	- 5	
Agriculturalists	- 9	(university graduates)
Agriculture Officers	- 19	(Vo Ag gragudates 5/3)
Agriculture Personnel	- 57	(Vo Ag graduate 3)
Drivers	- 37	
Tractor Drivers	- 38	
Total	173	

This is in full accord with DLD's Soil and Water Conservation Project, September 1981.

To be successful the project needs two new positions in the LDC's:

Soil Conservationist - A key position to the success of conservation programs. It is a generalist position in conservation work. One that is trained in all of the needed disciplines, sciences, and skills to the degree necessary to inventory, plan, and apply conservation at the field level. It should be the title of the line officer position throughout the soil conservation organization.

Criteria should be developed in the form of a job approval classification for the soil conservationist position. This establishes difinite limits to which the position can function in each of the disciplines such as agronomy, soils, engineering, hydrology, economics, forestry, biology, and salesmanship. There has to be a technical support staff of specialists to assist the soil conservationist beyond his job approval classification.

The soil conservationist position description and qualification standards are shown in Appendix C.

Working Relationships

The soil conservationist position is important for reducing the discipline stratification that now exists in DLD and would allow work to be done by the generalist. This allows the different needs of the farmer to be met by one employee usually during one visit. The soil conservationist should be the Chief of the Mobile Unit with two agriculturalists, one conservation technician, and one operator under his supervision.

The agriculturalists should be one 5-year and one 3-year graduate of a Vocational Agricultural School. Both positions must be trained in resource conservation plannin and application. The 5-year graduate would be fully qualified as a conservation planners while the 3-year graduate would be trained to do the more simple, one practice type of plan. These are the two positions which will conduct the follow-up and maintenance conservation program. The 5-year agriculturalist personnel would be good candidates for the soil conservationist positions. Most of them come out of the villages of the Northeast and have farming experience. Also they usually prefer to work at the village and farmer level.

The conservation technician position standards should require a minimum of a high school education. The employee in this position will be expected to become trained and productive in design layout and installation of conservation practices. He or she must understand conservation planning and be able to apply the plans.

High quality production will have to be obtained if the project is to be successful and the resource needs of the Northeast are met within the needed time frame. One method of increasing production is for the mobile unit chief, as a soil conservationist, to train and develop his crew into an interdisciplinary team. The two agriculturalists should be trained in resource conservation planning as well as application. The operator should be trained to assist in engineering survey and layout.

This type of cross-training of the unit personnel would allow the mobile unit to be used as one, two, or three teams at one time depending on the jobs to be done. An example would be the chief might be doing conservation planning with one village; the 5-year agriculturalist with another village; while the 3 year agricuturalist, technician, and mechanic are laying out terraces in a third village all on the same day.

In order for this system to work management must give the mobile units the needed equipment and travel expenses. Then the unit chief must be given the needed authority to get the job done. Criticism and reprimand must be held to a minimum where honest mistakes are made, remembering that they are indications of a high producing unit. A recognition and reward program for above average to outstanding work must be developed for the LD Centers and carried out religiously. A good slogan would be "Quality Production is the Name of the Game" for this approach to getting the soil erosion problem under control.

LDC Technical Support Team - A technical support staff of specialist should be developed at the Khon Kaen LDC. This team would consist of an agronomist, two soil scientists, one agricultural engineer, one economist and one forester. The staff would work under the supervision of the LDC chief and give technical support to all the mobile units in the targeted areas. They would be used by management to develop technical guidelines, handbooks, standards, and specifications for each of their disciplines. They would be responsible to maintain quality control in the work and could assist management in production control.

The specialist staff would conduct the technical training at the LDC and give on-job-training to mobile teams and individuals. The staff will also be used in working with and training of other agency personnel in soil and water conservation. They will assist in technology diffusion to the villagers and the general public. The success of the project design will depend a lot on the abilities of the LDC support staff.

Professional staff support at the Bangkok level is essential to assist the KK/LDC in the information program, sociological, administrative and management needs, and to give broad national overview of the technical disciplines.

A temporary village soil conservation position for a resident of the village is considered essential for installing and maintaining soil conservation practices. The DLD mobile units would work with this person as a contact for working cooperatively with villagers in planning, and construction phases. He would later notify DLD if maintenance is needed beyond the capability of the farmers. A small payment is suggested for services performed compatible with RTG regulations. The training, responsibilities, and management of this position are discussed in section VI-D.4 of this proposal.

C. Technical Assistance

1. Objective

The basic objective of USAID Technical Assistance is to assist DLD in reorganizing, strengthening, and institutionalizing the soil and water conservation program in Northeast Thailand. The long-term consultant team will be made up of USDA-SCS employees. There will be:

1 - Team Leader
3 - Soil Conservationists
3 - Conservation Technicians

The short-term team members will be:

1 - Agronomist
1 - Agricultural Engineer
1 - Economist
1 - Geologist
1 - Resource Conservationist

(Additional specialists may be requested if need is determined)

2. Members Responsibilities and Duties of Consultant Team

The team will be located at Khon Kaen and will furnish technical support and assistance to the Khon Kaen Land Development Center. This effort will be closely coordinated with DLD and USAID in Bangkok. The consultants will assist in formal and on-job training of 100 DLD employees during the first 24 months. They will also assist in conservation planning and application at the village and farmer levels.

The team will assist in watershed planning and application in the two targeted areas in the Lam Pao and Lam Takong Watersheds.

3. Responsibilities of Individual Team Members

a. USDA-SCS Soil Conservationist

(1) Will assist DLD in designing the Resource Conservation and Application training course and in development of course lesson plans.

(2) Assists DLD in instruction of the training course.

(3) Serves as the leaders of all USAID teams for on-job planning, application, and training.

(4) Coordinates and directs work of short term consultants.

(5) Provides management and technical support to the LDC team responsible for carrying out the program.

(6) Assists in development of technical guidelines, bulletins, manuals, and farmer oriented publications.

(7) Will advise and assist in coordination of project with other RAI components, NERAD, other Northeast donors, Khon Kaen University and related agency programs.

(8) Assists in monitoring and evaluation of project.

(9) Will maintain continuous liaison with the team leader.

b. Conservation Technicians

(1) Will serve on training team for classroom and on-job training activities related to applying resource management systems.

(2) Assists in development of training course and conservation application components.

(3) Assists in developing application standards and specifications, guidelines, publications, and manuals.

(4) Documents costs and other inputs in the application program and assists management in evaluation resulting outputs.

(5) Demonstrates techniques for use of all available resources to obtain maximum quality production in application.

(6) Keeps team leader properly informed of all phases of work.

(7) Assists in publicizing and selling the conservation program.

c. Team Leader

(1) Will have a working technical knowledge of what is expected of each team member.

(2) Will see that team responsibilities and scheduling of work are carried out as planned.

(3) Serves as liaison between the USDA-SCS team and DLD and USAID.

(4) Will keep the national office of the U.S. Soil Conservation Service informed of project activities and accomplishments.

(5) Gives leadership that will create new ideas and innovations and work to get the needed program additions and revisions.

(6) Directs the team's participation in the training activities.

4. Short-Term Support Team

The short-term team of specialists will assist the DLD-USAID field teams in the targeted areas to do conservation planning and application. They will work with their Thai specialist counterparts to develop their particular discipline into the program.

The specialist will serve as trainers, assist in developing technical information, and help in program evaluation. They will serve under the direction of the team leaders.

5. Report Requirements

a. The long-term team leader will submit a project progress report to USAID every 3 months. A final report in 10 copies will be submitted at the end of the project before the team leaves Thailand.

b. The short-term specialists will each give USAID a draft report of activities covered during their visit. After comments from USAID, the team Leader will revise reports and send AID 5 copies of each report.

6. Language

Each USDA-SCS team member who will be on TDY one year or longer will take a Thai language course before starting to work on the project.

D. Soil and Water Training Program

Training in the fields of management, language, salesmanship, and technology is basic to the success of the project. It must be given a high priority in the approval pre-authorization period. This is essential if the project is to stay on schedule after authorization.

1. Management

It is recommended that a 10 lesson home study course, "Principals of Supervision and Management" be used for all permanent employees who will be working as soil conservationist and agriculturalist. The course and materials will be furnished by the USDA/SCS for translation into Thai by DLD with all course material expressed in Thai examples and experiences. Employees should begin in the course as soon as they are assigned to the project. Management will also be a part of on-job training by supervisors on a daily basis. The management training in the classroom will involve techniques of developing an inventory of resource problems and conservation needs, workload analysis, development of annual and multi-year plans of work, staffing plans, work goals, scheduling, developing priorities, record and reports, and monitoring and evaluation.

2. Salesmanship

Knowing how to sell conservation to the farmer, decision makers, and the public is the key to a successful conservation program. Once that gets conservation on the ground. Every employee at the LDC and field level should be trained in the art of selling. A training program by a professional consultant in salesmanship is suggested for all employees in the first 3 months of the project and repeated for new employees during their first year. Supervisors will carry out salesmanship training on the job.

3. Technology

a. Resource Conservation Planning - DLD and USDA/SCS team will provide a 4-week of training at the Khon Kaen LDC to all employees who will be involved in resource conservation planning in the project areas. Training should be given in the first 3 months after project approval. USDA/SCS team members will give on-job training in planning during the first two years. This training will be designed to teach the necessary disciplines involved in resource conservation planning and application to the degree necessary to train the soil conservationist and the agriculturalist to work with the farmers within their job approval classification in agronomy, soils, plant science, engineering, economics, hydrology, and forestry.

b. Application - DLD and USDA/SCS team will give training in application of conservation practices to all employees involved in conservation planning and application. The training session will be 6 days in time and conducted during the first 6 months after project approval. Application resulting from good conservation plans should be emphasized.

c. Soils - On-job training in soils for employees who will be involved in planning and application should be given by the DLD soil scientists during the first 18 months after project approval. The training period will be 3-6 days depending on prior experience of employee.

d. USLE - Training in the use of the USLE should be given to all employees by the USDA/SCS team in the first 3 months after project approval. Training time is 2 days. This training will be a part of the 4-week soil conservation course.

e. Training is a continuous process and follow up training should be given to all LDC employees a minimum of once every two years in conservation planning and application. Training program evaluations should be conducted annually using the Individual Employee Development plan.

f. Training teams will be made up of Thai program managers and specialists from the Bangkok and Land Development Center staffs. The USDA-SCS team members will assist in the training effort as needed.

4. Training Others in Conservation Work:

a. Subject Matter Specialists and Tambon Extension Agent - Develop a two-day workshop for the SMS's and TEA's in the project areas. These workshops will be held at the LDC's. Workshop will address principals of resource conservation planning and application, benefits and costs, erosion and sedimentation rates and ways the extension program can better inform and educate the farmers in use of conservation and the assistance available. The TEA's will be encouraged to inform the Village Council, the Tambon Council, and Provincial Governor's Committee of the conservation needs and assistance available. LDC staff members should also seek exposure to the above groups at every opportunity.

b. Village Soil Conservationist - LDC to train village soil conservationist in applying and maintaining conservation practices. This will involve 2 days of formal training at the LDC and 3 days of on site training with the village farmers. It is suggested that during this 3-day period the team meet with the people of the village conservation group and explain the program. Thereafter, on-job training will be given Village Soil Conservationist as work is done in his village in the project area by the Unit Team.

c. Others - Two-day workshops should be held for contractors and operators, village conservation group, Kaset Tambon, contact farmers, and other interested village people. The training program should include erosion, sedimentation, conservation practices, assistance available, benefits and costs of conservation, and on site examples.

5. Training in U.S.

Selected DLD employees from the LDC's should be given 8-12 weeks of on-job training by USDA-SCS in the USA. These candidates should be able to speak English, have completed a minimum of two years of work in a LDC, have a strong work ethic, be ambitious, have necessary qualities to transfer their training received to others, and be in physical condition necessary to apply conservation work. This training should be given to four employees per year during the first two years of the project in teams of two. Training locations should be in the southern states with similar resources, agriculture, and climatic conditions to Thailand. If selected, LDC chiefs and assistant chiefs should be given on-job training in the area offices of the USDA-SCS organization while the Soil Conservationist position should be trained at the field office level. This training would consist of the DLD employees becoming a part of the area or field office staff and working side by side with the USDA-SCS employees in the daily work routine. They would be involved in scheduled meetings, training sessions, workshops, tours, etc. of the organizational unit. This phase of training should be funded by USAID in conjunction with USDA.

6. Third Country Training

Selected teams of 3 and 5 year Vocational Agriculture graduates should be sent to developing countries such as Taiwan, Philippines, South Korea, or Indonesia to do observation studies of conservation applied. Suggested time would be up to one month.

7. Training Facilities and Tools

Training aids and tools must be available in needed quality and quantity to do a good job. The Khon Kaen Center will need:

1 - slide projector	3 - level (dumpy)	10 - soil augers
1 - overhead projector	1 - transit	25 - abney levels
1 - screen	3 - statis rods	25 - lock levels
1 - black board	3 - measuring chains	2 - 12 passenger vans
75 - soil maps	75 - planning photos	

The center will need one new training classroom to accommodate 30 students. Living quarters may be considered as the center will become the training location for the central part of Northeast Thailand.

Formal training in soil and water conservation should be strengthened and designed for all levels of schooling in Thailand. There is a growing awareness of natural resource conservation and wise use among all sectors of the society. The DLD should give priority to working with the Ministries of Education and State Universities in developing conservation courses and tools for classroom teaching and demonstration.

Development of conservation outdoor classrooms is recommended as a part of each LDC's workload. An area of 4 rai or more is sufficient to show the process and results of conservation planning and application of resource management systems, soil profiles and characteristics should be displayed along with the other conservation disciplines.

These out-classrooms should be made available to the primary and secondary schools. They could be used for teaching conservation to the people of the villages and tambons.

Outside interest groups such as banking institutions, professional organizations and civic group should be solicited to sponsor the outdoor classrooms.

Figure 6.5 Training Model

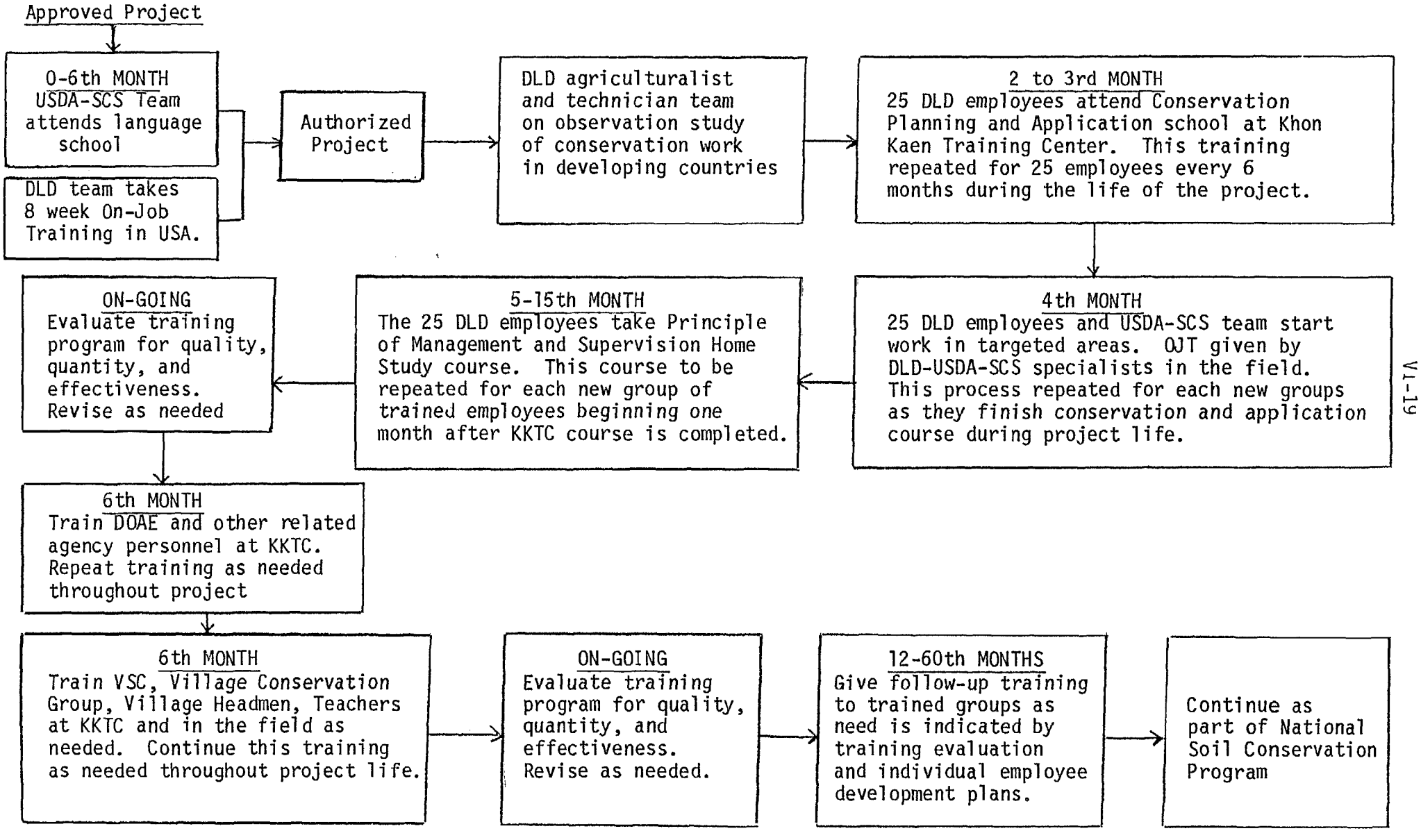


Figure 6.6

Individual Employee Development Plan

Name_____ Title_____ Grade_____

Changwat_____ Headquarters_____

(1) Subject or Disciplines	(2) Skill Levels (1)		(3) Method of Training (on-job, school, home study, etc.)	(4) Trainer or Facility	(5) Date		Remarks on Training Received
	Present	Needed			Begin	Complete	

(1) Skill Levels are: 1 - Proficiency
2 - Apply Independently
3 - Perform with supervision
4 - Understanding
5 - Awareness

E. Equipment

1. Equipment Needs for Each Mobile Team

A mobile team consists of a soil conservationist, two agriculturalists, a technician, and an operator. All members of the team, except the operator, will be trained in conservation planning and application. The mobile team will divide into two forces, the planning force and the application force. The planning force will consist of one soil conservationist and one agriculturalist. The application force will consist of one agriculturalist, one technician, and one operator. Both forces may be called on to plan or apply conservation practices depending upon workload priorities.

Conservation Planning

1	soil conservationist	1000	survey flags
1	agriculturalist	1	50 meter tape
2	abneys	1	truck
2	clip boards	1000	practice visual aids for farmer training purposes; practice Standards & Spec.; USLE factors, drafting paper for recording village conservation plan, soils maps
2	composses		
2	soil augar		
2	engineering scales		
2	soil PH test kits		
1	crop scale		
4	pens		

Application

1	agriculturalist	1	hoe
1	technician	1000	survey flags
1	operator	1	soils auger
1	dumpy level	6	pens
3	lock levels	1	Engineering Handbook
3	lock levels	3	clipboards
1	50 meter tape	3	note books
1	rod	1	abney
1	axe	1	tool kit
1	shovel	1	truck

2. Village Soil Conservationist Equipment Program

DLD-LDC will provide training to Village Soil Conservationists on the maintenance of equipment before any equipment is made available to farmers in his village. DLD-LDC will have available for farmer use a hand steered two wheel power tractor with a 12-15 HP motor (with plow, disc-harrow and blade attachments, two gas cans, and a tool kit), an animal pulled terrace machine, and 50 hand hoes or shovels.

The Village Soil Conservationist will provide farmers with instruction in the use of equipment minor maintenance, and see that the equipment is properly storage. DLD-LDC will make any major repairs. The Village Soil Conservationist must have conservation work lined up and farmer agreement to properly use the equipment before DLD-LDC will make equipment available. A member of the DLD-LDC Mobile Team will check the status of equipment weekly.

The farmer may rent equipment and construct his own conservation practices and use part or all of any cost share funds he receives to pay rental charges.

3. Equipment Needs for Each Village Soil Conservationist

The following equipment would be entrusted to the village soil conservationist with the understanding he must return it if he fails to perform his operation and maintenance duties.

1 lock level
2 rods (poles with 10 cm. marks)
1 string with one meter knots
1 hat with a DLD-LDC-Mobile Unit symbol

A supply of conservation practice application and maintenance drawings for use in working with farmers.

A supply of practice maintenance report forms (drawings showing practice elements to be checked).

4. Equipment Needs on a Ten Mobile Unit Basis

10	Mobile Units will service approximately 40 villages per year in planning and application.
1	Motor grader (small)
10	Rubber tired 60 HP tractors with disc-harrow and blade
400	Hand hoes
400	Shovels
8	Hand steered two wheel powered tractors with plow, disc-harrow, and blade attachments
8	animal pulled terrace machines

Seventy percent of the heavy equipment needs will be met by private contractors and thirty percent with DLD-LDC equipment. Plans call for phasing out DLD-LDC heavy equipment services to farmers over the next ten years.

At the end of two years there will be 20 mobile teams equipped at the above rate. The following next 30 teams to be formed from the 30th month through the 60th month will be equipped with only 1 motor grader, one 60 HP tractor and other listed equipment on a 10 mobile unit basis. This reduction is consistent with moving DLD-LDC out of the business of providing heavy equipment service to farmers. The cost sharing incentive program will provide ample incentive to attract private contractors to do the construction of conservation practices.

Table 6.1 Equipment Needs Over the 5 Year Project Life

Project Month	Number of Mobile Team	Number of 75 HP Tractors	No. of D4 Power Graders	Number of Hand Hoes	Number of Shovels	No of Two Wheel Power Tractor	No. of Animal Pulled Terrace Machine
6	6	1	1	400	400	8	8
12	12	2	2	800	800	16	16
18	18	3	3	-	-	-	-
24	24	4	4	-	-	-	-
30	30	5	5	1200	1200	24	24
36	36	-	-	-	-	-	-
42	42	6	6	1600	1600	32	32
48	48	-	-	-	-	-	-
54	54	7	7	2000	2000	40	40
60	60	8	8	2400	2400	48	48
Total	60	8	8	2,400	2,400	48	48

Table 6.2 Equipment for Training Center

Kind	Amount	Unit Cost (Baht)	Total Cost
Slide Projector	1	4,600	4,600
Overhead Projector	1	3,450	3,450
Screen	1	460	460
Blackboard	1	460	460
Soil Maps	5	3,450	17,250
Dumpy Level	3	23,000	69,000
Transit	1	9,200	9,200
Statea rods	3	1,330	1,380
Measuring Chairs	3	1,380	1,380
75 Planning Photos	1	3,450	3,450
Soil Augers	10	345	3,450
Abney Levels	25	5,750	143,750
Lock Levels	25	575	14,375
12 Passenger Van	2	345,000	690,205
Total			Baht 962,205

F. Incentives

Farmers in the Northeast are poor, have limited land, and are constantly faced with the prospect of crop failure. Farmers are not going to accept new technology and change unless they are convinced that the recommended changes in their farming methods will not endanger their already risky situation. Outside of their own labor subsistence farmers in the Northeast have little to invest in soil conservation practices. There is very little likelihood of controlling soil erosion and establishing sustained agricultural production in the Northeast without substantial incentives. Technical assistance to plan and apply soil conservation practices will be made available in targeted areas, at no cost to farmers. This is essential but without a cost sharing program to complement technical assistance little will be accomplished.

A cost sharing program administered by DLD covering 80 percent of the cost of soil conservation practices should be instituted. This program should have provisions to:

1. permit direct payments to farmers who construct or establish their own conservation practices; provided they are part of a DLD-LDC approved conservation plan and have been certified as properly installed by a village soil conservationist and spot checked by a member of the DLD-LDC staff.

2. permit farmers to hire private contractors to construct and establish conservation practices. The program should contain provisions for making direct payments to contractors for authorized work meeting DLD-LDC standards and specifications.

3. permit the use of force accounts by DLD-LDC's in making payments to private contractors.

4. permit the farmer to meet his 20 percent of the total cost of conservation practice application by providing in kind services. In kind services could include his labor, equipment (including animal drawn equipment), mulch, compost, fertilizer, lime, seed, operation and maintenance, and the value of land removed from production for conservation practice installation.

5. base cost share payments on average conservation practice cost. Average cost lists for each type of conservation practice authorized for cost sharing should be developed annually. Payments to farmers and, or contractors should be made based upon the current average cost list not to exceed actual costs.

6. cost share on management, agronomic, engineering and forestry types of practices meeting DLD-LDC standards and specifications.

The cost of conservation practice application per rai is estimated at 324 Baht. Table 6.3 presents the estimated levels of cost share funds required during the five year project.

Table 6.3 Estimated Levels of Cost Share Funds Required During Life of Project

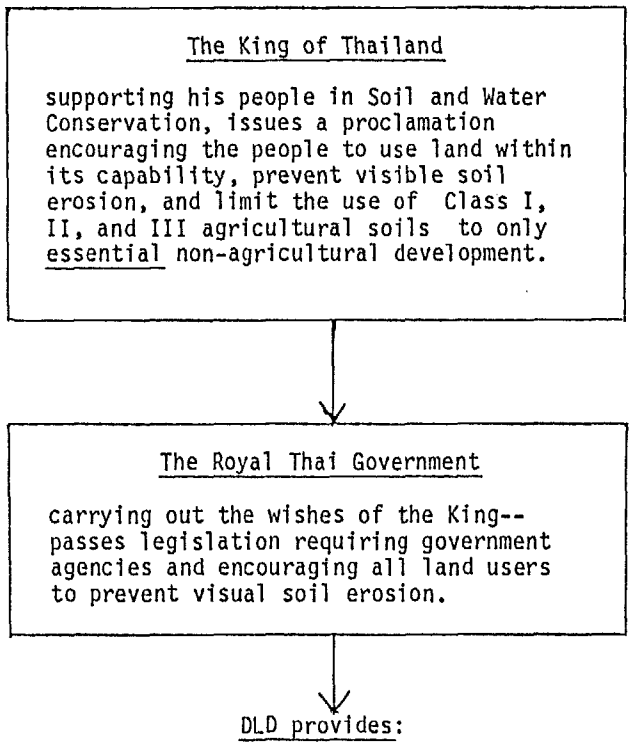
Month	Number of Rai With Applied Conservation Practices	Total Cost in Baht for apply Conservation Practices	Projected Funds in Baht Needed for 80% cost sharing program
6	-	-	-
12	-	-	-
18	7,875	Baht 2,551,500	Baht 1,913,625
24	27,562	8,930,088	6,697,566
30	59,253	19,197,972	14,398,479
36	99,500	32,238,000	24,178,500
42	129,927	42,096,348	31,572,261
48	165,370	53,579,880	40,184,910
54	200,813	65,063,412	48,797,559
60	236,250	76,545,000	57,408,750
Total	926,550	Baht 300,202,200 ($1,305,226)	Baht 225,151,650 ($978,920)

G. Scheduling of Program

Figure 6.7

Resource Conservation Planning and Application Strategy

Delivery System



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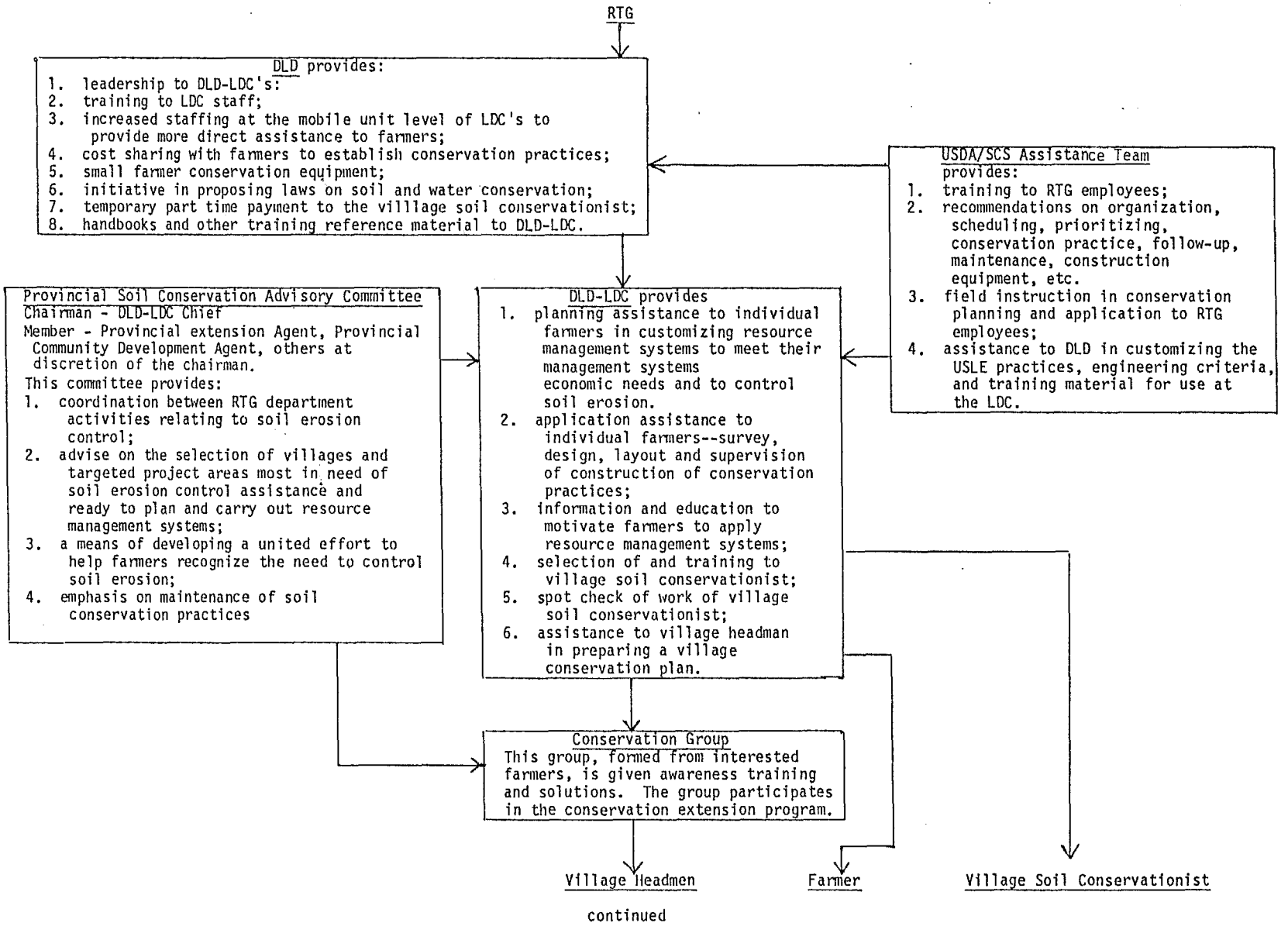
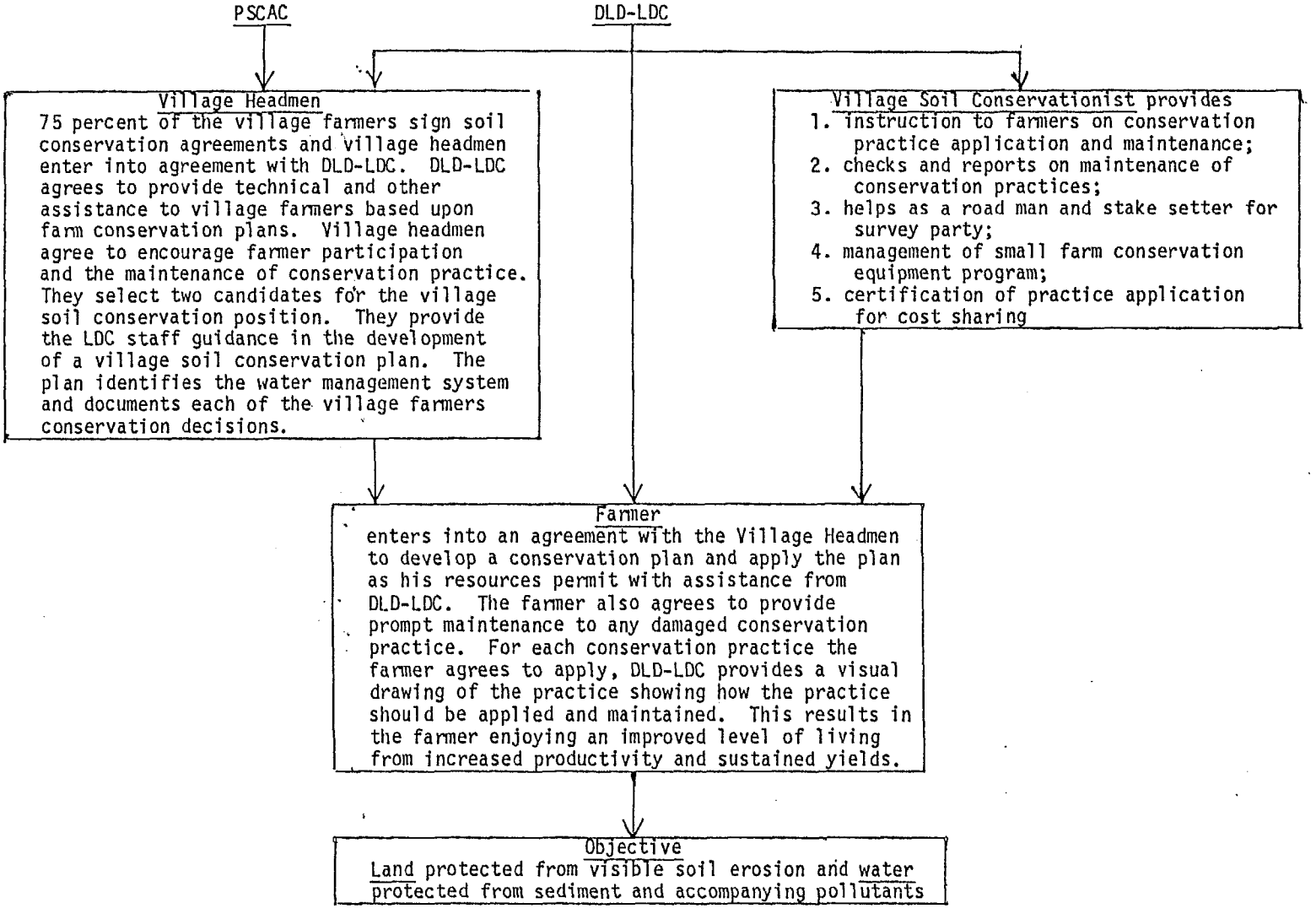

RTG
DLD provides:
1. leadership to DLD-LDC's:
2. training to LDC staff;
3. increased staffing at the mobile unit level of LDC's to provide more direct assistance to farmers;
4. cost sharing with farmers to establish conservation practices;
5. small farmer conservation equipment;
6. initiative in proposing laws on soil and water conservation;
7. temporary part time payment to the villlage soil conservationist;
8. handbooks and other training reference material to DLD-LDC.
USDA/SCS Assistance Team provides:
1. training to RTG employees;
2. recommendations on organization, scheduling, prioritizing, conservation practice, follow-up, maintenance, construction equipment, etc.
3. field instruction in conservation planning and application to RTG employees;
4. assistance to DLD in customizing the USLE practices, engineering criteria, and training material for use at the LDC.
Provincial Soil Conservation Advisory Committee
Chairman - DLD-LDC Chief
Member - Provincial extension Agent, Provincial Community Development Agent, others at discretion of the chairman.
This committee provides:
1. coordination between RTG department activities relating to soil erosion control;
2. advise on the selection of villages and targeted project areas most in need of soil erosion control assistance and ready to plan and carry out resource management systems;
3. a means of developing a united effort to help farmers recognize the need to control soil erosion;
4. emphasis on maintenance of soil conservation practices
DLD-LDC provides
1. planning assistance to individual farmers in customizing resource management systems to meet their management systems economic needs and to control soil erosion.
2. application assistance to individual farmers--survey, design, layout and supervision of construction of conservation practices;
3. information and education to motivate farmers to apply resource management systems;
4. selection of and training to village soil conservationist;
5. spot check of work of village soil conservationist;
6. assistance to village headman in preparing a village conservation plan.
Conservation Group
This group, formed from interested farmers, is given awareness training and solutions. The group participates in the conservation extension program.
Village Headmen
Farmer
Village Soil Conservationist

continued


PSCAC
DLD-LDC
Village Headmen
75 percent of the village farmers sign soil conservation agreements and village headmen enter into agreement with DLD-LDC. DLD-LDC agrees to provide technical and other assistance to village farmers based upon farm conservation plans. Village headmen agree to encourage farmer participation and the maintenance of conservation practice. They select two candidates for the village soil conservation position. They provide the LDC staff guidance in the development of a village soil conservation plan. The plan identifies the water management system and documents each of the village farmers conservation decisions.
Village Soil Conservationist provides
1. instruction to farmers on conservation practice application and maintenance;
2. checks and reports on maintenance of conservation practices;
3. helps as a road man and stake setter for survey party;
4. management of small farm conservation equipment program;
5. certification of practice application for cost sharing
Farmer
enters into an agreement with the Village Headmen to develop a conservation plan and apply the plan as his resources permit with assistance from DLD-LDC. The farmer also agrees to provide prompt maintenance to any damaged conservation practice. For each conservation practice the farmer agrees to apply, DLD-LDC provides a visual drawing of the practice showing how the practice should be applied and maintained. This results in the farmer enjoying an improved level of living from increased productivity and sustained yields.
Objective
Land protected from visible soil erosion and water protected from sediment and accompanying pollutants

End.

VII. TECHNICAL FEASIBILITY

The type of conservation practices and the methods of application outlined in this paper have been used and proven successful in controlling soil erosion and sustaining crop production in Thaiand.

Soil and water conservation is the effective use of land and water to obtain maximum profit on a sustained basis and improve soil and water resources. Soil and water conservation prevents soil erosion, improves soil fertility and increases productivity.

Objectives of Conservation Resource Management Systems are to:

1. decelerate the rate of soil erosion to a point where it is in balance with the rate of natural soil formation through the use of appropriate management, agronomic, engineering, and forestry practices.

2. raise the level of organic matter and maintain an effective level of plant nutrients in the soil.

3. maintain and improve soil structure and water holding capacity.

4. improve crop yields and economic return on a sustained basis.

5. provide farm families with a self-satisfying level of living.

Soil Treatment to Achieve These Objectives include:

1. Addition of organic matter to improve soil structure.

2. Keeping a vegetative cover on the soil surface as much of the year as possible particularly during raining season, to reduce the erosion force of rain and wind.

3. Reduce the speed and concentration of rain water run-off by constructing structures to carry water down slopes at safe velocities.

Soil and Water Conservation Measures

A. Technical Control

1. Contour cultivation involves plowing, harrowing, sowing, planting and harvesting on the level across the slope. Contour cultivation is influenced by soil characteristics, land slope, climatic conditions, and land use patterns. Contour cultivation is most effective when carried out slopes ranging from 2-7 per cent and on lengths of slope not exceeding 100 meters. On steeper and or longer slopes combinations of terraces and contour cultivation is effective. Results of experiments in Thailand indicate this combination of treatments showed that:

a. Approximately 0.12-16.72 ton of soils is protected from erosion per rai per year.

b. Approximately 12.7-48,206 milimeters of soil moisture is conserved per year.

c. Approximately 10 per cent increase in yields can be expected.

d. Seed and fertilizer is prevented from being carried away.

The following are some of the disadvantages of contour cultivation:

a. Long slopes result in excessive run-off at the lower end of feeds. Small rills form and soil is carried away.

b. Uneven topography makes it difficult for disc-plowing as there will be too many sharp bends.

2. Terracing is achieved by the construction of ridges and furrows across slope. Advantages and disadvantages of terracing are as follows:

Advantages:

a. Decrease in length of slope and amount of soil losses.

b. Prevents occurrence of gullies.

c. Soil moisture is conserved.

d. Steeper and longer slopes can be farmed without incurring excessive soil losses.

Disadvantages:

a. A method of soil and water conservation which requires construction and maintenance--both costly.

b. A method useless by itself unless other practices such as contour cultivation is applied.

c. In general, this method is suited to areas with slopes not exceeding 10 percent. Bench terraces, however, may be used on steeper slopes.

There are two main types of terrace:

a. Bench terrace: (see pictures on pages VII 17 and 18)

- applied to areas where slopes exceed 8 percent.
- unsuited to the areas or to crops which require heavy equipment for plowing and planting.
- construction and maintenance is expensive.
- unsuited to shallow topsoils.

b. Broadbase or field terrace are divided into 2 types:

(1) Channel type
(2) Level or ridge type

Bench and Broadbase Terrace system planning on farms includes:

a. Detailed field surveys are generally not required for planning. Planners determine the best interval and the location of the key terrace. Using abneys (adjustable hand level) and flags composition terraces are located on planned intervals.

b. Terrace system must be consistent with a farm plan and part of a resource management system.

c. Consideration should be given to relationships between road systems and terrace systems to make them look pleasant and for convenience in working. Roadline may be located at a higher level than the area cultivated, or right on the terrace, or right below the terrace.

d. Crop row drainage must be planned as part of terrace system.

Construction of Terrace:

a. The site for broadbase terrace construction should be prepared by cut and fill to make it even. Little site preparation is required for bench terraces. Dense stands of weeds should be removed if a whirlwind terracer is used.

b. Dozer, graders, farm tractors, animal pulled terrace machines, and hand hoes may be used in the construction, depending on topography and soil removal requirements.

Selection of equipment will be made in reference to land slope and soil characteristics. In general, light equipment should be used for land with slopes not exceeding 12 percent, and on land with slopes exceeding 12 percent heavy equipment, such as bulldozer, motor patrols, and elevating grader may be required unless terraces are built by hand labor with hoes and shovels.

a. Construction of a terrace by the use of disc and moldboard plows may be done in two ways. The first way is to remove the soil from both the upper part and lower part of the center line, the second way is to remove the soil only from the upper part of the center line. Generally, the

construction of a terrace requires 32-40 trips of plowing. 45-50 trips may be needed in the case of a level terrace. Operations should be carried out at a time when the soil is neither too dry nor too wet, as the speed of equipment must be high enough to throw the soil away from the center line.

b. Construction of a terrace with a whirlwind terracer is limited to topography free from stones or gravel. If weeds and trash are abundant, plowing or harrowing is required before construction can take place. Generally, 30-35 trips of plowing are made for the construction of a terrace, depending on condition of the soil and horsepower of the equipment.

c. Construction of terrace with a bulldozer gives a very satisfactory result, due to its versatility on any type of topography or soil condition. After forming the ridge, 2-3 addtional trips along the top of the terrace are necessary to finish the cross section. Waterways are usually required to prove a safe outlet for the terrace.

d. Construction of a terrace with hand equipment such as hoes or animal drawn equipment is slow but has many advantages. The villagers form work groups and this provides local employment. The villagers in constructing their own terraces identify with them, and provide the needed maintenance after construction.

3. Construction of waterways and establishing a good vegetative cover are important soil and water conservation measures. Waterways are established to drain off excess water from terrace systems.

There are 2 kinds of waterways:

a. Paved waterways are lined with concrete for long-term use and require a simple design.

b. Vegetated waterways are sodded with grass or other vegetation and require a sophisticated design.

The kinds of grass suited for sodding waterways include Bahia, Pangola, Coastal Burmuda, and Swaziland.

4. There are a variety of disc-harrowing methods applicable to soil and water conservation. A tested and proven best method is minimum tillage. This method can decrease soil erosion during the land preparation stage, plant growth stage, and post-harvest stage. It also helps conserve soil moisture.

Choice of method of disc-harrowing for the reduction of soil erosion and surface run-off depend on the nature of the land, and other factors. The method of disc-harrowing listed below should be applied in combination with other soil and water conservation practices in order to obtain maximum effectiveness. Tillage for soil and water conservation may be divided as follows:

a. Conventional tillage involves harrowing and plowing.

b. Minimum tillage is a method by which many soil and plant treatments are carried out at one time. This avoids multiple compacting of the soil which reduces plant growth and increases surface runoff. Herbicides may also be applied at the same time.

c. Mulch tillage is a method of disc-harrowing which leaves most of the crop residues on or near the surface, covering the soil and preventing moisture from evaporating, as well as reducing surface run-off and soil erosion.

d. Zone or strip tillage is a method of disc-harrowing which prepares the soil in a series of strips, which reduce surface run-off and soil erosion.

e. Ridge-row tillage is a method of disc-harrowing which forms ridges and rows, and is suited to well drained soil.

5. A hillside ditch is a narrow water channel established across the slope.

Objective: To divert water in a desired direction and to shorten the length of slope, reducing erosion and flooding in cultivated areas.

Suitability: Generally suitable to areas where disc-harrowing is required. The soil must be deep and free from excessive stones or sand. The land slope should not exceed 40 percent. In the construction of the hillside ditch, consideration must be given to the drainge area and outlet. The length of ditch which diverts the flow should not exceed 400 feet (130 meters).

6. Farm irrigation is aimed at maximizing the effectiveness of water utilization by plants helping insure good production.

General recommendations on irrigation frequencies are as follows:

a. Water should be available at the depth of 1 - 1.50 m. in the soil before crops are planted.

b. The first irrigation should be made when approxiately 50 percent of the moisture has been utilized by the plant at the root zone. The root zone varies in accordance with kind and age of crops. The water available must be in the form of soil moisture, not standing water the result of over-irrigated.

c. The application of water must be tailored to stage of plant growth.

d. Limit water application to what the soil can hold, and avoid wastage through deep percolation or waterlogging.

B. Maintenance of Soil Fertility Level

1. Application of chemical fertilizers to obtain maximum crop production effectiveness requires soil tests. Consideration in application of fertilizers must be given to follwing four points:

a. Obtain the right kind of fertilizer--proper ratio of plant nutrients. The ratio of plant nutrients indicates the proportion of NPK. The kind of plant, its growth stage, and type of soil determine the proper ratio.

b. The appropriate amount of fertilizer is determined by the rate of application per rai.

c. Apply when needed by the plant.

d. Apply where the plant can readily use it.

2. Organic fertilizers are derived from decomposed crop and animal residues, human and animal wastes, as well as rubbish and trashes. They improve soil structure, increase water holding capacity, facilitates good aeration and movement of soil micro-organisms, as well as provide nutrients required for favorable plant growth.

Application of organic fertilizers to upland crops and paddy fields is usually made prior to planting by means of broadcast and worked into the soil. The amount to be applied depends on type of organic fertilizer and requirements of the soil. Generally organic fertilizers should be used in combination with chemical fertilizers for best crop growth.

C. Vegetated Control

1. Cover cropping is the practice of planting a leafy and firmly rooted plant to protect the soil from the impact of rain drops. Cover crops include legumes and grasses.

Objectives:

a. To provide soil protection from rain drops.

b. To capture plant nutrients which might be lost by erosion and leaching.

c. To provide green manure and increase organic matters in the soil.

d. To improve physical properties of the soil and increase water holding capacity and drainage.

e. To decelerate the speed of surface run-off.

Advantages of Cover Cropping

a. Decreased loss of plant nutrients and organic matter.

b. Conserved soil moisture.

c. May be used for animal feeds.

d. Improved soil aggregates, chemical, and biological properties.

e. Used for green manure it provides plant nutrients.

f. Increased income from sale of seed.

g. Increased nitrogen from leguminous crops.

Disadvantages:

a. Difficulty in obtaining good quality seed.

b. Host for crop damaging pests.

c. Care must be exercised to keep to the cover crop from climbing on the principal crop, reducing production.

2. Mulching is the practice of covering the soil by any object, including crop residues,black paper, soil, plastic, etc.

Objective: To prevent cutaway action by reducing contact force of rain and strong wind, increase strength of soil aggregates improve water permeability, and decrease surface run-off.

Advantages:

a. Prevent rain water soil erosion by reducing detachment.

b. Control soil moisture and soil temperature.

c. Increase water holding capacity of the soil, permeability, and increase soil porousness.

d. Improve soil aggregates and soil structure.

e. Reduce nutrient losses caused by surface run-off.

f. Improved energy, moisture, maintain constant soil temperature, increase positive action of soil micro-organisms.

Disadvantages:

a. Increased crop pests.

b. Increased weeds (if mulching provides less than an incomplete cover).

3. Strip Cropping. Strip cropping is the cultivation of different kinds of crops across the slope usually on the contour. Strip cropping can reduce erosion up to 75 per cent in areas with slopes not exceeding 12 per cent and length of slope not exceeding 150 meters. There are 4 types of strip cropping.

a. Contour strip cropping means the cultivation of each crop on a contour line, such as the planting of corn, grain, meadow, meadow crop rotation.

b. Field strip cropping means an orderly series of strips laid out across the slope but not on the contour. This type of cropping is suited to uneven topography on which a contour strip is not practicable.

c. Wind strip cropping is similar to field strip cropping. They are laid out across the prevailing direction of the wind and consists of even width strips. This type of cropping is applied where land slope is minimal and wind erosion is a major problem.

d. Buffer strip cropping means the establishment of a correction area to keep strips pararell with uneven topography. The corrected area or buffer strip is usually planted to leguminous crop or grass. The width of crop strip depends on the length of slope, percent of slope, permeability, susceptability to erosion, rainfall, types of rotational crops, and type and size of equipment to be used.

Disadvantages

Grass strips may become a host for crop pests resulting in increased cost for the purchase of insecticides.

4. Rotational cropping system involves the cultivation of different kinds of crops on the same piece of land over a period of years.

Types of crops used in rotational cropping are as follows:

a. a soil protecting crop includes all cover crops, such as grasses and legumes (which have firm rooting systems, are prostrated, and have rapid growth.)

b. soil building crops are generally legumes.

c. soil consuming crops are generally crops raised for harvest and utilize nutrients from the soil. Harvesting of crop causes the depletion of soil nutrients. Examples of these crops include cereals, tubers, oil crops, etc.

Advantages:

a. Employement available year-round.

b. Systematic work.

c. Increased income.

d. If carried out properly, soil fertility can be maintained and soil erosion prevented.

e. Minimized risk.

Disadvantages:

Reduced income when land is diverted from cash crops and crop land is limited.

Vegetated control is an appropriate and beneficial soil and water conservation measure.

a. Vegetation helps intercept the force of rainfall from direct contact with the soil surface.

b. Vegetated land will help decrease the amount and rate of surface run-off.

c. Crop roots makes the soil porous and help hold the soil from being washed away by water, especially on long steep slopes.

d. Vegetation increases permeability which further alleviates severity of surface run-off.

e. Some of the leguminous crops used as covering crops not only prevent soil erosion but also improve soil fertility.

Table 7.1 Technical Feasibility

Conservation Resource Management Systems Components needed to reduce soil erosion to non-visible levels and improve the level of living of subsistence farm families.

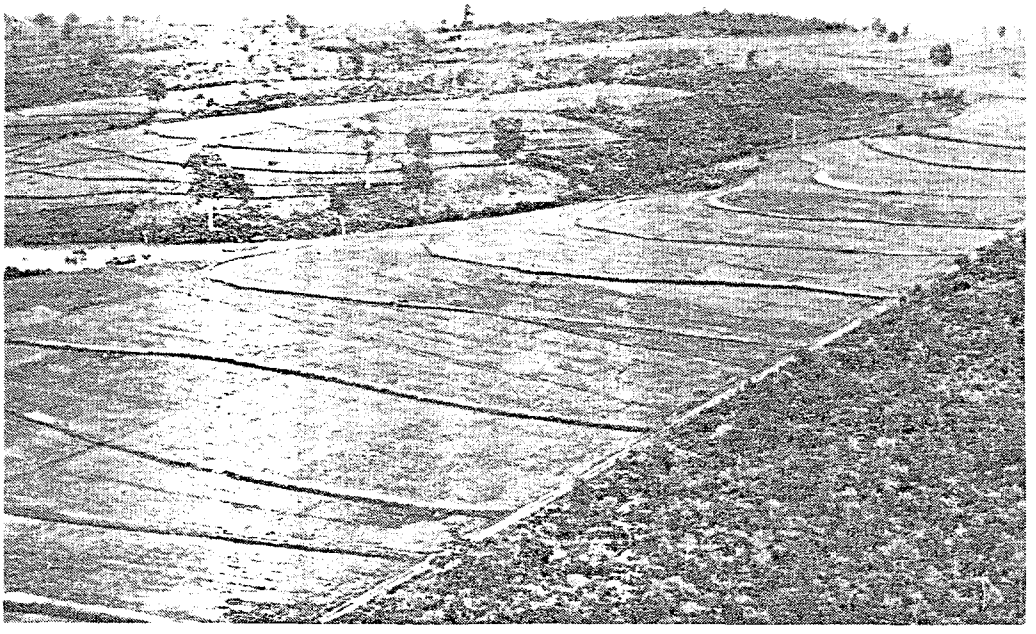
Forestry						
Tree Planting						X
Thinning						X
Weeding						X
Harvest				X	X	X
Engineering						
Waterways	X			X	X	X
Terraces	X			X	X	X
Sediment Traps				X	X	X
Water Control Structure (drop)	X		X	X	X	X
Irrigation Water Development			X	X		
Dug Ponds			X			
Agronomic						
Practice Rotation				X	X	X
Composting	X			X	X	X
Critical Area Planting					X	X
Minimum Tillage	X			X	X	X
Cover Crops	X			X	X	X
Green Manure				X	X	X
Double Cropping	X	X	X	X	X	X
Interplanting				X	X	X
Strip Cropping	X			X	X	X
Contour Plowing	X			X	X	X
Crop Rotations	X	X	X	X	X	X
Crop Residue Use	X	X	X	X	X	X
Pasture Planting & Management		X		X	X	X
Management						
Maintenance	X	X	X	X	X	X
Row Direction				X	X	X
Field Arrangements	X	X	X	X	X	X
Proper Use of Fert., Lime, & Pesticides	X	X	X	X	X	X
Crop Production & Marketing	X	X	X	X	X	X

Conservation planning will be carried out recognizing rice land, upland crops, pastureland, and forest land resource management systems (RMS). The famer will select the combination of practice components that best meet his needs. The soil conservationist in assisting the farmer will insure the components applied will complement and not violate the resource management system.

Estimated rates of soil erosion per rai in tons by land use and land form in the Northeast

Typical Land Forms	Typical Land Uses			
	Paddy	Upland Crops	Pasture	Forest
River Levee	0-3	-	-	-
River Basin	0-3	-	-	-
Low Terraces 4% slopes	0-10	5-20	-	-
Undulating Middle Terrace 4-8% slopes	-	5-20	5-10	-
Rolling High Terrace 8-16% slopes	-	20-100	10-50	5-20
Hilly to steep areas 16% slopes	-	100-900	25-100+	15-100

Figure 7.1 Soil Conservation Application



Soil Conservation Practices

Gradient Terrace System

Gradient terraces carry the collected runoff in a graded channel to an outlet. Outlets are of two types, surface or subsurface. Surface outlets are waterways either natural or constructed. Subsurface outlets are underground conduits, such as tile or pipe.

Gradient Terraces With Waterway Outlets

The gradient terrace which uses a grass waterway for an outlet is the most common type. Erosion is controlled because the slope length of the field is reduced to that of the terrace spacing. When runoff occurs, the flow travels overland to the terrace and thence along the terrace at a safe velocity to the waterway outlet.

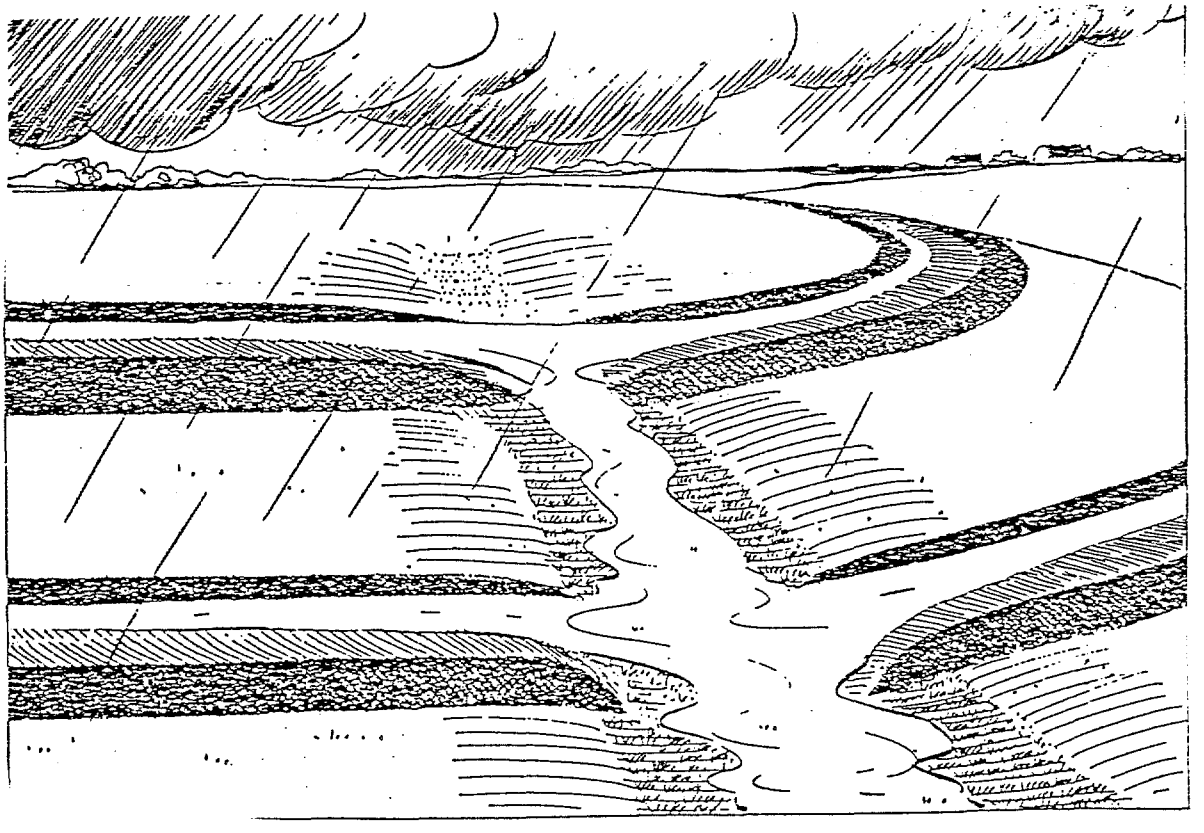


Figure 7.2 Gradient Terraces with Waterway Outlet

Channel grades may be either uniform or variable. Grades should be sufficient to provide good drainage and develop adequate flow without scouring the channel and washing out crops.

This type of terrace system requires an outlet of suitable capacity that can be maintained in good vegetative cover. Gullies developing in an outlet could extend up the terrace channels, causing failure of the entire system.

VIII. ECONOMIC ANALYSIS

A. Introduction

Time was limited with regards to collecting new data and undertaking sophisticated evaluation techniques. Publications primarily used were the Agricultural Statistics of Thailand, 1978, Social and Economic Conditions of a Rural Population in Northeast Thailand, Village Khon Kaen, 1979 and DLD's proposal for the Soil and Water Conservation Project, 1981. The objective of the economic analysis was to evaluate the flow of net benefits, both to the Northeast Thai farmer and those in excess of total project costs over a 5-year period.

B. Evaluation Procedure

The analysis is based on comparing estimated net income without conservation practices to the estimated net income with conservation practices applied.

1. Crop budget information was developed using the agricultural statistics as a base. Five year average crop yields and three year average costs of production were considered. It was decided that since assumptions on soil loss--soil productivity were probably the most sensitive to the analytical results, the evaluation would be done under two different variations of yield changes.

a. Method 1:

(1) present conditions - averages from agricultural statistics.

(2) future, without conservation - a 33 percent reduction is present crop yields, 10 years hence.

(3) future, with conservation - a 33 percent increase in percent crop yields, 10 years hence.

b. Method 2:

(1) present conditions - same as Method 1.

(2) Future, without conservation - a 15 percent reduction in present crop yields.

(3) Future, with conservation - maintain present level of productivity.

c. It was also assumed that in the future, without conservation conditions, costs of production would increase 10 percent. In anticipation of certain managerial and agronomic practices applied under the future "with conservation" conditions, a 10 percent increase in production costs was included. Increase in technology costs were held to a minimum as they will be too expensive for the Northeast Thai farmers to use as an effort to mask the effects of erosion.

2. Upon study of the Village Khon Kaen report, it was favored to use it as a key data source in adjusting the first estimates of net farm income. This information was adjusted to current price levels by using appropriate indexes. The percent change in net incomes due to soil erosion calculated from the crop budget information was applied to this income figure. Table 8.1 summarizes the final net income calculations.

3. Operation and maintenance costs of long term conservation practices such as terracing are based on 3 percent per year.

4. Cost effectiveness of conservation practices were estimated on three of the land form areas--the hilly steep area, the rolling high terraces and the middle terraces. The cost effectiveness of each practice applied in sequence is expressed in cost (Baht) per metric ton of soil erosion reduced. Table 8.2 summarizes the results of this part of the study. It should be pointed out, even though the steeper sloping lands can be protected with more cost effective ways, the less steep slopes have a higher capacity to produce crops. It was assumed that long term practices would have a 10-year life. A 12 percent rate of interest was used.

C. Off-site Damange and Benefit Analysis

It was originally intended to base the calculations of these impacts on information from two recently completed irrigation reservoirs, Lam Pao and Lam Tagong. Data on drainage area, storage capacities, construction costs, etc. were obtained through DLD personnel. However, no sediment delivery ratios have been developed for these area of concern in Northeast Thailand.

In the time frame allotted, it was decided to use an alternate evaluation approach, that of basing sediment damages on cost of removal. Earth movement costs for conservation practices have been estimated to be from ฿ 25 per m^3 to ฿ 60 per m^3, depending on whether its by hand or by farm tractor. Here a cost of ฿ 40 per m^3 was determined to be representative. It also includes an increase due to necessary movements of sediments (probably having a high moisture content) from rather inconvenient sites. Soil erosion occurring on an annual basis in the Northeast is estimated at 706 million tons.

For this analysis, it has been assumed that 25 percent of the projected sheet and rill erosion (176.5 million tons) ends up in areas such as streams, canals, drainage ditches, road ditches, fish ponds and irrigation reservoirs. This is primarily based on experience and visual observations noting the proximity of the damage sites to the eroding areas and the severity of the deposition. Based upon the cost of sediment removal, soil erosion is causing ฿ 1.7 million is in damages annually.

Table 8.1

Net Income, With and Without Conservation Practices Applied

	Year				
	1	2	3	4	5
	(Baht per Rai)*				
Method 1					
Present	736	736	736	736	736
Future, without conservation	674	612	550	488	426
Future, with conservation	810	884	958	1,032	1,106
Method 2					
Present	736	736	736	736	736
Future, without conservation	706	676	646	616	586
Future, with conservation	736	736	736	736	736

*Price Base, 1982

Table 8.2

Cost Effectiveness of Conservation Practices

Conservation Practice	Baht per metric ton of erosion reduced per rai per year*
Hilly Steep	
Land conservation, to forest	-5
Crop rotation and cover crops	2
Terrace, waterways & drop structures	2
Contour strip cropping	1
Rolling High Terrace	
Crop rotation and cover crops	5
Terraces, waterways & drop structures	27
Contour strip cropping	7
Middle Terrace	
Crop rotation and agronomic practices	28
Terraces, waterways & drop structures	12
Contour farming	18

*Price Base, 1982

Note: Practices are applied in sequence and are those necessary to prevent visible sheet and rill erosion.

D. Short and Long Term Impacts

Impacts from applied conservation practices will quickly produce on-farm net income over and above the farmer's share of soil conservation costs. Their projected increase in net income will result from preventing reduced crop yields due to soil erosion. In addition, higher crop yields will be attained when conservation practices are applied due to better retention of soil moisture, improved levels of soil nutrients and the renewed willingness of the participating farmer to assist a higher level of management and other production inputs. Improved net incomes will also result from lowering future crop production costs on upland soils as they are protected from the high rates of sheet and rill erosion. Eroded soils usually have higher costs of crop production than non-eroded soils. The reduction in sediment deposition on paddy lands is another type of benefit to the farmer as conservation practices are applied on the upland areas.

In the year following the application of conservation practices, their improved net farm income as just described will begin to exceed their share of the project costs and their operation and maintenance costs. Tables 8.3 and 8.4 summarizes the impacts to the farmer.

Table 8.3

On-Farm Impacts for One Typical 25 Rai Farm

When Conservation Practices Were Applied in Year 2

Item	Year 1	2	3	4	5	6-15
			(Baht)*			
On-farm Benefits	0	0	3,400	6,800	10,200	187,000
Farmer's Cost	0	2,008	275	275	275	2,750
Surplus (Net Benefit)	0	-2,008	3,125	6,525	9,925	184,250

*Price Base, 1982.

Table 8.4

On-Farm Impacts of Conservation Practices Applied, by Years

Item	Year 1	2	3	4	5	6-15
No. of Rai, Cons. Practices Applied	0	35,437	194,190	489,487	926,550	**
No. of Farmers with Applied Con. Practices	0	3,700	20,400	51,500	97,200	
			(Million Baht)*			
On-farm benefits	0	0	4.82	64.77	80.32	13,508.64
Farmer's Cost	0	2.92	14.58	29.62	51.10	75.92
Surplus (Net Benefit)	0	-2.92	-9.76	35.15	29.22	13,431.72

* Price base, 1982.
** 926,550 rai in conservation until year 11, then number of rai would decrease over 5 years unless practices were replaced.
*** Average area treated per farm, 9.5 rai.

Total beneficial impacts from the entire program will equal and continue to exceed yearly project expenditures in the 6th year following initial outlay of funds. (See Table 8.5.)

Addtional benefits which will accrue but were not measured monetarily would be the added income to those farmers providing construction inputs (labor) to the application of conservation practices and paid with cost share funds. Also, added income to village shop keepers will occur as the direct beneficiaries of the project have more Baht to spend on material goods and services. The increase in net income to the farmer will result in a higher more stable income to the agricultural areas and a greater improved standard of living for farm families.

Table 8.5
Total Benefits and Total Costs, by Years

	Year					
	1	2	3	4	5	6-15
	(Baht - Million)					
On-farm Benefits*	0	0	4.82	64.77	80.32	13,508.64
Off-Site Benefits*	0	2.98	16.31	41.12	77.83	778.30
Total U.S. Cost**	33.52	38.72	60.92	111.45	182.76	0
Total RTG Cost**	13.47	54.69	127.30	240.00	417.22	76.92***
Total Project**	46.99	93.41	188.22	351.45	599.98	76.92***
Net Benefits	-46.99	-90.43	-167.09	-245.56	-441.83	14,210.02

* Price base, 1982.
** Includes contingencies and inflationary adjustment.
*** Costs to assure proper operations and maintenance of conservation practices.

IX. FINANCIAL ANALYSIS

Present values of benefits and costs were computed at a 12 percent rate of interest. The stream of benefits and costs each covered a 15-year time span since most conservation practices were assumed to have a 10-year life. Positive net returns are expected to be achieved and to be continued in year 6, immediately following the end of the program period. Using benefits calculated under Method 1 (on-site), the internal rate of return under undiscounted conditions is estimated to be 29 percent.

Where benefits are derived under assumptions included in Method 2 (on-site), positive net returns will be achieved in year 11 when discounted at 12 per cent. Table 9.1 summarizes the benefits and costs.

Table 9.1
Summary of Present Value Benefits and Costs

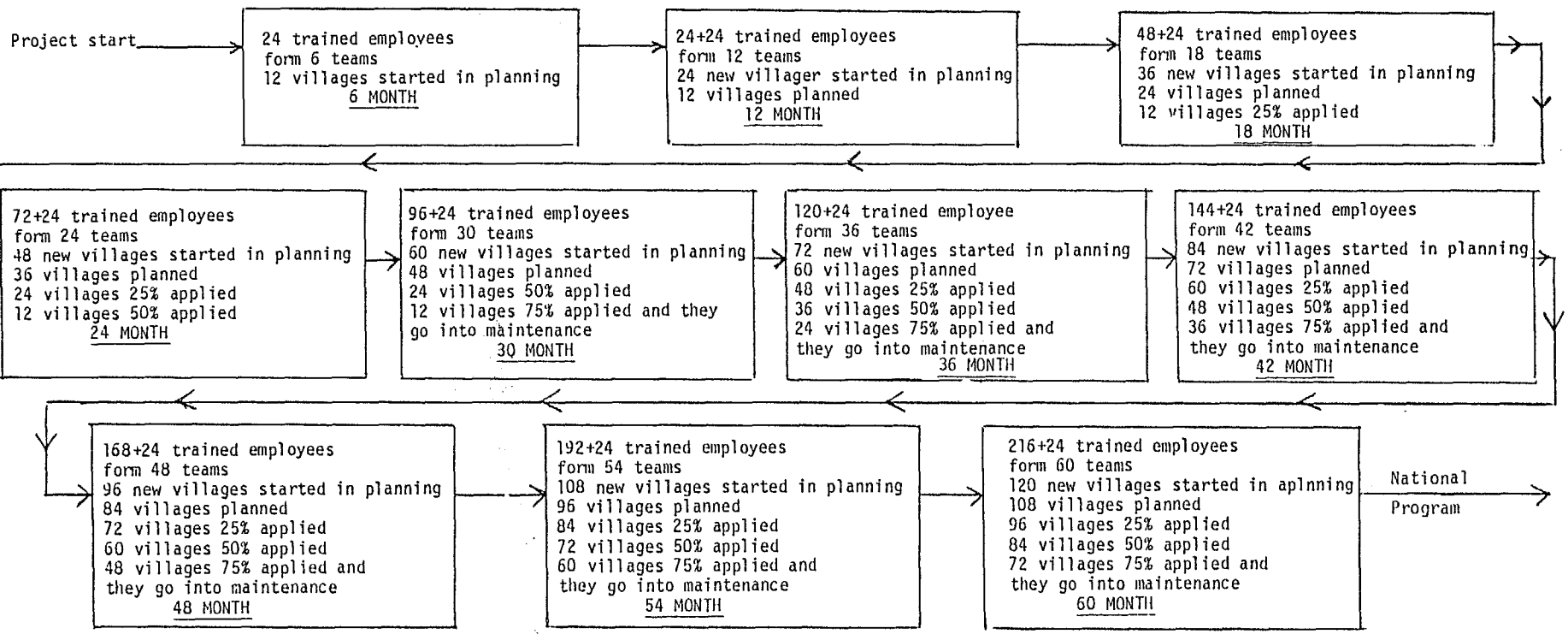
On-Farm Assumptions	Benefits (M. Baht)	Cost (M. Baht)	Benefit Cost Ratio
Method 1	4,700.67	900.19	5.2:1
Method 2	1,225.22	900.19	1.4:1

X. IMPLEMENTATION

Figure 10.1

CONSERVATION PLANNING AND APPLICATION FLOW CHART*

PART I



*Assumes each team will consist of one soil conservationist, and one agriculturalist who will plan two villages every six months, and one agricultralist, one technician, and one operator who will apply conservation practices at the rate of 50% of a village (1212 rai) every six months. One village soil conservationist will be trained, and help implement the village conservation plan in each village.

PART 1 of 2

Table 10.1

Summary of Accomplishments

Assumes each team will consist of one soil conservationist, and one agriculturalist who will plan two villages every six months, and one agricultralist, one technician, and one operator who will apply conservation practices at the rate of 50% of a village (1212 rai) every six months. One village soil conservationist will be trained, and help implement and maintain the village conservation plan in each village.

Month	Number of Planned Villagers	Number of Rai with Applied Conservation Practice	Number of Farmers Assisted in Planning	Number of Farmers with Applied Resource Management System	Number of Rai Planned	Number of Trained Teams Available in 6 Months Period	Number of Trained Teams with One Year Experience by 6-Month Period
6	Start	Start	Start	Start	Start	6	-
12	12	Start	1,200	Start	31,500	12	-
18	24	7,875	2,400	315	63,000	18	6
24	36	23,625	3,600	945	94,500	24	12
30	48	47,440	4,800	2,290	136,000	30	18
36	60	70,875	6,000	2,835	164,500	36	24
42	72	94,490	7,200	3,780	196,000	42	30
48	84	118,125	8,400	4,725	227,500	48	36
54	96	141,750	9,600	5,670	259,000	54	42
60	108	165,375	10,800	6,615	390,500	60	48
TOTALS	540	679,365	54,000	27,185	1,461,500	60	48

PART 2 of 2

Conservation Planning and Application

It is assumed that after the soil conservationist and agriculturalist improve their skills and techniques (one year experience) they will double their rate of planning. This will result in each team after one years experience, planning four villages, in stead of two as shown on Part I of the flow chart. The application members of each team (one agricuturalist, one technician, and one oprator) will also be able to increase their rate of application by 50 percent. This will permit them to assist farmers in applying resource management systems on 3,375 rai rather than 2,250 rai per experienced team per year.

This increased production from each experienced team will be used to train additional village soil conservationists, to assist in planning more villages and in providing application assistance to farmers. The increased use and dependence on the village soil conservationists will extend the conservation effectiveness of DLD-LDC mobile teams. The village soil conservationist is the key to sustaining the conservation program through maintenance of applied conservation practices in all villages.

Table 10.2

Conservation Planning and Application Achievement of
Experienced Teams Supporting Village Soil Conservationists

Month	Planned Villages	No. of Rai with Applied Conser-vation Practices	No. of Trained Teams with One Year Experience
6	-	-	-
12	-	-	-
18	12	Start	6
24	24	3,937	12
30	36	11,813	18
36	48	28,625	24
42	60	35,437	30
48	72	47,245	36
54	84	59,063	42
60	96	70,875	48
TOTALS	432	256,995	48

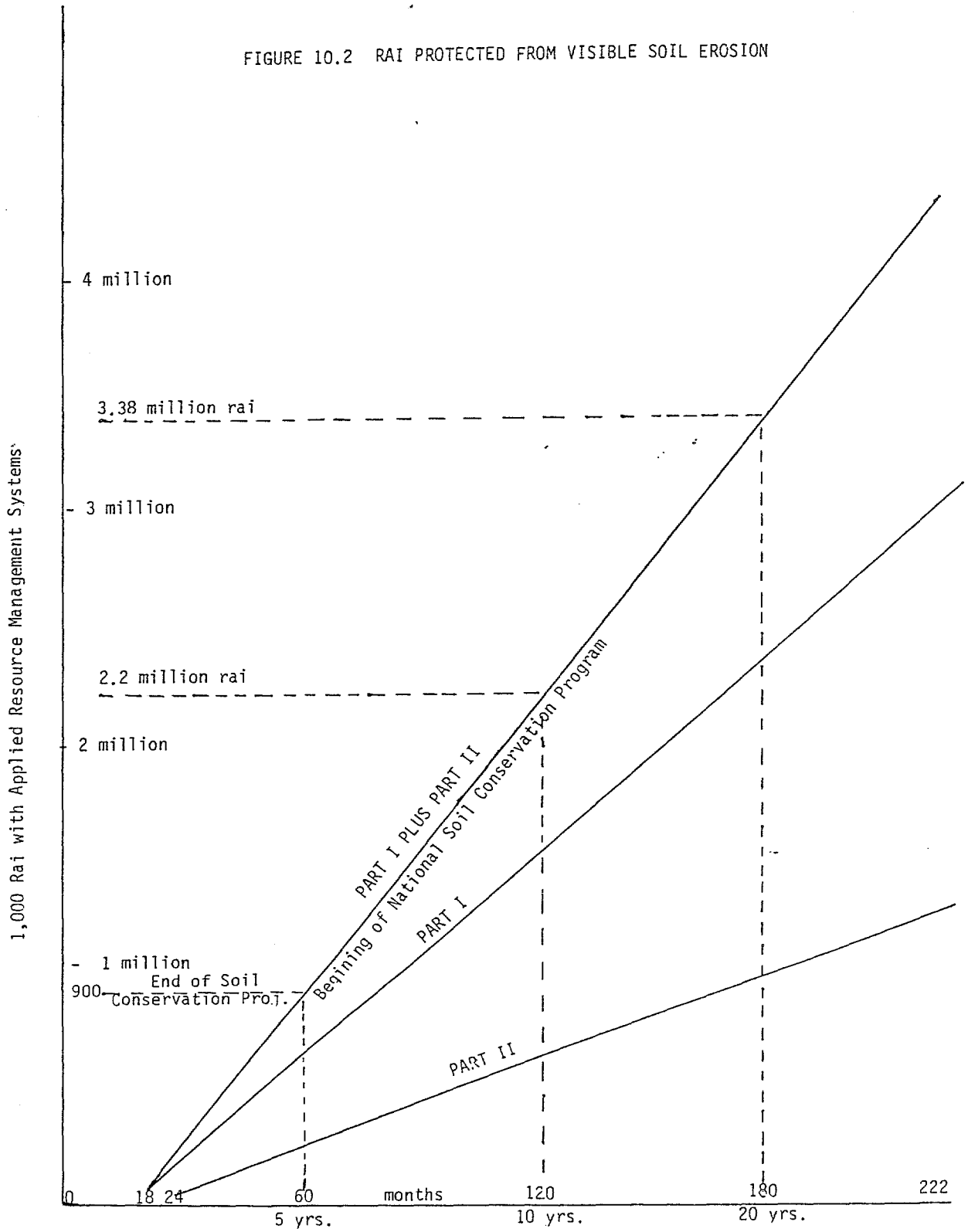
Table 10.3

Effect of Implementing Parts I and II of the Project

Month	Planned Villages	Number of Rai with Applied Conservation Practices (Protected from Visible Soil Erosion)
6	-	-
12	12	
18	36	7,875
24	60	27,562
30	84	59,253
36	108	99,500
42	132	129,927
48	156	165,370
54	180	200,813
60	204	236,250
TOTAL	972	926,550

The 972 villages represent 97,200 farmers assisted and 2,500,000 rai planned and 926,550 rai with applied conservation practices at the end of five years.

FIGURE 10.2 RAI PROTECTED FROM VISIBLE SOIL EROSION



This table shows rai protected over the five year project and projections of rai protected after ten and 20 years.

XI. MONITORING AND EVALUATION

A. Monitoring

Monitoring of the projects production in terms of goals and accomplishments should be carried out as follows:

1. Develop a multiyear plan for the five year period showing the different objectives desired and established goals to reach the objectives. The plan must be broad and flexible enough to adjust to unforeseeable events and changes beyond the control of the project. At the same time, the multiyear plan must be detailed enough to give direction to the annual plan of work.

2. From the multiyear plan develop annual plans of works showing input and output goals for each mobile unit and LDC involved in the project. Break down the annual goals to quarterly workloads for each unit.

3. The LDC chief, as project coordinator, must monitor the production of the mobile units and the training center for quality and quantity of production on a monthly basis. Documentation should be sent to the Project Manager in Bangkok each quarter. Copies of the production document should go to USAID.

4. An annual report of project progress compared to the plan must be presented to DLD and USAID at the end of each project year. At the end of the fifth year a final report of the project should be made in detail.

B. Evaluation

1. A team headed by the project manager for DLD and the USAID project officer should conduct an evaluation of the project at the end of each project year. The evaluation would include an analysis of quarterly and annual reports as well as field trips taken to talk to farmers, village conservation groups, Tambon Councils, Amphoe Committee and all agency personnel involved in the project. The evaluation team should review the conservation plans and resulting conservation work applied. Technical, socio-economic, and management work must be evaluated.

2. At the end of the second and fourth years an outside evaluation team should evaluate the project. A 3-5 person team knowledgeable about soil and water conservation work should do a thorough evaluation of the project at all levels of involvement. The team report should recommend additions or changes to the plan as need is indicated.

Suggested team members:

MOAC
DLD
DOAE
USAID
USDA-SCS
KKU
MOI

Team should represent resource conservation planning, sociology, agronomy, engineering disciplines.

3. A final evaluation of the project by an outside team should be made at the end of the fifth year. This should be in detail enough on all aspects of the project so that the RTG can determine the direction and resulting program for future national soil and water conservation work.

Measurable changes resulting from project activities at 60 months are:

1. One million rai will be protected from visible soil erosion. Over ten million tons of soil will have been prevented from washing off farm fields.

Method - soil conservationists using the USLE will predict the before and after conservation treatment rate of soil erosion for each field during planning.* This information will be recorded in the village soil conservation plan. The monitoring team using the USLE and visual inspection will be able to determine the effectiveness of the project in controlling soil erosion.

2. One thousand villages will have developed village conservation plans and approximately 10,000 farmers will have developed individual conservation plans. These farmers and villagers will have developed a strong conservation ethic toward land ownership and land use. Thirty thousand rai will have had applied resource management systems in place for three years; farmers operating these lands will be enjoying an improved level of living.

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* Average rate of soil erosion is 14 tons per rai in Northeast. Average rate of soil erosion on land use for upland crop is 40 tons per rai. Land treated with soil and water conservation practices will have soil erosion reduced to 3 tons per rai.

a. crop production per rai will increase by 25 percent on land that has had applied conservation resource management system in place for three years.

b. An alternate measurement would be net income per typical farm and this will increase by 6,000 Baht with applied conservation resource management systems inplace for three years.

Method - several villages picked at random from within the project area will be compared with several village selected outside the project but in the same general area. This comparison will show the positive measureable changes idnetified in a. and b. above.

3. DLD will have 60 new well trained mobile teams in the field assisting farmers plan and apply conservation practices. The percentage of DLD staff years working directly with farmers in planning and application of conservation practices will have increased by 100 percent. The rate of planning and application per mobile unit man year will have increased by a factor of ten.

Method - DLD has records indicating the production level of the different LDC's. Each center has a record of each of its three mobile units accomplishments. DLD-LDC's will continue to keep accomplishment records over the life of the pojrect. A comparison of the number of villages and farmers assisted in planning and applying conservation plans will be made before and after project.

4. Farmer, donor, and RTG investments in applying onservation practices will be protected by regularly carried out maintenance.

XII. IMPLEMENTATION STAGES AND ACTIONS

The following actions, sequence, and timing are required to efficiently and effectively implement the RAI Soil and Water Conservation Component.

A. Pre-Project Submission Stage

DLD	USAID
Actions:	Actions:
1. Work with the Civil Service Commission and get acceptance of the soil conservation position.	1. Provide standard and descripton for soil conservatonist position to DLD (copy contained in the project paper).
2. Develop detailed specifications for the equipment listed in Appendix D.	2. Work with DLD in developing equipment specifications and sources of supply.
3. Develop the policies and specifications for the soil share program.	3. Assist as requested.
4. Prepare heavy equipment phase out design to compliment equipment element in this paper. Include strategy and design for increasing private sector conservation practice construction capability. (This should be done in conjunction with item A-3).	4. Assist as requested.

B. Pre A.I.D. Authorization Stage

DLD Actions:	USAID Actions:
1. Inventory resource problems, needs, and identify target areas.	1. Assist as requested.
2. Develop training center staffing plan.	2. Assist as requested.
3. Institutional changes of strengthening the Khon Kaen LDC to serve as a regional headquarters by delegating functional responsibility and supervision authority to the chief.	3. Assist as requested.
a. Develop and identify program management responsibilities at the Bangkok and LDC levels specifying approval authorities. (Consider personnel actions, commitment of funds and equipment, conservation practice planning, design, and construction inspection).	
b. Restructure the LDCs making them responsible for both planning and application.	
c. Redirect LDC operating procedures to emphasize direct planning and application assistance to individual farmers in targeted area.	
d. Reverse the allocation of DLD personnel so that a majority of the staff are based at LDC's or mobile team field locations providing direct services to farmers.	

C. Condition Precednet Stage

DLD	USAID
Actions:	Actions:
1. Assist in translation of home study "Principals of Supervision and Management" Course. Develop examples of Thai conservation work and illustrations as needed.	1. Contract to have home study course "Principals of Supervision and Management" translated into Thai language, using Thai examples and illustrations. Also furnish example copies of USDA-SCS course design.
2. Assist USDA-SCS in developing a resource conservation planning and application course. Develop instruction outlines and lesson plans for training center.	2. Develop preliminary outline and design of resource conservation planning and application course in consultation with DLD.
3. Identify the first 25 DLD employees to be trained at Khon Kaen and the instructors to be stationed at Khon Kaen.	3. Select the USDA project team and send them to the Washington Language School to study Thai.

D. Disbursement Stage

DLD	USAID
Actions:	Actions:
1. Obtain equipment as outlined in project paper and in item A-2. Inventory and repair existing LDC equipment to compliment conservaton planning and application activities in targeted areas.	1. Purchase and ship to DLD terracing machines (pulled by animals or small tractors) and other equipment as identified in project paper.
2. Develop USLE factor values for each LDC with targeted areas.	2. Suply available information on Universal Soil Loss Equation (include slide rules). Provide USDA-SCS agronomist and geologist to assist in USLE factor value development.
3. Obtain services of a sociologist or anthropologist to provide training and assistance in forming "Villager Conservation Group" in every village.	3. Assist as requested.
4. Identify next group of 25 candidates to be trained at Khon Kaen.	4. Assist as requested.

XIII. CONCLUSIONS

The soil erosion and sedimentation problems in Northeast Thailand are of such magnitude that they pose a threat to the land resource base and the socio-economic welfare of the farmers. The problems have accelerated over the past 10 years due to a high percentage of the forest land being coverted to cropland. Thirty-six per cent of the forest in the Khon Kaen Province has been converted to crop land in the past six years. A marjority of this land is being used without any conservation management. Soil loss averages of 40 tons/rai/year are reported. If this rate continues the land resource base will be depleted over the next thirty years.

The team has designed a project for the five year period 1984 - 1988 which we believe can be justified by the number of rai which will have planned resource management systems installed. The project would then return unmeasureable benefits if used as a model to address the similar resource problems throughout the nation in the form of a national soil and water conservation program.

The project is designed to get resource conservation planning and implementation at the village and farmer level and maintain the resource conservation systems with a follow-up program. It is an action plan which calls for a ground implementation in selected target areas beginning the sixth month of the schedule.

This is a critical period of the design and all planned work must be carried out as schedule in order for the project to succeed.

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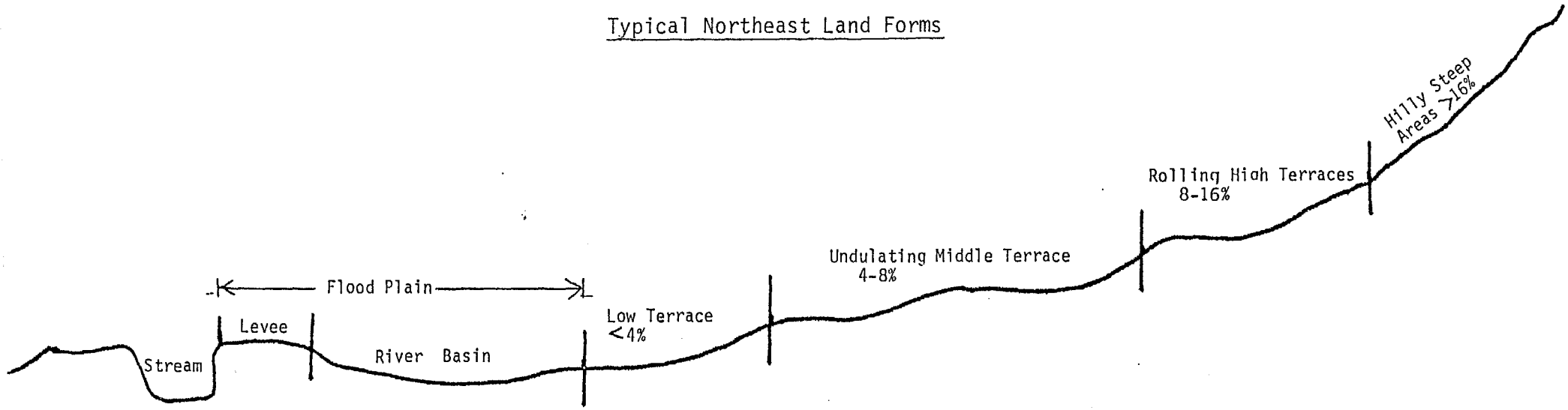
APPENDIX A

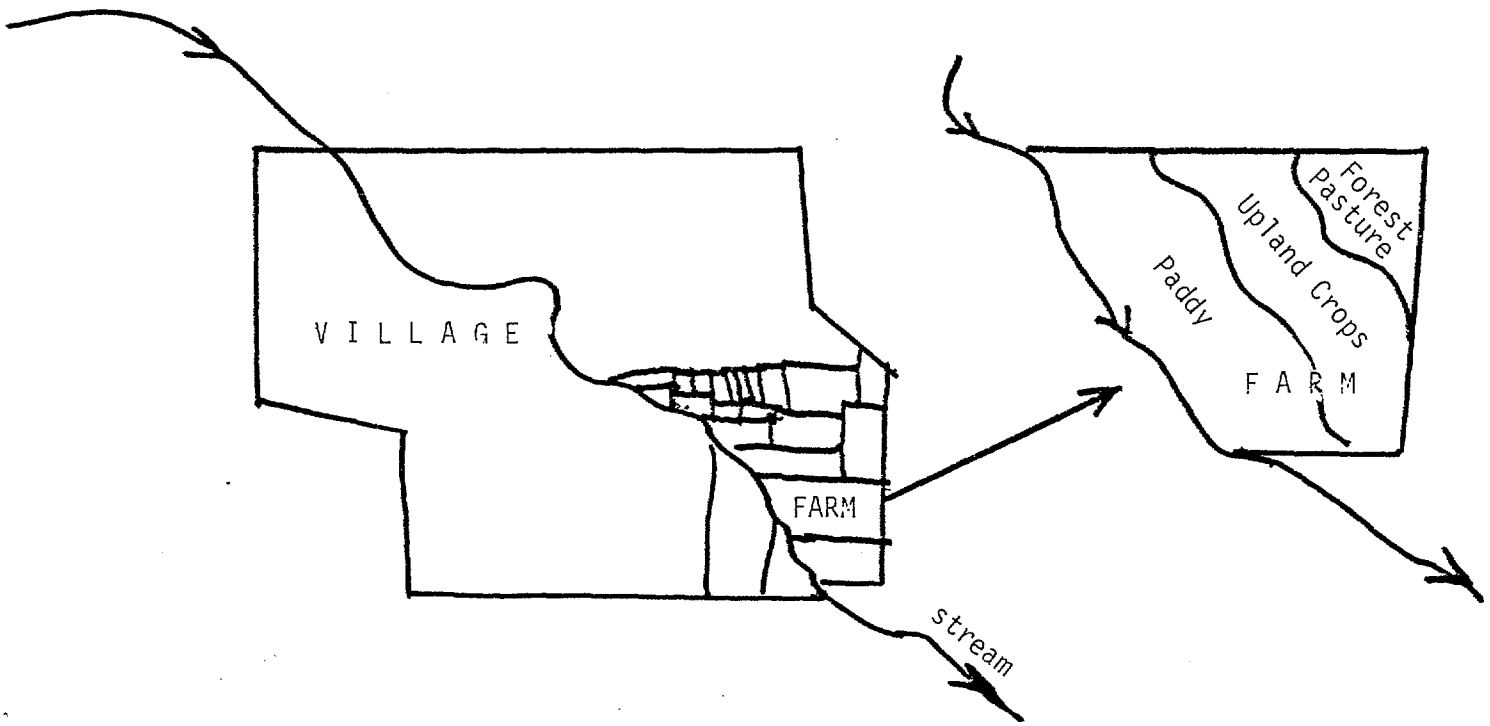
Typical Northeast Land Forms



APPENDIX A

Basis for determination of conservation needs for a typical Northeast village.

Population	710
Number of farms	105
Number of rai per farm	25
Size village per rai	2,625



APPENDIX A

Soil and Water Conservation Needs for an Average Northeast Village

Village area	2,625	rai
Land Forms - Levee 5%	131	rai
Revee Basin 20%	525	rai
Low Terrace 25%	656	rai
Undulating Middle Terrace 20%	525	rai
Rolling High Terrace 20%	525	rai
Hilly steep 10%	263	rai

Land Use		% Crop Use	No. Rai
Levee	Vegetable crops (mellons etc.)	100	131
River Basin	Rice	100	525
Low Terrace	Rice	100	656
Undulating Middle Terrace (525)	Rice	75	394
	Upland crops*	25	131
Rolling High Terrace	Upland crops*	100	525
Hilly Steep (263)	Upland crops*	25	165
	Forest	75	197

Crops		Percent
Rice	1,575	60
Upland Crop	722	28
Vegetables	131	5
Forest	197	7
Total	2,625	100

The information does not represent anyone particular village but is based upon a composite of information about Thai villages in the Northeast. This information was used in estimating conservation needs.

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* Upland crops are generally of the following types--cassava, kenaf, maize, sugarcane, etc.

APPENDIX A

Conservation Resource Management Systems Components needed to reduce soil erosion to non-visible levels and improve the level of living of subsistence farm families.

Forestry						
Tree Planting						X
Thinning						X
Weeding						X
Harvest				X	X	X
Engineering						
Waterways	X			X	X	X
Terraces	X			X	X	X
Sediment Traps				X	X	X
Water Control Structure (drop)	X		X	X	X	X
Irrigation Water Development			X	X		
Dug Ponds			X			
Agronomic						
Practice Rotation				X	X	X
Composting	X			X	X	X
Critical Area Planting					X	X
Minimum Tillage	X			X	X	X
Cover Crops	X			X	X	X
Green Manure				X	X	X
Double Cropping	X	X	X	X	X	X
Interplanting				X	X	X
Strip Cropping	X			X	X	X
Contour Plowing	X			X	X	X
Crop Rotations	X	X	X	X	X	X
Crop Residue Use	X	X	X	X	X	X
Pasture Planting & Management		X		X	X	X
Management						
Maintenance	X	X	X	X	X	X
Row Direction				X	X	X
Field Arrangements	X	X	X	X	X	X
Proper Use of Fert., Lime, & Pesticides	X	X	X	X	X	X
Crop Production & Marketing	X	X	X	X	X	X

Conservation planning will be carried out recognizing rice land, upland crops, pastureland, and forest land resource management systems (RMS). The farmer will select the combination of practice components that best meet his needs. The soil conservationist in assisting the farmer will insure the components applied will complement and not violate the resource management system.

Estimated rates of soil erosion per rai in tons by land use and land form in the Northeast

Typical Land Forms	Typical Land Uses			
	Paddy	Upland Crops	Pasture	Forest
River Levee	0-3	-	-	-
River Basin	0-3	-	-	-
Low Terraces 4% slopes	0-10	5-20	-	-
Undulating Middle Terrace 4-8% slopes	-	5-20	5-10	-
Rolling High Terrace 8-16% slopes	-	20-100	10-50	5-20
Hilly to steep areas 16% slopes	-	100-900	25-100+	15-100

APPENDIX A

Land Use Status of Northeast Thailand

Land Use	Number of Rai	Percent
Tree Crop	51,402	0.05
Annual Upland Crops	11,319,689	10.73
Paddy Field	50,819,925	48.16
Pasture (natural)	150,113	0.14
Forest	39,963,650	37.87
Swamp, depression	2,262,921	2.14
Settlement	87,269	0.08
Communication Center	8,997	0.01
Water Body (reservoir, river, etc.)	869,997	0.82
Total	105,533,963	100.00

APPENDIX B

Conservation Needs Analysis on A Village Basis

Amount of Practice needs per land form, per land use, for a typical village in the Northeast.
- Value in Baht
- Distance in meter
- No. of days in No. 1-10, etc may cover more than practice
- 100 farms per village 2,625 rai.

	Management							Agronomic											Engineering						Forestry				
	Pasture Management (seeding, rotational grazing, etc.)	Crop Production & Marketing	Lime, & Pesticides Proper Use of Fertilizer,	Field Arrangements	Row-Direction	Maintenance (annual)	Crop Residue Use	Crop Rotations	Contour Plowing	Strip Cropping	Interplanting	Double Cropping	Green Manure	Cover Crops	Minimum Tillage	Critical Area Planting	Composting	Practice Rotation	Dug Ponds	Irrigations Water Development	Drop Structures Water Control and	Sediment Traps	Terraces	Waterways	Harvest	Weeding	Thinning	Tree Planting
Levee (131 rai) 0-3% slope 50 meters length K =.35 Truck crop		X	X		X	X	X	X	X	X		X		X	X														
Cost																													
man-days of Tech. Asst. plan & application			38							15																			
River Basin (525 rai) 0% slope, K=.4 Rice		X	X	X		X	X	X				X																	
Cost																													
man days of Tech. Asst. plan & application			38																										
Low Terrace (656 rai) 0-2% slope, 200 m. 2-4% k=.35 Rice		X	X	X		X		X				X							X	X	X								
Cost																			150,000		2,500								
man-days of Tech. Asst. plan & application			38																10		10								
Undulating Middle Terrace (525 rai) 5% slope, 100 m. length of slope, k=.25 Rice 75%-394 rai		X	X	X		X		X				X								X	X								
Cost																					2,000								
man-days of Tech. Asst.			38																		8								
upland crops 25%-131 rai		X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X		X	X	X	X	X						
Cost														3%		5,000				30,000		2000	58,950						
man-days of Tech. Asst.			38							4	3									60			15	16					
Rolling High Terrace upland crops 525 rai	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X	X	X	X						
Cost													125000			5,000					2500	2500	41,600						
man-days of Tech. Asst.			38				120							32		5					10	10	32						
Hilly Steep 263 rai 20% slope, 100 m. length, k=.25 Upland crops 65 rai	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X	X	X	X						
Cost														1600		5000					32500	5000	58,950						
man-days of Tech. Asst.			38				30							8		5					130	24	16						
Forest (pasture) 197 rai	X	X				X								X		X									X	X	X	X	
Cost																													
man-days of Tech. Asst.		8				8								8											36				
Total Cost Baht 851,800													17,300			15000			150000	30000	39500	9500	589,500						
Total man-days = 957	284						296												341						36				

Note: It is assumed one inexperienced soil conservationist can assist 100 farmers a year and two hundred farmers a year after one year of field experience.

APPENDIX C

THAILAND

Soil Conservation Series

This series include positions that involve professional work in soil and water conservation to obtain sound land use, including water management, pollution abatement, and prevention of soil erosion. Such work requires application of knowledge of a variety of agricultural and natural resource management fields, including especially the properties and uses of soils and the techniques and practices used to improve and protect the soil.

Coverage of Occupation

Soil conservation involves treatment of the land so as to obtain optimum use while improving and protecting the soil. Soil conservation is dependent upon proper plant, animal, and water management because the land and its resources--soil, water, plants and animals--are interdependent. Therefore, the soil conservationist must be a generalist who is skilled in combining and applying to practical problems some of the methods and skills of such varied disciplines as soil science, biology, engineering, geology, hydrology, range conservation, forestry, agronomy, and wild-life management. The soil conservationist may combine aspects of these disciplines as an individual worker, or as a coordinator or manager of the combined efforts of specialists in these disciplines.

The soil conservationist is concerned with conservation of the land and its resources whether used for agricultural, commercial, residential or public purposes. In the simplest sense, the farmer manages the land and the soil conservationist advises the farmer. In practice, the soil conservationist works to achieve an integrated system of sound land use and conservation treatment in harmony with the capability and needs of the land and the landowners. Accordingly, the soil conservationist must know the political, economic and cultural makeup of the people served in the area of assignment. The soil conservationist considers these factors as integral parts of assignments.

No one feature, but a combination of features, distinguishes this occupation from related occupations; namely:

1. required knowledge of the properties and uses of soil and of the techniques and practices used to improve and protect the soil;

2. a primary objective of protecting and improving the soil, water and related natural resources;

3. primary functions of advising landowners on and developing alternative plans for the use and treatment of land areas to maintain and improve the quality of the environment;

4. a multidisciplinary approach in analyzing and treating land areas as a combination of land resources, consistent with the social and economic resources and needs of individuals, groups or communities.

Titles

The basic title for positions in this series is Soil Conservationist. Those soil conservationist positions which include supervisory responsibilities of such significance as to require supervisory qualifications are titled Supervisory Soil Conervationist.

Classification Factors

Grade levels are determined and defined under two broad factors: Nature of Assignment and Level of Responsibility.

Nature of Assignment

This factor deals with the scope and complexity of assignments; nature of personal contacts; and nature of the advice rendered.

At lower grade levels the soil conservationist typically works directly with landowners to advise on conservation measures for individual units of land. At higher grade levels the soil conservationist typically works with and through organized groups to advise on conservation programs or projects for a geographic area.

At non-trainee levels assignment involves a variety of personal work contacts with other agency representatives, groups and the public. At lower grade levels these contacts typically involve obtaining and providing information and cooperative support on immediate problems of limited scope, or on standard programs. At higher grade levels contacts typically relate to special projects or problems which affect many landowners, involve complex or controversial features and require extensive coordination or negotiation with others to carry out assignments.

At non-trainee levels the advice rendered by the soil conservationist includes consideration of related social and economic factors. The soil conservationist seeks to improve and protect the land while it is being used. Consequently, the capability and needs of the land must be related to the capability and needs of the landowners. In some cases, substantial social or economic complexities may offset the presence of few complicating physical characteristics, or vice versa. At lower grade levels consideration of these relationships involve individual units of land and the resources of the landowner. At the higher grade levels consideration of these relationships may involve the total physical, social, and economic resources of a geographic area.

This standard refers to "rural development projects" and "resource development projects" in describing representative assignments. As used in this standard, a rural development project is a locally initiated project to expand the economic opportunities for the people in an area through a plan of action for the conservation, improvement, development and wise use of their natural resources. A rural development project frequently includes project measures associated with the development of natural resources, such as facilities, activities or enterprises needed for the use, and processing or marketing of natural resource products.

As used in this standard, a resource development project is also a locally initiated plan specifically for the development of land and water resources. This kind of project may be included in a rural development project, or may be a project in itself. A resource development project may be a single, dual or multiple-purpose project which includes one or more measures such as flood prevention, irrigation, drainage, public recreation, fish and wild-life development and municipal or industrial water supply.

A rural development project is an open end project which continues indefinitely as a flexible, growing and changing program. A resource development project may be developed over a period of years, depending on the scope of the project, but eventually terminates as a completed project.

Level of Responsibility

This factor deals with applicability of guidelines; nature of recommendations; and nature and extent of supervisory controls.

At lower grade levels guidelines are substantially or directly applicable to assigned tasks. At higher grade levels guidelines are inadequate for some, most, or all significant aspects of assignments.

At lower grade levels recommendations mainly concern individual units of land and individual landowners. Recommendations relate to improvements and modifications of methods or procedures. At higher grade levels recommendations apply to areas of land and population groups. Recommendations relate to improvement and modification of programs, or to the resolution of substantive administrative problems.

At lower grade levels the soil conservationist receives assignments in terms of specific objectives. Technical assistance is readily available from the supervisor or a specialist. Completed work is reviewed for technical adequacy. At higher grade levels assignments are given in terms of general objectives. Completed work is reviewed cursorily, or not at all, for technical adequacy.

Qualification Standards
For Soil Conservation Series

Duties Statement

Soil conservationists perform professional work such as the following:

- Advise and work with farmers to develop soil and water conservation plans for farms, and other land uses.

- Advise and work with government officials to develop a comprehensive soil and water conservation program which serves a number of communities.

- Advise and work with government agencies or private groups to develop broad plans and recommendations for the orderly development of the natural resources in the area.

- Coordinate broad rural development or multiple-purpose development projects.

- Manage broad soil and water conservation programs.

Basic Requirements for All grades

Candidates for positions at all levels must show successful completion of paragraph A or B:

A. A full 4-year course of study in an accredited university leading to a bachelor's or higher degree with major study in soil conservation, or one of the closely related natural resource or agricultural fields, such as agronomy, forestry, wildlife biology, regional planning, agricultural education or agricultural engineering. The study must have included 30 semester hours in natural resources or agricultural fields including the equivalent of a 6-semester hour course in soils.

B. A minimum of a 5-year Vocational Agricultural School Certificate and 4 years of field experience in soil and water conservation. The vocational agriculture study must have included 4 credit hours of work in soils.

APPENDIX D

Workload Analysis

Introduction

A. A workload analysis should be prepared by each organizational unit in DLD. It should be prepared or updated annually and will form the basis for multiyear and annual plans of operation.

B. The workload analysis at each level is a study of activities and/or program needs to which DLD resources (money, people and equipment) can be directed. Insofar as practical, it should identify the kind of problems or opportunities needing action, the quantitative extent thereof, and the annual requirements by staff days to do that activity or job. Land Development Centers should consider programs, responsibilities, and resources of all related departments, agencies, and groups such as DOAE, DOA, DOLD, KKU, DTEC PWD, RFD, RID, Province Governor's Council, Tambon Council, Village Conservation group, etc. Every effort must be made to coordinate and use all available conservation related programs and resources.

C. The workload anlysis is to consider physical resources, economic conditions, conservation, conservation needs, program needs, and all other activities and needs associated with the total workload at each level.

D. Items identified as potential for DLD action must be authorized by legislative, appropriation, or other legal authority for the activity.

Guidelines

A. The workload anaysis must be tailored to the needs of the organizational unit making the analysis. It should be updated when conditions change enough to affect the reliability of the analysis for work planning and productivity measurements. It is suggested that the workload analysis be filed in a loose-leaf binder so revisions can be easily made to keep the analysis current. It should contain the following:

1. A brief outline of resource conditions (physical, social, and economic) within the work area;

2. Long-range needs related to the resource conditions;

3. Trends in resource conditions and needs;

4. Strategies for accomplishing work, including such things as improving the information program, training conservation contractors, giving direct DLD technical ssistance, and making other conservation program available;

5. Methods to improve the efficiency and effectiveness of DLD operations;

6. Estimated non-DLD resources needed to do each identified job (technical assistance, equipment, etc.).

B. The workload analysis is to be reviewed when preparing the Multiyear Plan and the annual plan of work for the LDC.

APPENDIX E

Cost and Benefits (Economics)

Net Income Data, Method 1

Typical Village, Sugar Cane Area

Table E-1 Present Conditions (1982)

Crop	Rai	Yield 1/	Returns	Cost 2/	Net Returns
Rice	1575	210	714,400	910,400	-196,000
Sugar Cane	722	5142	1,039,500	910,300	129,200
Misc.	131	283	1,121,800	94,500	1,027,300
Forest	197	200	39,400	-	39,400
Total	2625				999,900
					Say ฿ 1.0 M.

1/ Five year average, agricultural Statistics of Thailand, forest is quoted as net incomes.
2/ Three year average, Agricultural Statistics of Thailand

Table E-2 Without Conservation (10 year hence)

Crop	Rai	Yield 1/	Returns	Cost 2/	Net Returns
Rice	1575	141	479,700	1,001,500	-521,800
Sugar Cane	722	3445	696,400	721,800	25,300
Misc.	131	190	753,200	128,100	625,100
Forest	197	150	29,600	-	29,600
Total	2625				158,200
					Say ฿160,000

Table E-3 With Conservation

Crop	Rai	Yield 3/	Returns	Cost 4/	Net Returns
Rice	1575	279	949,200	1,001,400	-52,200
Sugar Cane	722	6839	1,382,600	721,800	660,800
Misc.	131	376	1,490,500	128,100	1,362,400
Forest	197	250	49,250	-	49,200
Total	2625				2,020,200
					Sav ฿2.0 M.

1/ Yields reduced by 33 percent
2/ Costs increased by 10 percent
3/ Yield increased by 33 percent
4/ Costs increased by 10 percent

Net Income Data, Method 2

Typical Village, Sugar Cane Area

Table E-4 Present Conditions (1982)

Crop	Rai	Yield 1/	Returns	Cost 2/	Net Returns
Rice	1575	210	714,400	910,400	-196,000
Sugar Cane	722	5142	1,039,500	910,300	129,200
Misc.	131	283	1,121,800	94,500	1,027,300
Forest	197	200	39,400	-	39,400
Total	2625				999,900
					Say ฿1.0 M.

Table E-5 Without Conservation (10 year hence)

Crop	Rai	Yield 3/	Returns	Cost 4/	Net Returns
Rice	1575	178	605,600	1,001,500	-395,900
Sugar Cane	722	4371	883,600	721,800	161,800
Misc.	131	241	955,300	128,100	821,200
orest	197	175	34,500	-	34,500
Total	2625				627,600
					Sav ฿600,000

1/ Five year average, agricultural Statistics of Thailand, forest is quoted as net income.
2/ Three year average Agricultural Statistics of Thailand
3/ Yields reduced by 15 percent
4/ Costs increased by 10 percent

Table E-6 With Conservation

Crop	Rai	Yield 1/	Returns	Cost 2/	Net Returns
Rice	1,575	210	714,400	910,400	-196,000
Sugar Cane	722	5,142	1,039,500	910,300	129,200
Misc.	131	283	1,121,800	94,500	1,027,300
Forest	197	200	39,400	-	39,400
Total	2625				999,900
					Say ฿1.0 M.

1/ Yield increased by 33 percent
2/ Costs increased by 10 percent

Cost Effectiveness Analysis

Hilly Steep (65 rai)

1. Land use conversion, crop to forest

   - erosion reduction, 400 T to 4 T/rai
   - annual costs of conversion

cover crop	Baht	20	
trees		4,000	
labor		20	
	Baht	4,040	10 years = Baht 404

   - annual returns - Baht 25,000 10 years = Baht 2,500
     cost = Baht 2,096

   (data from Australian forester, Chiang Mai).

2. Crop rotation and cover crop

   - erosion reduction 400T to 280 T
   - annual costs, Baht 25/rai (cover crop)
   - annual costs, Baht 200/rai (crop rotation)
   - annual costs, Baht 225/rai

3. Terraces, waterways and drop structure

   - erosion reduction, 280 T to 120 T
   - annual cost per rai, Baht 315

4. Contour strip cropping

   - erosion reduction, 120T to 4T
   - annual cost per rai, Baht 50

Summary - Cost per Ton Reduced

1. Land use conversion - Baht 5.30/ton

2. Crop rotation and cover crops - Baht 1.90/ton

3. Terraces, waterways and drop structures - Baht 2.60

4. Contour strip cropping - Baht 0.40

Rolling High Terrace (525 rai)

1. Crop rotation and cover crop

   - erosion reduction, 60 tons to 18 tons
   - annual cost/rai, Baht 225

2. Terraces, waterways and drop structures

   - erosion reduction, 18 tons to 11 tons
   - annual cost/rai, Baht 190

3. Contour stip cropping

   - erosion reduction, 11 ton to 4 ton
   - annual cost/rai, Baht 50

Summary - Cost per Ton Reduced

1. Crop rotation and cover crop - Baht 5.30/ton

2. Terraces, waterways and drop structures - Baht 27.0/ton

3. Contour strip cropping - Baht 7.10/ton

Middle Terraces (525) rai

1. Crop rotation and supporting agronomic practices

   - erosion reduction, 18 tons to 9 tons
   - annual cost/rai, Baht 250

2. Terraces, waterways and drop structures

   - erosion reduction, 9 tons to 6 tons
   - annual cost/rai, Baht 36

3. Contour farming

   - erosion reduction, 6 tons to 4 tons
   - annual cost/rai, Baht 35

Summary - Cost Per Ton Reduced

1. Crop rotation and agronomic - Baht 27.80/ton

2. Terraces, waterways and drop structures - Baht 12.00/ton

3. Contour farming - Baht 17.50/ton

Off-Site (Sediment Deposition) Benefits

Average annual erosion rates:

Without conservation -	11.4 ton/rai
With conservation -	3.0 ton/rai
	8.4 ton/rai

The team has assumed a sediment delivery ratio of .25.

8.4 ton/rai X .25 = 2.1 tons

2.1 tons X ฿ 40 per ton (cost of removal) = ฿ 84 per rai having conservation practices applied

Basic Cost Data - Conservation Practices

	Cost Per Rai	
	Total	Farmers
Capital Costs	฿ 312	฿ 62
Annual practices	12	2
O & M		9
	฿ 324	฿ 73

Data from Publication
Social and Economic Conditions of a
Rural Population in Northeast Thailand, 1979

Village of Khon Kaen

Lowland villages (gross income)

paddy	77%
vegetable	17%
field crops	6%

Upland villages (gross income)

paddy	59%
vegetable	13.5%
field crops	27.5%

Average income

full agricultural farm -	฿ 8,500	50%
sub marginal farms -	฿ 8,500	50%

Use ฿ 9,500 x 50% = 4,750
Use ฿ 6,500 x 50% = 3,250

Average farm income ฿8,000

Table E-7 Adjustment of Net Incomes per Farm

Method 1

Average net income per farm		X 2.3
Present	฿ 8,000	18,400
Future, w/o	1,280	2,900
Future, w/	16,000	36,800
Change from cons.	14,720	33,900
		(3390/yr.)

Method 2

Average net income per farm		
Present	฿ 8,000	18,400
Future, w/o	4,800	11,000
Future, w/	8,000	18,400
Change from cons.	3,200	7,400
		(740/yr.)

Indexing from 1970/77 to 1982 (est.)

1970/71	= 96	
1979/80	= 204	
say 1982	= 220	use 2.3

Table E-8 Mobile Team Thai Membership
Five Members

Position	Education	No.	Pay & Per Diem
Soil Conservationist	BS Degree	1	Baht 5,000
Agricultralist	5-Yr. Vo. Ag.	2	8,000
Technician	3-Yr. Vo. Ag.	1	3,000
Operator (Mechanic)	-	1	2,800
Total per team/month			18,800

Table E-9 Personnel Costs USDA-SCS*

Position	Period of Stay in Mo.	No.	Baht/Year	Total (Baht)
Soil Conservationist GS-14	30	1	2,300,000	5,750,000
Soil Conservationist GS-12	24	3	2,300,000	13,800,000
Cons. Technician GS-7	24	3	2,300,000 (Baht/Mo)	13,800,000
Agronomist GS-13	4	1	230,000	920,000
Agri. Engineer GS-13	4	1	230,000	920,000
Agri. Economist GS-13	4	1	230,000	920,000
Resources Cons. GS-13	4	1	230,000	920,000
Geologist GS-13	4	1	230,000	920,000
Total				37,950,000

*$100,000 per man per year and $10,000 per man-month were used in determining cost.

Table E-10

Review of Foreign Government Conservation Program

By Four Representatives of the RTG-DLD for One Month

Number	Cost	Unit	Total
4	Air fare	@23,000	Baht 92,000
4	Per Diem	@2,300	9,200
	Total		Baht 101,200

Table E-11 Training of 4 RTG-DLD Officials for Two Months in the U.S. by USDA-SCS

Number	Cost	Unit	Total
4	Air Fare	@57,500	Baht 230,000
4	Per Diem	@1,150	4,600
4	USDA-SCS Training Cost	@34,500	138,000
	Total		372,600

Table E-12
Equipment for One Mobile Team -First 24 Months

Kind	Amount	Unit Cost (Baht)	Total Cost (Baht)
Pickups	2	100,000	200,000
Tractor with Accessories	1	240,000	240,000
Power Grader	.2	260,000	52,000
Disk Plow	1	30,000	30,000
Levels (Dumpy)	1	7,000	7,000
Hand Levels	3	150	450
Misc. Equipment	1	10,000	10,000
Hand hoes & Shovels	80	230	18,400
2-Wheel Tractors with Attachment	.8	46,000	36,800
Terrace Machines	.8	11,500	9,200
Total			603,850

Table E-13 Equipment for One Mobile Team Formed From Month 30 Through Month 60

Kind	Amount	Unit Cost (Baht)	Total Cost (Baht)
Tractors with Accessories	.5	240,000	120,000
Power Grader	.11	1,600,000	176,000
Disk Plow	.5	30,000	5,000
Pickups	2	100,000	200,000
Levels Dumpy	1	7,000	7,000
Hand Level	3	150	450
Misc. Equipment	1	10,000	10,000
Hand hoes & Shovels	80	230	18,400
2-Wheel Tractors with Attachment	.8	46,000	36,800
Terrace Machines	.8	11,500	9,200
Totals			592,850

Table E-14 Village Soil Conservationist Equipment

Kind	Amount	Unit Cost (Baht)	Total Cost (Baht)
Lock Level	1	115	115
Rods	2	92	184
Measuring String	1	46	46
Hat	1	69	69
Total			414

Equipment Cost Analysis

Three alternative methods will be used in constructing conservation practices:

1. DLD-LDC equipment

2. Private contractor equipment, and

3. Village farmers using hoes, shovels, animal drawn terrace machines, and two wheel tractors.

Cost and production studies have not been made on these three methods. Interviews with USAID engineers, DLD staff, and the experience of team members were used in developing the following information:

Table E-15

Item	Cost per cubic meter of soil in terrace construction	Production of Terraces per 8 hour-day in linear meters (based upon 1&1/2 cu.m. per linear meter)
DLD-LDC 75 HP tractor with* disk harrows and blades	Baht 6.5	250
Private Contractors	7	300
Village hand labor with hoes and shovels	7**	6
Animal pulled terrace machines	2***	100
Two wheel tractors operated by village farmer with disk harrows and blades	2	100

* Information from NERAD--costs do not cover overhead items such as supervision and labor.

** 60 Baht per village day laborer--Villagers will be given the opportunity to construct their own terraces. Villagers will not be asked to work outside their own village. Usually the village will develop a work force of 50 to construct terraces.

*** Two water buffalos, terracing machine, and one village laborer are estimated to cost 300 baht per day

Table E-16 Project Costs

RAI/Soil and Water Conservation Component

(in Thousand Baht)*

(1) Months	(2) Mobile Team Equipment	(3) Village Soil Conservation Equipment	(4) Training Center Equipment	(5) USDA/SCS Personnel Costs	(6) Thai Officials on Foreign Govt. Con. Review	(7) Thai Officials Training in U.S. USDA/SCS	(8) Cost Share Funds for Installation of Conserva. Practices	(9) Total of Columns 1-8	(10) RTG Cost	(11) Total Project Cost
6	3,950	-	1,058	18,975	111	409	-	24,503	3,595	28,098
12	3,950	5	-	5,060	-	-	-	9,015	9,878	18,893
18	4,384	18	-	19,481	-	-	2,315	26,198	20,935	47,133
24	4,384	30	-	-	-	-	8,104	12,518	33,751	46,269
30	4,734	46	-	-	-	-	19,164	23,944	53,697	77,641
36	4,734	59	-	-	-	-	32,182	36,975	73,603	110,578
42	5,208	80	-	-	-	-	42,023	47,311	105,955	153,266
48	5,208	94	-	-	-	-	58,835	64,137	134,042	198,179
54	5,729	120	-	-	-	-	78,589	84,438	183,477	267,915
60	5,729	136	-	-	-	-	92,457	98,322	233,747	332,069
TOTALS	48,010	588	1,058	43,516	111	409	333,669	427,361	852,680	1,280,041

* Contingencies at 10 percent and inflation at 10 percent per year.

Table E-17 Cost and Budget

RTG PROJECT COSTS - RAI SOIL AND WATER CONSERVATION COMPONENT
(in Thousand Baht)*

Month	No. of Teams	No. of Men	Pay Costs Pay & Per Diem	No. of Truck	Operation & Maint. Cost	Building & Other Misc. Cost	# RTG/ DLD 75 HP Tractors	Operation & Maint. Costs	# of D4 Power Graders	Operation & Maint. Costs	No. of 2-Wheel Tractors	Operation & Maint. Costs	Terrac-ing Machine	Operation & Maint. Costs	Total
6	6	30	900	12	356	-	6	1,584	1	264	5	396	5	5	3,595
12	12	60	3,960	24	1,426	-	12	3,162	2	528	10	792	10	10	9,878
18	18	90	9,801	36	3,528	-	18	5,227	4	1,056	15	1,307	15	16	20,935
24	24	120	17,424	48	6,273	-	24	6,970	5	1,320	20	1,742	20	22	33,751
30	30	150	29,948	60	10,781	-	27	8,625	6	1,917	25	2,396	25	30	53,697
36	36	180	43,124	72	15,525	-	30	9,583	7	2,460	30	2,875	30	36	73,603
42	42	210	64,567	84	23,244	-	33	11,596	8	2,811	35	3,690	35	47	105,955
48	48	240	83,600	96	30,360	-	36	12,650	9	3,162	40	4,217	40	53	134,042
54	54	270	117,406	108	42,234	-	39	15,074	-	3,479	45	5,218	45	66	183,477
60	60	300	144,946	120	52,180	11,272	42	16,234	-	3,479	48	5,566	48	70	233,747
TOTAL	60	300	515,566	120	185,907	11,272	42	90,705	9	20,476	48	28,199	48	355	852,680

* Contingencies at 10 percent and inflation at 10 percent per year.

APPENDIX F

Social Impact Assessment

Achieving the goal of soil and water conservation will require a strong "Nation Commitment". The RTG can help rural needy people by helping them to help themselves in improving their resource base. Soil conservation does not always show in the short run, but the impacts on social benefits are long lasting.

The key to technical assistance technology transfer is to create in people a sense of pride in land use and ownership. Soil and water conservation is a means for farmers to raise their incomes and enjoy a better way of life. Soil conservation does not mean giving up old practices, but learning new and better ones, that can be added to the traditional way of farming. In the social aspect, it might be said that cultural change consists in abandoning old ways and adopting new ones. Most farmers still use traditional types of equipment in farming. The farmer's way should be respected by people, agencies, and programs aimed at helping him.

The result of the impact assessment showed soil conservation is the best way to keep the people in their habitat, still having hope in their lives, health and happiness. This should be found after they apply practice in soil conservation on their land and reap the benefits.

Strategy to Approach to the Farmers

Soil conservationists must make contacts with the farmers. A few can be entioned, here:

1. Preliminary survey in the community by house to house.

2. Observation and keep records on their farm size, erosion, problems, crop production, income, and what they need in the record paper.

3. Set up or try to keep workings of core group such as village key informant or informal leader as informal as possible.

4. Farm exhibits should be done as much as possible.

5. Discussion of local problems should be done at the village hall in the evening after dinner or at night.

6. Try to use sociometric (sociogram) to seek for the village key person to take responsibility of soil conservation.

7. Soil conservationist should visit the villagers with agricultural extensionist in order to understand their needs in agricultural production.

Strategy to Form "Village Soil Conservation Group"

Teach the concepts and ideas of soil conservation to the farmers. Soil conservationist must help form the organization group. The steps of this strategy as follows:

1. Sociologist or Anthropolist is needed to identify the village phenomena before the implementation begins.

2. Mobile Soil Conservationist should develop the formal organization of Village Conservation Group (VCG) which adapted from core group.

3. The organization should be simple and easy to understand their activities in V.C.G.

4. The villagers who are going to be members of V.C.G. are not limited.

5. The leader of the V.C.G. must be accepted the members by when he was selected.

6. Members of the V.C.G. should consist of village headman, active farmers, informal leader, teacher, and anyone else, abbot who has influence in the community.

7. The V.C.G. should have an advisory committee (AC) (soil conservationist, community development worker, agricultural extensionist, etc.)

8. The V.C.G. should have objectives and method should be written by the V.C.G. themselves under the advisory of V.I.P. or A.C.

9. The term of V.C.G. should be 2 years.

10. V.C.G. should have some material for their activities such as:

    a. Map of the paddy field, upland crop;

    b. Flow chart of activities;

    c. Objective and implementation plan during the cycle of agricultural year;

    d. Record paper on soil problem and soil conservation activity;

    e. Record of the V.C.G. members;

    f. Record of the successful cases of their activities after V.C.G. had worked.

D. Strategy to Follow Up and Evaluate V.C.G.

Follow up and evaluation are necessary for soil conservation services. Following are to be mentioned:

1. V.C.G. activities should be followed up every six month by the soil conservationist.

2. The result of the follow up should be discussed with V.C.G. and their members.

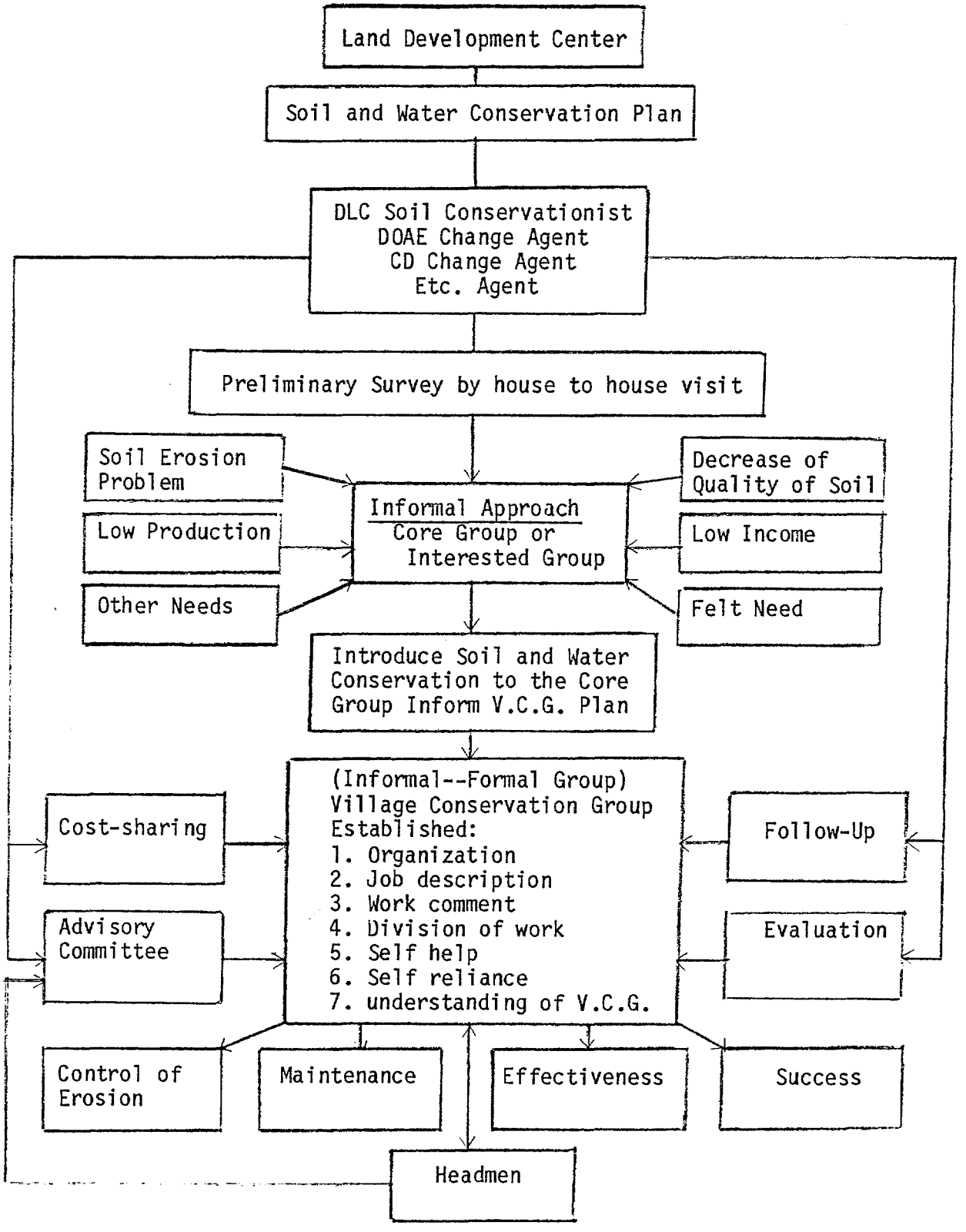
3. The problems of maintenance should be discussed.

4. The problem of interrelationship among villagers should be discussed and evaluated.

5. The market of upland crop and transportation should be discussed.

6. Soil conservationist should identify the effective use of the whole program in the local level plan.

Strategy Model to Form V.C.G.*



* V.C.G. = Village Conservation Group

APPENDIX G

Technical Assistance - USAID

Long Term		Months
1	Team Leader	30
3	Soil Conservationists	24
3	Conservation Technicians	24

Short Term

1 Agronomist
1 Agricultural Engineer
1 Economist
1 Resource Conservationist
1 Geologist

Qualifications

1. All long-term consultants to have language course in Thai.

2. The Team Leader will have a minimum formal education of a BS, MS with work experience at the field area, and state levels of USDA-SCS organization. Grade level GS-13 or above.

   The Soil Conservationists will have a minimum of formal education of a B.S. and work experience at the field and area levels of USDA-SCS organization. Grade level GS 11 or above.

The Conservation Technicians will have a high school education and five years of work experience at the field level. Grade level GS-6 or above.

Specialists will have a minimum formal education of BS and work experience at the area level or above. Grade level GS-12 plus.

Proposed Schedule of Work

1. Long Term Consultants - Team should arrive in Bangkok two weeks prior to authorized project start.

2. Short term USAID consultants will be scheduled as need is determined by team leader in consultation with USAID and DLD.

APPENDIX H

A. Training Outline for Resource Conservation Planning and Application Course:

1. Conservation Planning Process

   - Steps in planning
   - Resource data for planning. This will include soils, land use, ownership, drainage area and sediment sources.
   - Basis for conservation planning (Technical guide and how to develop one).

2. Preparation of a Conservation Plan

   - Classroom
   - Field exercise (development of a plan)

3. Salesmanship

4. Operations Management

B. Application of Resource Management Systems and Practices.

1. Design of Ditches

   - General
   - Drainage runoff (20-40 rule)
   - Ditch alignment
   - Hydraulic or Energy gradient
   - Design methods

2. Erosion Control

- Erosion Processes

  Water erosion
  Wind erosion
  Factors influencing the rate of erosion
  Soil loss prediction equations

- Estimating runoff

  Introduction
  Factors affecting surface runoff
  Volume of flood runoff
  Peak Rate of Discharge

- Preparation of Engineering Plans

  General
  Planning Procedures

- Structures

  Definition
  Introduction and Purpose
  Component parts of structures
  Structure Selection
  Stability of Grades Below Spill Ways
  Structure Types (Selection & Design)

3. Grassed Waterways and Outlets

- Definition
- Protection
- Shape or cross section
- Watershed Treatment
- Location
- Surveys
- Design and Design Criteria
- Construction
- Maintenance

4. Terraces

- General
- Objectives of Terrace Systems
- Types of Systems
- Soil Considerations
- Terrace Cross Section
- Terrace Spacing
- Alignment
- Layout Geometry
- Layout
- Design
- Construction
- Maintenance

5. Diversions

- General
- Survey
- Desing of Diversions
- Layout and Construction
- Maintenance

6. Ponds and Reservoirs

- General
- Types of Ponds and Reservoirs
- Selecting the Pond Site
- Primary Site Studies
- Engineering Surveys
- Embankment Ponds (dams)
- Damless or Excavated Ponds

7. Soil Management and Land Improvement

- Soil Improvement Practices
- Crop Rotation Systems
- Soil Profile Modification
- Fertilizer Application

8. Institutional Aspects of Water Management in Small Watersheds

- Application of Engineering Practices
- Economic Aspects
- Extension - Conservation Education
- Summary