BASIC DESIGN STUDY

ON

DON MARIANO MARCOS MEMORIAL STATE UNIVERSITY AGROFORESTRY COMPLEX PROJECT

IN

THE REPUBLIC OF THE PHILIPPINES

FEBRUARY 1984

JAPAN INTERNATIONAL COOPERATION AGENCY

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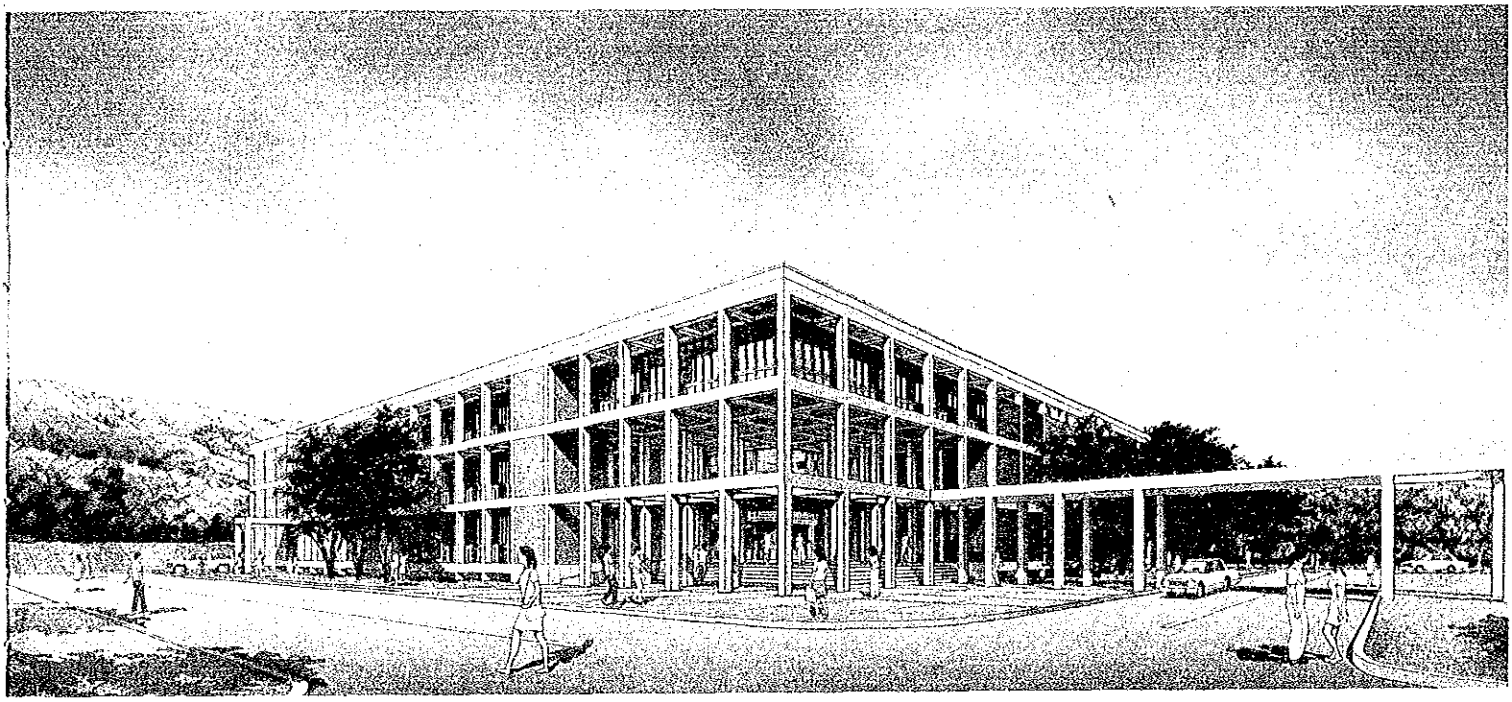


DON MARIANO MARCOS MEMORIAL STATE UNIVERSITY
AGROFORESTRY COMPLEX PROJECT

PREFACE

In response to the request of the Republic of the Philippines, the Government of Japan decided to conduct a basic design study on the Don Mariano Marcos Memorial State University Agroforestry Complex Project and entrusted the study to the Japan International Cooperation Agency (JICA). The JICA sent to the Philippines a study team headed by Mr. K. Hara, Director of Forestry Promotion Division, Forestry Agency, from October 25th to November 14th, 1983.

The team had discussions with the officials concerned of the Government of the Philippines and conducted a field survey in Metro Manila and Bacnotan, La Union. After the team returned to Japan, further studies were made and the present report has been prepared.

I hope that this report will serve for the development of the Project and contribute to the promotion of friendly relations between our two countries.

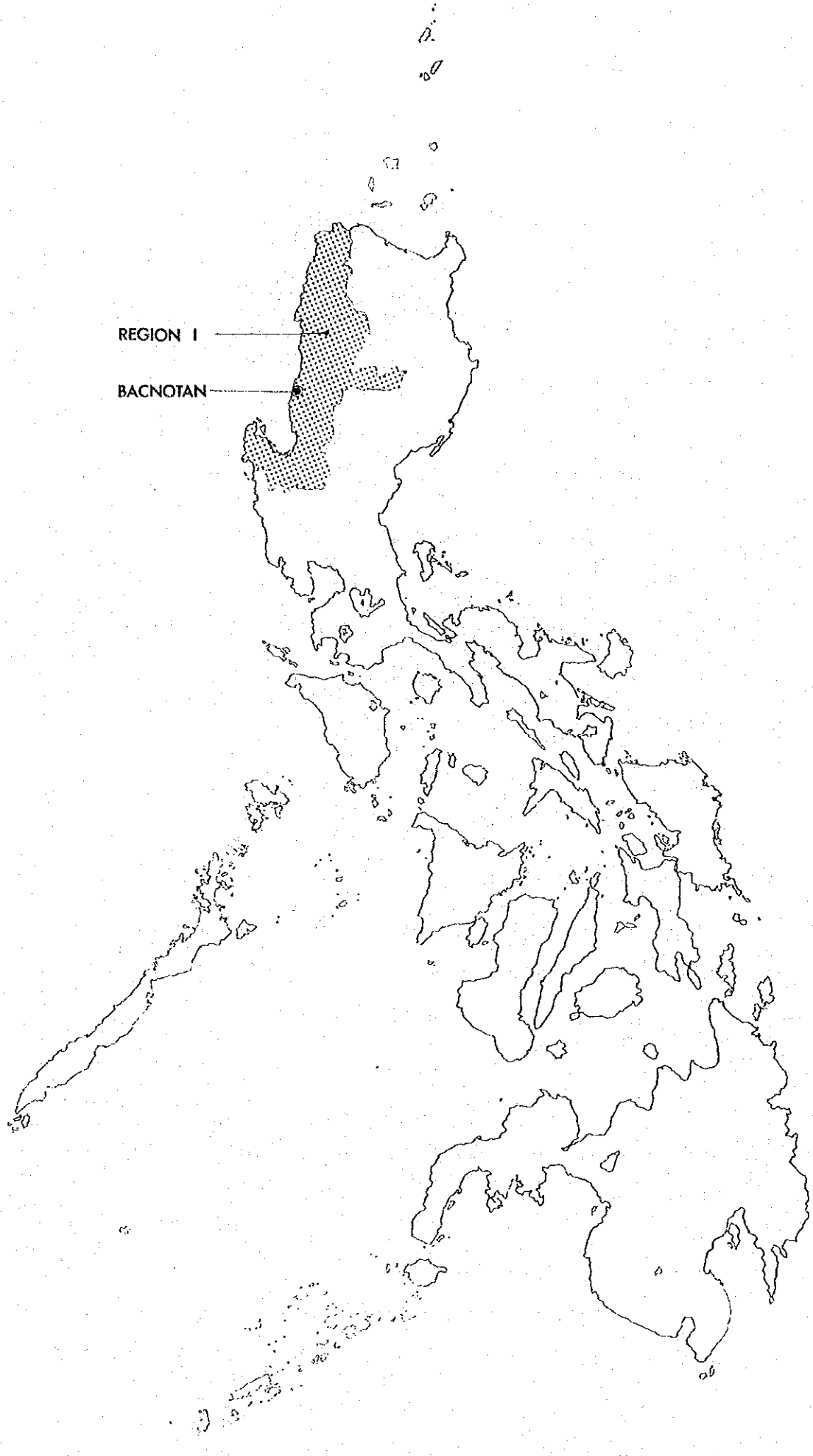
I wish to express my deep appreciation to the officials concerned of the Government of the Republic of the Philippines for their close cooperation extended to the team.

February, 1984

Keisuke Arita

President

Japan International Cooperation Agency



A Map of the Republic of the Philippines

INDEX

CHAPTER 4: PROJECT

CHAPTER 5: IMPLEMENTATION OF THE PROJECT

SUMMARY

SUMMARY

Under a pressing demand for regional development, the Government of the Republic of the Philippines requested the Government of Japan for their cooperation in the Don Mariano Marcos Memorial State University, Agroforestry Complex Project to be located in La Union, Region I.

Responding to this request, the Government of Japan despatched to the Republic of the Philippines a Basic Design Study Team headed by Kiichiro Hara, Director of Forestry Promotion Division, Forestry Agency, through Japan International Cooperation Agency for the period of October 25 to November 14, 1983, in the region around Manila and La Union, for the purpose of conducting studies on the feasibility and adequate basic design for the Project.

Recognizing a well-balanced regional development as an effective method of socio-economic development, the Republic of the Philippines is currently making strenuous efforts for upgrading the living standards of its people through such movements as the KKK Program.

Since old times, Region I has been the object of upland shifting cultivation resulting not only in a meager land left for forestry and poor quality of soil but also a serious concern for natural disasters. Therefore, the natural environments and geological conditions of the Region also point out the urgent need for adjusted and effective land use based on agroforestry.

Under these socio-economic situations of the local region, the Project aims at providing necessary facilities and equipment for research, education and dissemination of knowledge related to agroforestry, which is certain to play an important role in the development of Region I in general and La Union in particular.

The outline of the Project is as follows:

Objectives: To construct Agroforestry Complex on the site of the Don Mariano Marcos Memorial State University and provide equipment instrumental to the research, education and extension of agroforestry.

Executive Agency: Don Mariano Marcos Memorial State University

Project Site: in the campus of the Don Mariano Marcos Memorial State University in Bacnotan, La Union

Facilities:

Agroforestry Complex	
3-story building of reinforced concrete	4,990 m^2
Field Workshop	
1-story building of concrete hollow block	240 m^2
Handcraft Workshop/Garage	
1-story building of concrete hollow block	270 m^2

Equipment: Equipment necessary for Agroforestry Biological Sciences, Processing of Agroforest Products, Agroforestry Resources Management and Agroforestry Extension, as well as office machines for preparing teaching materials and equipment for first-aid treatment.

It will take a period of 15 months to construct the Complex provided with the necessary equipment.

The Republic of the Philippines is now in a stage of economic growth that urgently calls for regional development and adjustment in the differences in economic strength of each region , as is the case with all developing countries.

It is in this light that the Project aiming at Research, Instruction and Extension of Agroforestry through effective use of time and space without a large investment of capitals will be meaningful for improving the living standards of the residents of Region I, 60 percent of the total area of which is occupied by highlands.

This Project can also be positioned as a prototype for realizing effective development not only in the region and the country itself, but also for all other nations in the tropical area currently burdened with difficulties in economy and overflowing population. From this viewpoint, it is appropriate that this Project is to be carried out as a Grant-Aid Project of the Government of Japan.

Although the feasibility study revealed that not only the site but also the University already has a sufficient socio-economic background and adequate natural and geological conditions for the Project, technical cooperation, as strongly requested by the University, is nevertheless very meaningful for the Project.

We sincerely hope that both Governments of the Republic of the Philippines and Japan will recognize the urgency and importance of this Project, and that the Project will be carried out in success under a close collaboration between the Government of both countries resulting, in the long run, in the upgrading of living standards of the people in the Philippines and a lasting, friendly relationship between the two countries.

CHAPTER 1: INTRODUCTION

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1-1 Proposal

1-1-1 Develoment of the Proposal

Under the Presidential Decree No. 1778 of the Republic of the Philippines dated Januray 15, 1981, seven colleges and specialized institutions scattered in La Union of the Philippines have been merged into the newly-established Don Mariano Marcos Memorial State University.

There were three major objectives for this plan: to instruct human resources responsive to the needs of Region I for manpower, to research the studies closely related to the industries of the region, and to extend technological training through such irregular programs as publishing activities, demonstration on pilot farms and public address system.

By establishing a state university in the area, the Project aims at providing greater opportunities to a larger number of students for varied and specialized advanced technological training, thus realizing an effective and rapid education on the human resources of La Union and maximizing the well-directed use of the limited natural resources of the area.

One of the main features of this Project is to promote scientific studies, professional training and dissemination of knowledge in the field of agroforestry, which ranks high among the promising industries of the region. For this purpose, the Government of

the Republic of the Philippines has forwarded the following proposal to the Government of Japan for cooperation in construction of the Agroforestry Complex at Don Mariano Marcos Memorial State University, La Union, Region I.

1-1-2 Outline of the Proposal

Name of Project: Don Mariano Marcos Memorial State University, Agroforestry Complex Project

Name of Client : Don Mariano Marcos Memorial State University

Location of Site: : Bacnotan, La Union, Region I

in the campus of Don Mariano Marcos Memorial State University located in a hilly region with a 897-ha land

Main Objectives: To construct a building complex equipped with classrooms, laboratories, administration offices, etc. necessary for professional instruction, scientific research and extension of knowledge in the area of Agroforestry which will, in turn, contribute to the improvement and promotion of the forest cultivation plan, and major feature in the development plan of La Union in particular and of Region I in general.

While functioning as the center for agroforestry extension, the Agroforestry Department of the State University will also pay a vital role in the instruction, research and extension of agroforestry applied to the slopes of the hilly regions that make up a unique topological feature of Region I. Moreover, the training of human resources equipped with intensive knowledge and appropriate experiences in agroforestry will lead to an enhanced quality of the University itself.

Main function: The Agroforestry Complex will include classrooms, laboratories and offices for the four major areas of agroforestry.

Accommodation: The Complex will accommodate a minimum of 1,500 , which is the total number of the agroforestry department students of the Bacnotan and Rosario campuses of the State University.

Education/ Training Equipment: The Complex will be furnished with a complete set of equipment for professional instruction, scientific research and field work to be primarily used by the agroforestry department.

Administration : Administration work for the Complex will be conducted by the collaboration of the Director and Deputy Director of the Agroforestry Department, and the head professors of each of the four units.

Architectural Style : The traditional architectural style of the Philippines, particularly that which reflects the unique cultural heritages of La Union, Region I, shall be applied as much as possible to the Complex.

1-1-3 Outline of Don Mariano Marcos Memorial State University

Don Mariano Marcos Memorial State University originates from La Union Senior High School of Agriculture established on June 18, 1960. The high school was later merged into the Don Mariano Marcos Memorial Agricultural College founded in 1968 in memory of Don Mariano Marcos who is reported to have died on the spot where the main campus is today located. Under Presidential Decree No. 615 dated December 10, 1974, the college was named a state college and, in due time, became Don Mariano Marcos Memorial State College after merging with the Balaoan School of Fisheries according to the Presidential Decree No. 1617 in 1979.

In 1981, under the Presidential Decree No. 1778, the college was united with La Union School of Arts and Trade, the Southern Ilocos Polytechnic State College, the Southern La Union National School, Rosario National Agricultural School etc. to form a university consisting of seven campuses: the main campus in Bacnotan, Rosario Campus, San Fernando Campus (2), Agoo Campus, St. Thomas Campus and Balaoan Campus.

There are a total of 9,500 students on the seven campuses of this University, and the teaching faculty consists of 14 professors, 38 associate professors, 179 assistant professors and 357 lecturers. The total site area is 11,036,591 ha.

Under the slogan of "a University oriented to regional development", the State University offers education based on three principles: to instruct people responsive to the demands of Region I, to make grass-roots research closely related to the industries of the region , and to extend knowledge to the local population through such channels as irregular educational programs, public address system, publishing activities and demonstration on pilot farms. The most outstanding feature of the University lies in its close inter-relations with the local region and, with its elementary and high schools, it is regarded as something of a local educational center rather than a normal concept of a university.
Nominated in 1981 as the first target for the KKK Project in Region I, the State University also paved the way for a full-scale regional development plan.

The following shows the location of each campus, organization chart of the University, and specifications on the major departments, number of students and site area for each of the campuses.

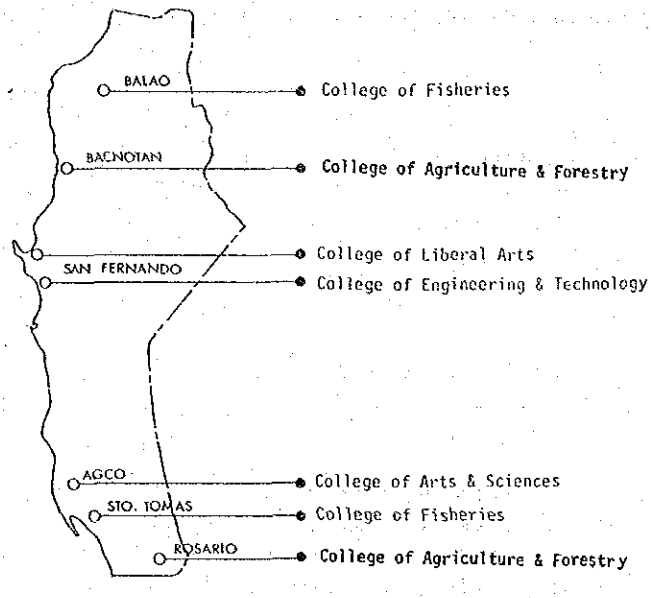

Fig. 1–1–3–a) Location of each Campus

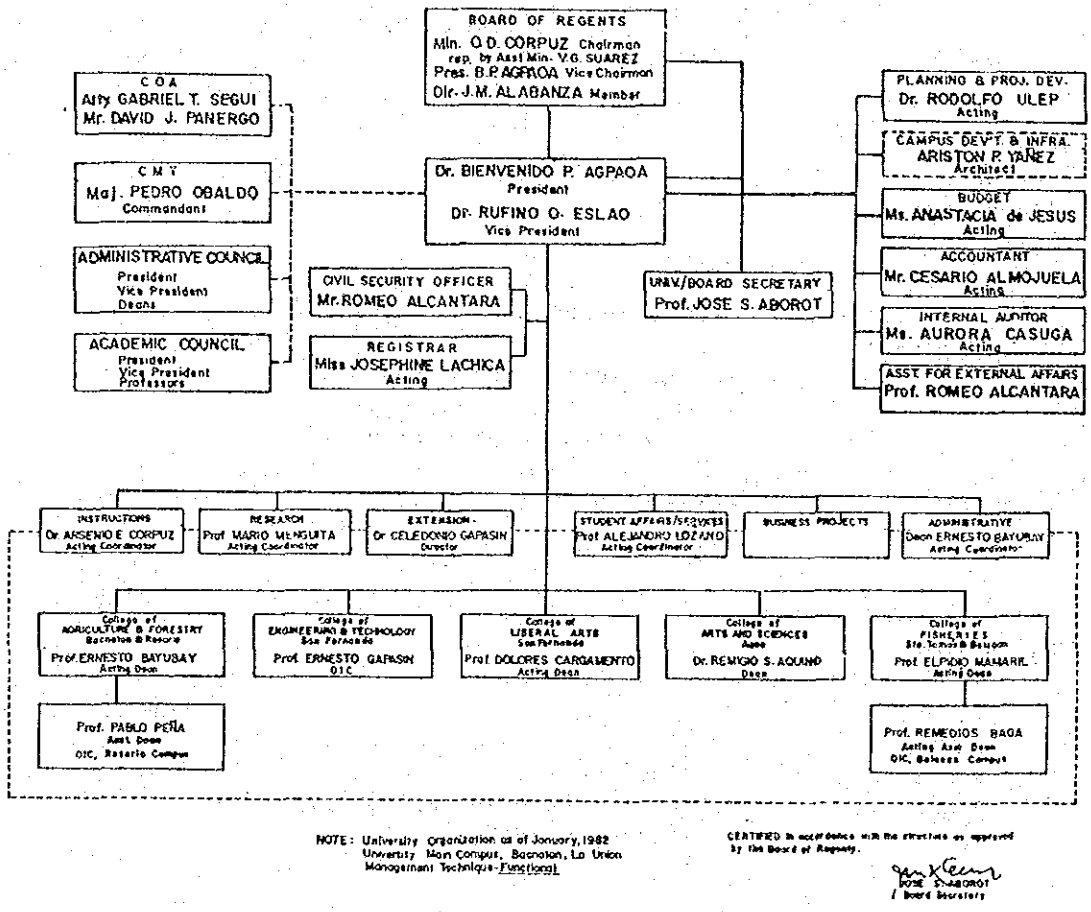

Fig. 1–1–3–b) Organization Chart

Major Departments, No. of Students and Site Area of Each Campus

Campus	Department	No. of Students	Site Area
(1) Agriculture/ Forestry			
1. Bacnotan Campus	* basic education * agriculture B.S. * graduate school a. reforestration M.S. b. livestock M.S. c. agricultural education d. agricultural management degree	1,821	896.6 ha
2. Rosario Campus	* basic education a. agriculture B.S. b. agricultural management B.S. c. forestry B.S.	520	161.045 ha
(2) Engineering/ Technology			
3. San Fernando Campus I	* basic education a. engineering education B.S. b. engineering technology B.S. c. mechanical engineering B.S. * graduate school education M.A.	3,092	
(3) Education			
4. San Fernando Campus II	* basic education a. elementary education B.S. b. fine arts c. hotel/restaurant management d. management B.S.	700	6.765 ha

Campus	Department	No. of Students	Site Area
(4) Law	Bachelor of Law		
4. San Fernando Campus II		34	0.5 ha
Fine Arts/ Science	* basic education		
5. Agoo Campus	a. biochemistry B.S. b. chemistry B.S. c. mathematics B.S. d. physics B.S. e. behavioral sciences B.S. f. veterinary medicine B.S. g. linguistics B.S. (Philippino - English)	2,770	4.089 ha
	* master of science a. educational management M.S. b. manpower development M.S. c. public education M.S. d. natural science education M.S. e. musical education M.S.		
(5) Fishery			
6. St. Thomas Campus	* basic education		
	* fishery B.S.	449	21.243 ha
7. Balaoan Campus		245	8.328 ha

1-2 Dispatchment of Basic Design Study Team

As the first step responding to the proposal, the Government of Japan sent out a Basic Design Study Team of Japan International Cooperation Agency headed by Kiichiro Hara, Director of Forestry Promotion Division, Forestry Agency, for the period of October 25 through November 14, 1983 for the purpose of conducting a survey on a Grant-Aid Program for the Project in Manila and its vicinity, as well as the local area around Bacnotan, La Union, the site of the main campus.

In the course of this expedition, the Study Team contacted the National Economic Development Authority (NEDA) for a briefing on the present state of agriculture and forestry in the Philippines, and the necessity of promoting agroforestry. The Team also held a session with the Bureau of Forestry Development (BFD) and learnt from them the current forestry policies in the country and their views on agroforestry. The Study Team also visited the Agriculture & Forestry Department of the University of the Philippines (UP) to learn the latest in agroforestry education and witness how it is actually being applied.

By the end of these investigations, the Study Team was not only impressed by the positive attitude and enthusiasm directed toward agroforestry in the Philippines but was also convinced of the great awareness in the country for the necessity of promoting agroforestry.

So the Study Team went on to have a briefing session with the staff of the Ministry of Education, Culture & Sports on the subject of educational policies and higher education programs in the Philippines, finding out in the process where the Don Mariano Marcos Memorial State University fits in, within the educational system of the country. As a result, the Study Team concluded that the thrust of the Republic of the Philippines was to upgrade the level of education and promote specialized technological education that would contribute to the improvement and stability of the life and welfare of its people, leading to industrial progress and upturn of national economy in the long run.

The Team also acknowledged that, true to its slogan of "A University Oriented to Regional Development", the Don Mariano Marcos Memorial State University will be certain to play a vital role in the implementation of this educational focus.

Survey meetings were held in Bacnotan, where the main campus of the University is located, after which the Study Team and the Philippine side reached a final agreement on the definition and curriculum for the Department of Agroforestry, the main theme of the Project.

The definition and curriculum thereby agreed upon were used as a basis for further discussions on the size of facilities and details of the equipment to be installed. Having undergone the above process, mutual agreement was reached on the basic policy of the Project, and there was a formal exchange of the Minites of Discussions on the Don Mariano Marcos Memorial State University, Agroforestry Complex Project dated November 4, 1983.

Furthermore, the Study Team investigated the Pantabangan Project developed in the central Northeast region of Luzon Island, gleaning information from technological assistance staffers on the current issues of forestry in the Philippines. The Team also participated in such additional investigations as survey tours to the other campuses of the University (Rosario, St. Thomas, Agoo, San Fernando), sessions at NEDA Regional Office on the current state of forestry and agroforestry in Region I, and a survey on Bacnotan Consolidated Cement, Ltd. to investigate the capacity and the specification of the cement.

Having taken into account the results of all these investigations, Japan International Cooperation Agency has drawn up a Report of the Basic Design Study.

After that the government of Japan sent out a Basic Design Study Team (Explanation & Confirmation) of Japan International Cooperation Agency headed by Mr. Kiichiro Hara, Director of Forestry Promotion Division, Forestry Agency, for the period of January 27 through February 3, 1984 to explain and confirm the Basic Design Draft Final Report. Through sincere discussions the Philippine counterparts and the team members reached good understanding each other, and Minutes of Discussions were exchanged as indicated in Appendices.

CHAPTER 2: BACKGROUND OF THE PROJECT

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2-1 Economic Status in General

2-1-1 General

With its total area of 300,000 square kilometers and a population of approximately 50 million (48,090,000 as of May 1, 1980), the Republic of the Philippines, a country consisting of some 7,000 islands of varied size, applies its rather inexpensive labor force to promote the three pillars that support their economic structure, namely, agriculture/forestry/fishery, manufacturing and commerce.

Statistics show that these three key factors also account for a large share of the Gross Domestic Product (GDP); 25.7% for agriculture/forestry/fishery, 24.8% for manufacturing and 20.8% for commerce (as of 1981), and 71.7% for the total of these three.

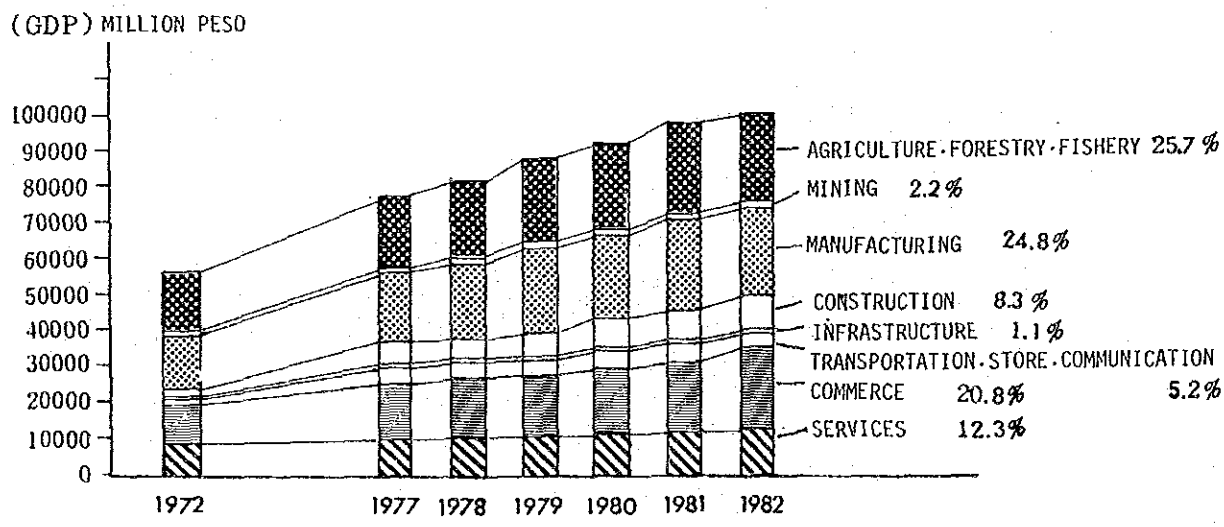


Fig. 2–1–a) Industrial Structure (Source: NEDA)

Breakdown of employees by industries also indicate that, as of 1978, 74.2% of the total working population are engaged in one of these three fields (52.2% for agriculture/forestry/fishery, 11.5% for manufacturing and 10.5% for commerce), and that the ratio has not undergone a large shift since 1976.

In 1981, the national income, in terms of nominal GNP, was 313,563,000,000 peso (9,406 billion yen) and the nominal GNP per capita was 5,660 peso (186,780 yen). Although the country has sustained a 6 percent level of substantial growth in GNP in 1976 (6.1%), 1977 (6.1%) and 1978 (6.3%), the second oil crisis caused the Philippine economy to take a bad turn and the growth rate gradually dropped to 5.8% in 1979, 5.4% in 1980 and, finally 4.9% in 1981, the first time in ten years since 1972 that the country registered the low growth rate of 4 percent level. The unfavorable condition continued in 1982, when the substantial growth rate in GNP dropped down to 2.6%.

In an effort to restore its economic crisis, the Government of the Republic of the Philippines has drafted a new 5-year economic development program with a markedly high aim of an average growth of 6.5% per year.

Under these circumstances, the rate of inflation, which had maintained an average rate of 10 to 15 percent per year has supposedly made a big jump since fall this year. The November 8, 1983 edition of a Philippine newspaper reported that President Marcos has approved of a raise in minimum wages.

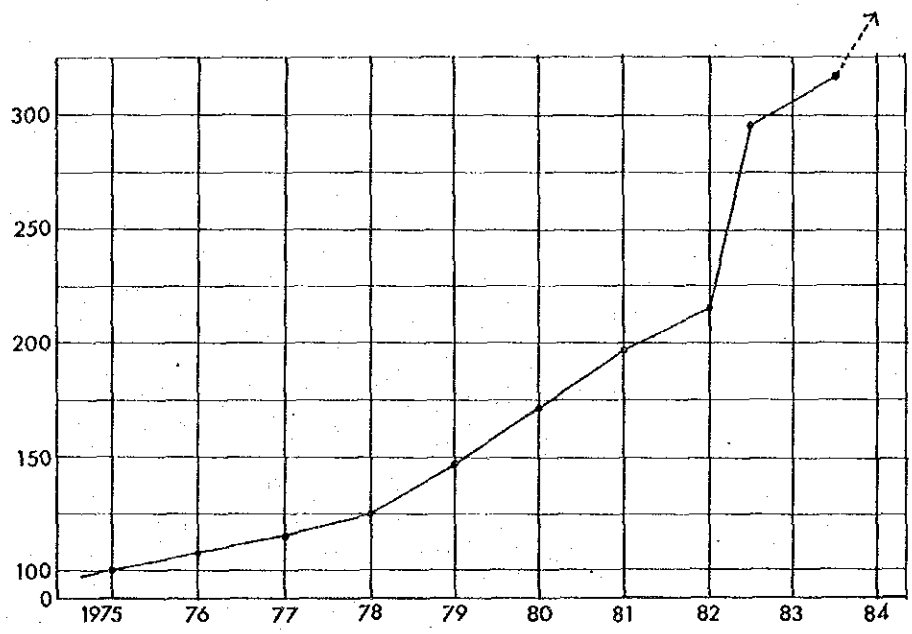


Fig. 2–1–b) Consumer Price Index

(source: up to 1982: 1983 edition of Overseas Economic Cooperation Handbook

1983 and onward: Philippine Economic Indicator 1983 issued by NEDA)

Turning to external trade, the below diagram shows an overview of the performances for 1976 through 1980. It should also be added that in 1981, a negative growth was recorded in the total amount of export (-1.1% compared to previous year), for the first time in six years.

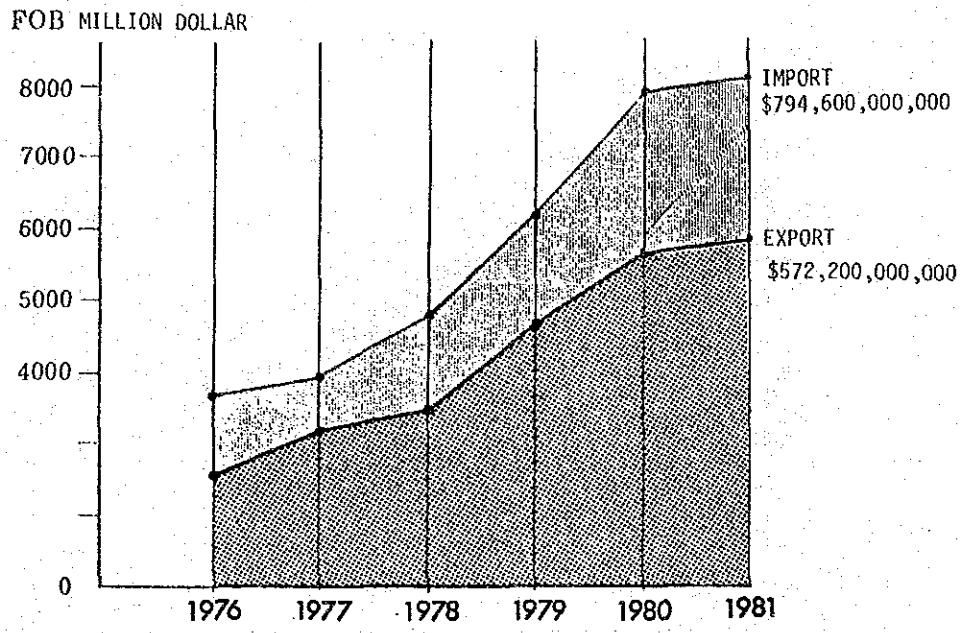


Fig. 2–1–c) External Trade (Source: NEDA)

Breakdown by countries show that exports in 1980 were directed to Japan (27.1%), U.S.A. (26.8%), EC countries (17.0%), Holland (6.3%), West Germany (4.3%) and ASEAN countries (5.8%), whereas imports mainly came from U.S.A. (23.0%), Japan (20.0%), Saudi Arabia (9.8%), Kuwait (4.6%), EC countries (11.6%) and ASEAN countries (6.3%). This means that, in both exports and imports, Japan and the U.S.A. put together take up a share of approximately 50%.

2-1-2 Higher Programs and Activities

It was under these economic environments that the Government of the Republic of the Philippines issued on August 6, 1981 the Presidential Decree No. 715 stipulating the launching of the so-called KKK Program as a countermeasure for upgrading the living standards of its people.

a) KKK Program

KKK stands for Kilusang Kabuhayan at Kaunlaran, and the Program is carried out by the Ministry of Human Settlements. The thrust of this Porgram is not on raising a small number of technical experts and specialists but enlightenment on a national scale. The aim of this program is in converting the 42,000 Barangays existing in the Philippines today into independent, productive communities, bestowing technical education on the general public mainly based in rural communities and improving their livelihood, thus contributing to the overall social and economic development on a national basis and finally upgrading the living standard of the people.

Promoted by the Ministry of Human Settlements, the KKK Program is supported by the following four basic policies:

1) Financial
2) Marketing
3) Technical
4) Training/Operating/Development

2-2 Need for Regional Development and Government Policies

2-2-1 5-Year Socio-Economic Development Plan

Under such economic climate, the Government of the Philippines has been making efforts to improve its economy by applying new policies to various areas. The "5-Year Socio-Economic Development Plan of the Philippines" covering the years 1978/79 - 83/84 aims at upgrading the general living standards of the people through active implementation of programs like the aforementioned KKK, focusing on the following main targets:

1) Improved self-sufficiency rate in food and energy
2) Social development promoted through better employment situation, higher income and upgraded living standards
3) A high-level, sustaining growth in economy (target annual growth rate of 7-8%)
4) Stable commodity prices and favorable balance in international trade
5) Exploitation of under-developed regions

The efforts, however, have had little effect for the 78% hike in oil prices in 1979-1980 has had direct impact on the Philippine economy and, unfortunately enough, coincided with a world-wide slumping in business conditions. The drop in export prices for such key products as copper, coconut and sugar has triggered a decline

Out of the four basic policies, "Technical" and "Training" are the two subjects for which cooperation was requested to the Government of Japan as a target of the Grant-Aid Project for 1983 for the Philippine Human Resources Development Center (PHRDC - Program IV and PHRDC - Program I, II, III). According to the KKK Program, those who have mastered specialized skills and wish to open up a business of their own are qualified to borrow funds at special low interest, supplied from the annual budget of 10 billion peso (17 billion yen) of the Program.

b) University of Life

Established in 1983, the University of Life is an educational organization aiming at providing practical professional education to trainees, an access to knowledge, technology and experiences deeply rooted to local communities, and a means of self-support. With a headquarters in Pasig, Metro Manila,the University of Life holds affiliated ties with a total of 21 universities and educational organizations in the 13 divided Regions of the country. The University of Life, which offers a wide variety of specialized educations to trainees, regardless of their age or academic background, is managed by the Ministry of Human Settlements headed by the First Lady. Because of its close relations with the KKK Program, a KKK Community Services Group is formed within the University of Life, to take care of the development of its organization, in particular. The Don Mariano Marcos Memorial State University, an object of this Project, is also one of the Regional

Centers of the University of Life, and it provides the five courses consisting of Managing of Trainers, Training, Technology, Agriculture and Technology.

c) PHRDC Program

During his tour of the 5 ASEAN countries in January 1981, former Prime Minister Suzuki of Japan announced that Japan was willing to cooperate in human resources development plan in the ASEAN countries based on the Human Resources Development Program conceived by his predecessor, the late ex-Prime Minister Ohira. It was upon this concept that the Government of the Republic of the Philippines issued a Presidential Decree No. 785 dated March 19, 1982 stipulating the establishment of the Philippine Human Resources Development Center (PHRDC). As was the case with the previously-mentioned KKK Program, this PHRDC Program lays its thrust not on raising a small group of technical experts and a few elite specialists but on directing an overall education on the residents of rural communities and fishing villages, introducing and training them in knowledges and industries deeply rooted in their own communities, with the final aim of upgrading their living standards.

in purchasing power in rural communities which, in turn, is slowing down the growth of manufacturing industries.

The comparison table below showing the breakdown by region of annual output per capita clearly indicates that productivity in Region I is notably low compared with that of Manila and its vicinity, and that there are considerable differences in productivity according to regions.

Region	Actual	Projections	
	1980	1983	1987
Philippines	1,918	2,026	2,403
NCR	5,033	5,360	6,016
Region I	940	993	1,238
II	1,082	1,071	1,302
III	1,558	1,637	1,941
IV	2,103	2,144	2,513
V	930	1,035	1,284
VI	1,613	1,682	2,037
VII	1,780	1,869	2,248
VIII	826	808	1,008
IX	1,274	1,377	1,688
X	1,536	1,659	1,968
XI	1,870	1,908	2,245
XII	1,343	1,411	1,757

Table 2–2

Productivity per Capita, based on the appraised value of the peso as of 1972

(Source: 5-YEar Philippine Development Plan 1983-87)

For a country equipped with little natural resources to speak of and struggling to improve its economy, it is necessary to promote economy on a regional basis and upgrade the rate of individual purchase which accounts for 64% of the GNP (1982). It therefore seems evident that the key to improving the Philippine economy lies in developing industries responding to the needs and capacities of each region, in both long-term and short-term programs, and promoting economic development in harmony with the regional communities.

In the announcement in May 1982 of the "5-Year Socio-Economic Development of the Philippines, 1983 - 87", the Government of the Philippines stressed the continuing need for regional development and also advocated the following countermeasures, to be realized through further administration of the KKK Program, against the economic crisis the country is currently subject to.

1) remedies for unemployment and layoff
2) improvement of unfavorable agricultural and industrial output
3) adjusting regional differences in economic growth
4) calling off high dependency on imported crude oil
5) counterplan against insufficient infrastructure
6) the need to increase domestic revenue sources
7) the need to counter against domestic population growth
8) the need to improve and reinforce existing socio-economic systems and organizations

In relation to the "adjustment of regional differences in economic growth", some point out that countermeasures are necessary, particularly for the squatters and the Kaingiñeros (farmers of shifting cultivation) based in the frontiers of the highland regions, and the Government of the Philippines advocate development responding to the potentialities of the region so as not to disturb the harmony between economic development and regional communities.

As to more specific targets of this program, higher priority is laid in the order of food production, energy development and industrial growth, supported by the seven prototype projects listed below:

a) agroforestry
2) agriculture/livestock
3) aqua-marine
4) recycling wastes
5) home industries
6) housing.housing equipment industries
7) service industries

In the Technical Annex, the Government also stresses the need for exploiting Region I (Ilocos Region), encouraging a wider variety of products like fish, livestocks and fruit, in addition to the traditional rice and vegetable farming. The Government also proposed an effective use of highlands, which take up two-thirds of

the land area of the region, for growing cotton and tobacco as well as garlic, 98% of the domestic share of which is produced in this area. Practical education for unemployed grownups and young school dropouts is also a vital issue in this program.

2-2-2 Importance of Regional Development

One can here recognize how important a factor regional development is for the Philippine economy, how much is expected of agroforestry as a means of regional development closely adhering to local community, and how much demand there is for professional education in agroforestry. This calls for an explanation on the situation and remedies for one of the major problems related to this region, that of the Kaingiñeros.

Through many centuries of shifting cultivation practiced by Kaingiñeros, the country has lost much of its forests, and the land turned into wilderness has brought about a new problem; outflow of defertilized soil causing flood disasters. A survey conducted in 1979 showed that such shifting cultivation accounted for 53% of the loss in forests and, despite various remedies starting with the Kaingiñeros Law in 1901 that have been drawn up, the situation did not improve. It was under these circumstances that the Government of the Philippines issued in 1975 a Presidential Decree marking a changeover in policies from shutting out the Kaingiñeros to inducing them to take up more rationalized farming in their residential areas.

The aim of this Presidential Decree lay in the so-called promotion of agroforestry by adjusting land use, improving agricultural management and encouraging afforestration under governmental authorization, guidance and financial aid, without increasing the agricultural space used by the Kaingiñeros, squatters and cultural minorities in the forest wilderness.

Responding to this Presidential Decree, the Government of the Philippines launched on an ambitious program for improving productivities of local districts, encouraging permanent settlement of the people, and promoting afforestration by establishing the FOM system (Forest Occupancy Management Program) followed by CIF (Communal Tree Farming) and FAR (Family Approach Reforestration) programs which are more oriented to afforestration.

a) **FOM** (Forest Occupancy Management Program)

A program directed to existing residents of national forests, alloting a maximum forest land of 7 ha per family so that they can engage in agroforestry without moving out (a single-generation leasing contract is applied). The Government will not only guarantee asignees with free use of land but will also provide them with seedlings free of charge, give out technical guidance for agricultural management, establish marketing and cooperative channels, install infrastructure, provide welfare, offer loans, etc. Coping with the Kaingiñeros is the primary aim; afforestry is the secondary.

b) **CTF** (Communal Tree Farming)

This program is directed to residents both within and outside the forestry areas that are in urgent need of reforestration. The appointed population will live on partitioned blocks of the area and will use a maximum of 2 ha per family to engage in agroforestry. A single term will last for 25 years. The land will be leased free of charge for the initial five years, and the annual rate will not exceed 10 peso per ha from the sixth through the twenty-fifth year of the contract. The Government will provide seeds and seedlings, conduct a guidance in marketing strategy of agroforestry products and will also offer special afforestry loans to those submitting a reforestry plan for an area that exceeds a certain level. Thus, the program serves two purposes; to cope with the problem of Kaingiñeros while saving land that are in urgent need of reforestration. The type of trees recommended for reforestration include the giant ipil-ipil, gmelina, albizzia, eucalyptus, endospermum pelatum and alnus.

c) **FAR** (Family Approach Reforestration)

A program in which each assigned family will move into a partitioned block of approximately 5 ha in the reforesting region of the national forest and will be licenced to engage in reforestration and farming there for the next three years. In the fourth year after plantation of the block, the family will

move into another block and will engage in agroforestry in the same manner. The Government will provide such families with seedlings as a compensation for the labor according to their achievements in reforestration.

d) Ten-Year Accelerated Reforestration Program for the Ilocos Region

This plan has been prepared in an attempt to hasten forest renewal activities in the region by trying to determine the extent of open areas needing reforestration, review the performance of all reforestration projects and what are the existing government policies and strategies that may be availed of to realize the objectives of the plan.

At the current rate, it would take for the existing reforestration project 32 years to fully cover their remaining areas to be reforested, while the private sectors would likewise take them 25 years. Meanwhile, the increasing demand for lumber is expected to be accelerated.

Without a concerted effort to assure a steady supply of fuelwood for the flue-curing of tobacco, the industry would undoubtedly suffer a major setback, and would likewise create a chain effect on production and employment especially those people who are directly dependent on it.

To speed-up reforestration programs no less than the President has launched in 1976 a program under LOI 423 commonly known as the Program for Forest Ecosystem Management (PROFEM) with the government and the private sector's involvement in the total reforestration effort. This was followed by the promulgation of PD 1153 otherwise known as the "Tree Planting Decree" requiring all citizens 10 years and above to plant 12 trees per year or 60 trees for a period of five years. LOI 818 likewise obliged timber licensees to reforest their logged-over areas, and Presidential Executive Order 725 dated September 9, 1981 requires recepients of tree plantation leases to develop/plant their respective open areas with a period of ten years from the date the lease agreement was issued.

Reforestration entails the collection of seeds, raising of seedlings into plantable sizes, plantation establishment and plantation maintenance and protection.

The accelerated reforestration program envisioned to achieve within a ten-year period 271,787 hectares to be planted with various species in various parts of the region.

The following two programs are also available in relation to agroforestry:

a) Tree Farm Lease (TFL)

A kind of leasing contract in which the likes of private companies lease a part of the national forest to engage in agroforestry. A land area of 10 to 100 ha will be leased per contract for 25 years as a start, and the contract can be renewed for another 25 years at the expiration of the initial term. Fruit and herbs are the main products.

b) Industrial Tree Planting (ITP)

A leasing contract in which corporations and other larger organizations lease a part of the national forest. A land area of 100 ha or more is leased per contract, and the main purpose is in reforestration for producing lumber.

2-3 Current Education Related to Agroforestry

Increased number of educational facilities related to agroforestry is in urgent demand today in many region of the Philippines to cope with the problem of natural disasters triggered by destruction of forests and the current inefficient use of forest land, and also as a means of upgrading the living standards of the residents of forestry areas.

The number of universities with courses in forestry currently counts 16 in Luzon, 8 in Bisaya and 6 in Mindanao. In addition, 3 educational institutions in Bisaya and 2 in Mindanao plan to provide a course in forestry within the next 5 eyars.

Out of the 30 universities currently facilitated with a course in forestry, 21 are public institutions (12 colleges and 9 universities). The remaining 9 private institutions consist of 1 vocational training school for engineers, 5 colleges and 3 universities. 7 of those schools, which take up 25 percent of the total, are located in Region I, manifesting also in actual number the large demand for forestry training in the region.

Specific contents of these courses tend to be practical, as shown by the fact that 20 percent of those schools have professional programs ranging from 4 to 5 years, and 24 percent of the schools have a one-year course in field training.

The following list shows the number of years required to complete each course:

practical forestry	1 year
forest ranger, associate in forestry, agroforestry technician	2 years
diploma in forestry technology	2 years
forest ranger, agroforestry specialist, diploma in forest science	3 years
B.S. forestry, B.S. forest product engineering, B.S. agroforestry, B.S. recreation and park administration	4 years
B.S. forestry	5 years

A most common course is a 4-year course for B.S. in forestry or a 2-year course for forest ranger certificate. M.S. is available in 2 universities whereas a doctorate degree is granted only by the University of the Philippines.

The following shows the number of students by type of curriculum.

Number of Students by Type of Curricula, 1978–1979

Name of Program	Number of Students
1-yr. Program	
Practical Forestry	5
2-yr. Program	
Ranger	924
Associate in Forestry	136
Agroforestry Technician	33
Diploma in Forest Technology	261
3-yr. Program	
Ranger	75
Agroforestry Specialist	no data
Diploma in Forest Science	no data
Sub-total for the professional level	1,434
4-yr. Program	
B.S. Forestry	3,395
B.S.F.P.E.	61
B.S. Agroforestry	278
B.S. Recreation and Park Administration	5
5-yr. Program	
B.S. Forestry	151
Sub-total for the professional level	3,890
TOTAL	5,524

30 Schools and Institutes in each Region related to Forestry

REGION I

1. Lagangiland Agricultural College
   Lagangilang, Abra

2. Mountain State Agricultural College
   La Trinidad, Benguet

3. Mariano Marcos State University
   Batac, Ilocos Norte

4. Ilocos Sur Agricultural College
   Sta. Maria, Ilocos Sur

5. Southern Ilocos Polytechnic State College
   of Agriculture and Forestry
   Rosario, La Union

6. Don Mariano Marcos Memorial State University
   Bacnotan, La Union

7. University of Baguio
   Baguio City

REGION II

8. Taggat Technological Institute
   Taggat, Cagayan

9. Isabela State University
   a) formerly CVIT
      Cabagan, Isabela

10. b) formerly ISCA
      Echague, Isabela

11. Nueva Vizcaya Institute of Technology
    Bayombong, Nueva Vizcaya

REGION III

12. Pampanga Agricultural College
    Magalang, Pampanga

13. Tarlac College of Agriculture
    Camiling, Tarlac

REGION IV

14. Araneta University Foundation
    Galoocan City

15. University of the Philippines at Los Banos
    College, Laguna

16. Palawan National Agricultural College
    Aborlan, Palawan

REGION V

17. Mabini Colleges
    Daet. Camarines Norte

18. Dr. Emilio B. Espinora Sr. Memorial
    College of Agriculture
    Mandaon, Masbate

REGION VI

19. Mambusao Agriculture and Technical College
    Mambusao, Capiz

REGION VII

20. University of Bohol
    Tagbilaran City

21. Japer Memorial School
    Pardo, Cebu City

REGION VIII

22. University of the Philippines at Tacloban
    Tacloban City

23. Visayas State College of Agriculture
    Baybay, Leyte

24. University of Eastern Philippines
    Catarman, Northern Samar

REGION X

26. Cagayan Capitol Colleges
    Cagayan de oro City

27. Central Mindanao University
    Musuan, Bukidnon

REGION XI

28. Recardo Castillo College
Mangagoy , Bislig, Surigao del Sur

29. University of Mindanao
Davao City

REGION XII

30. Mindanao State University
Marawi City

2-4 The Necessity of Agroforestry

Agroforestry can be defined as a science that aims to optimize the use of existing resources (solar energy, water, soil and labor force) for a diversified and high productivity compared with that expected by conventional methods of land use.

In other words , it is an attempt to integrate environmental factors (climate, geology, soil, topography) with economic factors (distribution, demand, labor, etc.) to determine the kind of crops most suitable to the region and to put them into actual practice in line with the national policeis for regional development.

Despite its relatively short history as a subject of science, agroforestry has come to attract a great deal of attention in recent years as a key indsutry for regional development which will glean the most suitable products for the region in the absense of investment of large capitals.

Reforestration of mountains and stabilization of the livelihood of farmers in highlands are a major socio-economic issues the Philippines is facing today. Reforestry in vast areas not only require a large amount of investment; it also takes a long span of time in spite of the tropical climate. To make matters worse, the specific region in urgent need of reforestration is a place where the quality of soil has declined considerably through continuous production of lumber and shifting cultivation agricultural method, calling for an even larger amount of investment compared to that for regular reforestration. This makes it impossible to glean any kind of profit from forestry.

Meanwhile, the only choice left for farmers in highlands, who cannot engage themselves in rice farming which provides a relatively stable source of income, is to take up the shifting cultivation which originally aimed at self-supply of crops. It is evident that this shifting cultivation is incompatible to the social and economic system of the modern world.

The result is that those farmers abandon their farm land, impoverized to a point where it is no longer capable of reforestration by natural powers alone, to make their life in urban areas. The endless flow of population into large cities is, in turn, trigerring a serious social problem.

The original aim of agroforestry is high-revenue management through a combination of crops and trees which are also regarded as crops in the long run, so agroforestry has traditionally been practiced within the scope that can be managed by family labor.

Today, agroforestry has emerged as one of the most realistic and powerful solutions for the Philippines to reforest its mountains and stabilize the livelihood of farmers in rural areas.

While the significance of agroforestry is being acknowledged more and more by the public, there is no university in the world, still less in the Republic of the Philippines, that has a coherent curriculum of this science, partly because of the comparatively short history of its development into a proper field of science, and in many universities it is included in the curriculum of Social Forestry as a branch of Forestry. However, it is a

common view in the world today that, in order to develop agroforestry properly, the mere requirements of special knowledges of forestry and agriculture separately are insufficient, and a total and positive study is earnestly required. Furthermore, since agroforestry is a science closely connected with communities, it seems clear that the scientific and systematic methods and technics should be developed urgantly and disseminated effectively among local residents, considering the present situation in the Republic of the Philippines. Agroforestry, therefore, should be well planned. The concept of permanent forests and an optimum use of land are vital factors for promoting agroforestry in the Philippines.

CHAPTER 3: OUTLINE OF PROJECT SITE

CHAPTER 3: OUTLINE OF PROJECT SITE

3-1 Location of Project Site and its Socio-Economic and Educational Circumstances

3-1-1 Summary

Located in the north-western part of Luzon Island with a land area of 21,568.4 km (7.2% of the entire land area of the Philippines), Region I is made up of 7 provinces and 60% of its land area is occupied by highlands and mountains. In its 172 towns and 4 cities, there are a total of 3,949 "barangais". The capital of La Union, the site of this Project, is San Fernando.

3-1-2 Socio-Economic Circumstances

a) Population

The total population of Region I is 3,540,892 , out of which 2,699,328 are residents of rural areas. Despite an annual average growth of 1.66% since 1975, there is a marked outflow of the population into Manila and other urban areas in recent years. As shown in the below ratio of the working population and breakdown of the fields they are engaged in, as compared with the average figures for the whole nation, there is a notable concentration in Region I in the number of people engaged in agriculture.

	Region I		The Philippines	
	No. of people	%	No. of people	%
population of 15 and above	2,200,000	100	29,902,000	100
1. working population	1,411,000	64.1	18,713,000	62.6
a. employed population	1,360,000	96.4	17,776,000	95
agriculture	832,000	61.2	9,504,000	53.5
others	528,000	38.8	8,272,000	46.5
b. non-employed population	51,000	3.6	937,000	5.0
2. non-working population	789,000	35.9	11,189,000	37.4

Table 3-1-2 Working population of Region I

b) Industry

Source of the total output of Region I for 1979 was 32% from agriculture, 34% from industries and 34% from commerce.

For a long period of time, approximately 58% of the land area of Region I had been subject to reckless cultivation and unplanned shifting cultivation resulting in a meager space left for forestry and poor quality of soil. According to the Regional Secretary of Region I, Forestry Development Bureau of the Ministry of Natural Resources, it is necessary to afforest a land area of at least 500,000 ha to guard against natural disasters and also as a means of securing production resources. As shown in below table, the region ranks very low in domestic comparison, both in the output of lumber logs and the number of lumber mills.

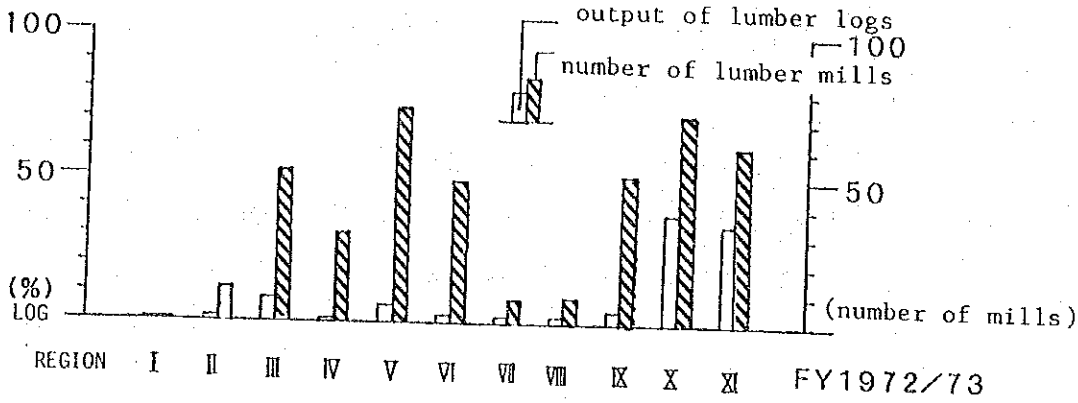


Fig. 3–1–2–a) Comparison by domestic regions in output of lumber logs and number of lumber mills

Cement and metal sheet production, beverage and tobacco processing and sugar refining are counted among industries on a larger scale in the district. Those on a smaller scale include salt refining and such home industries as pottery, hadncrafts using bamboo, rattan and wood, and hand-weaving.

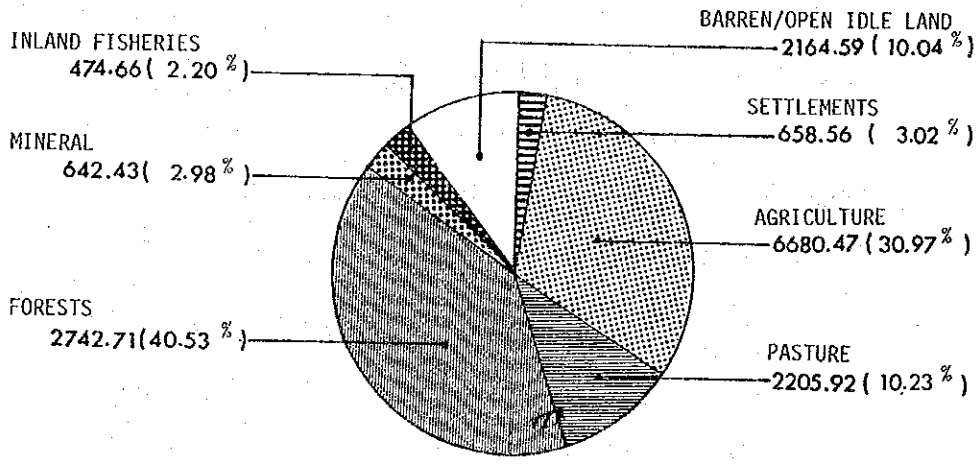


Fig. 3–1–2–b) Current Land Utilization

As indicated below, agriculture in this region (La Union) is charaterized by its relatively high output of rice and tobacco as compared with the general breakdown of farm products in the country. Banana, camote, mango and cotton are also specialties of this region.

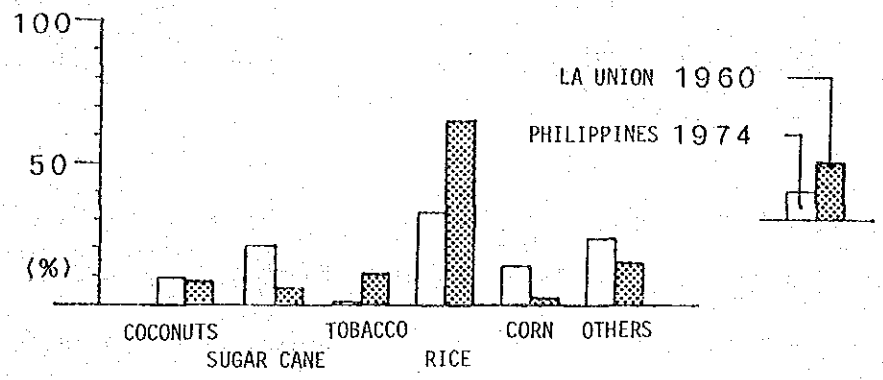


Fig. 3–1–2–c) Comparison with general breakdown of farm products in the Philippines

The average income per month per family for Region I in 1980 was ₱927, marking a level below the average income of ₱1,000 for the whole nation. The ratio of those in the low-income bracket of ₱1,333 or less marked a high level of 76.3% compared with the average of 67.6% for the whole nation. La Union is the most affluent area in Region I, marking an average income of ₱1,806 per family per month.

Triple cropping of rice is possible in irrigated areas, and the productivity is quite high. In other areas, peanuts, banana, mango, camote and other crops are grown together with rice. However, the destructed forests by shifting cultivation has recently resulted not only in declining productivity of the forestry industry but also an overflow of soil into rivers which, in turn, has destroyed irrigation dams in various districts, a bottleneck in industrial development of the region.

As illustrated in the below map of land use, a majority of the land in this region is occupied by little-used fields or secondary forests resided by farming people called "kaingineros" who practice shifting cultivation. The only land available for growing crops like rice and tobacco are the 10km region along the coastline and the plains of Pangasinan. As to forest land that can be put to commercial use, there is only a meager area left in the eastern highlands

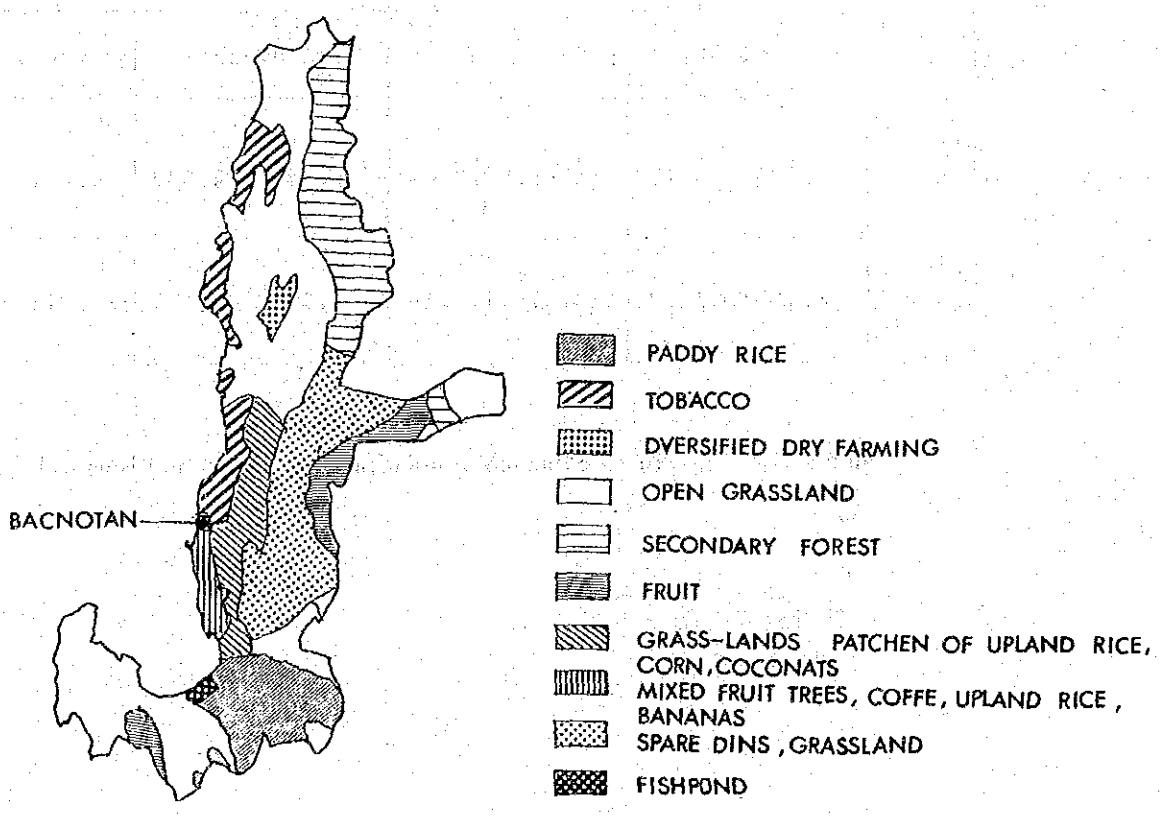


Fig. 3–1–2 Map of Agricultural Crops

3-1-3 Educational Circumstances

As of 1980, education has been extended to 81.4% of the population in Region I. As of 1982, there are 2,938 elementary schools, 671 high schools and institutions for vocational training and 6 colleges and universities. 363 of those schools, which account for 10% of the total number, are private institutions and 78% out of the total population are being educated in public schools.

The following are the number of students being educated in various schools in La Union.

	Elementary Schools	High Schools	Universities, Vocational Training Schools	Total
	private:public	private:public	private:public	private:public
La Union	3,224 : 74,133	14,687 : 20,040	6,546 : 4,539	24,457 : 98,712
Region I	28,153:593,635	113,374:175,147	85,696 : 24,495	227,273:793,277

Table 3–1–3–a) No. of educated population in La Union and Region I

The following table shows the rate of education extended in various districts of Region I.

district	percentage
Abra	78
Benguet	69
Ilocos Norte	82
Ilocos Sur	87
La Union	86
Mt. Province	68
Pangasinam	81
Baquio	89
Dagupan	91
Laong	77
San Carlos	89
Region I	81.4%

Table 3–1–3–b)

The topology of the Project site consists of a narrow plain along the coastline, the hills and plains between mountains stretching in the background, and a vast mountain range. The topology and the process of its formation are illustrated in Fig. 3 - 2 - 2 - b).

Judging from the boring data around the site and trial drilling in five spots on the Project site, the outer layer of the crust on the site consists of sedimentary rocks such as slate, sandstone, conglomerate, alluvium, shale and limestone. In the absence of volcanic zones nearby, there are no igneous rocks.

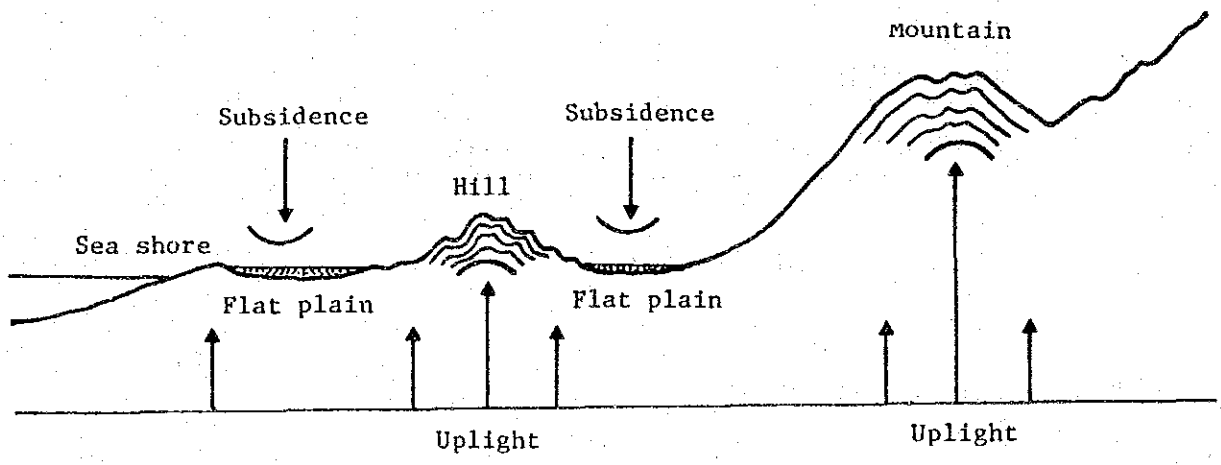


Fig. 3–2–2–b) Topology of Project Site

3-2 Natural Conditions

3-2-1 Climate

The climate in the Philippines is tropical in general, excluding the areas high above the sea level. Because of the size and height of the island, and the effects of the Asian Monsoon, the climate in the Philippines is divided into the following 4 regions according to the type of day/rain season:

1) Western Region Type

A climate with rain season in summer and fall, and dry season in winter.

2) Eastern Region Type

Rainy climate throughout the year.

3) Central Region Type A

A short dry season at the beginning of year.

4) Central Region Type B

Rainy climate throughout the year, but less rainfall compared with the Eastern Region.

In the region where the Project is located, the average monthly temperature is 23° centigrade at the maximum and 19.2° centigrade at the minimum, indicating a larger difference in temperature throughout the year compared with the tropical region directly below the equator. The difference throughout the year in rainfall is also large.

According to Fig. 3 - 2 - 1 - b) which gives statistical evidence on the effective climate, the site of the Project belongs to the Western Region Type where it is rainy in summer and fall and dry in winter. The region can also be characterized by large rainfalls during the rainy season.

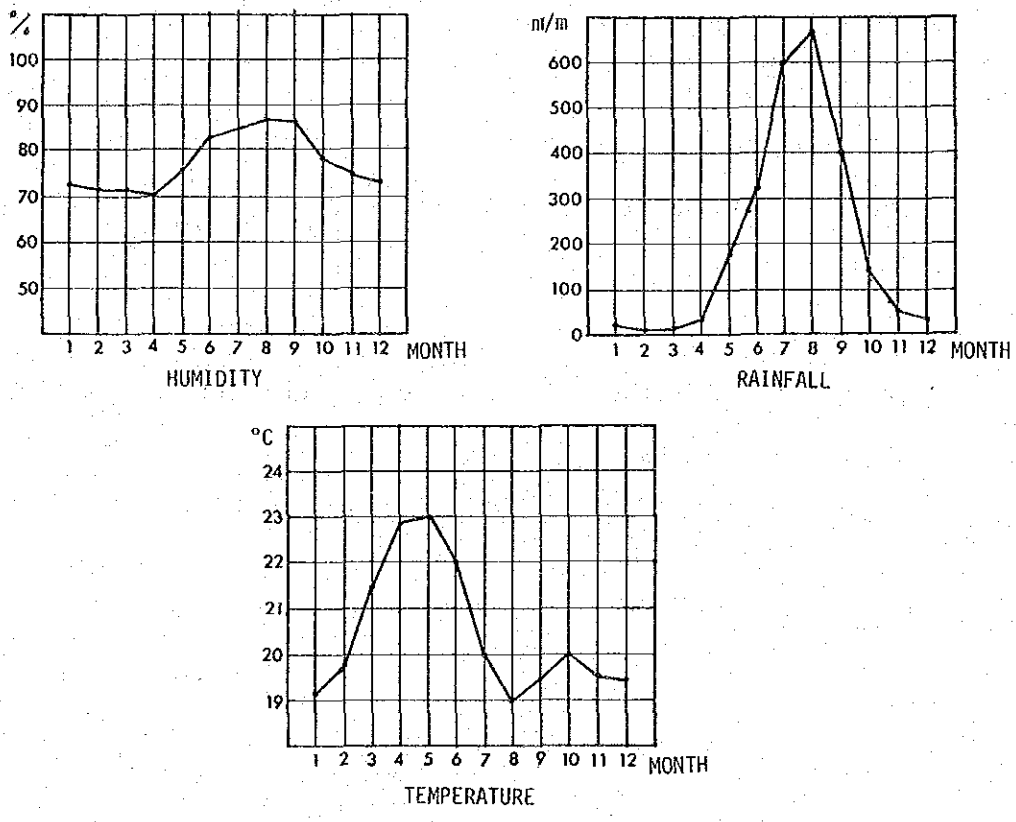


Fig. 3–2–1–a) Meteorological data of Region I

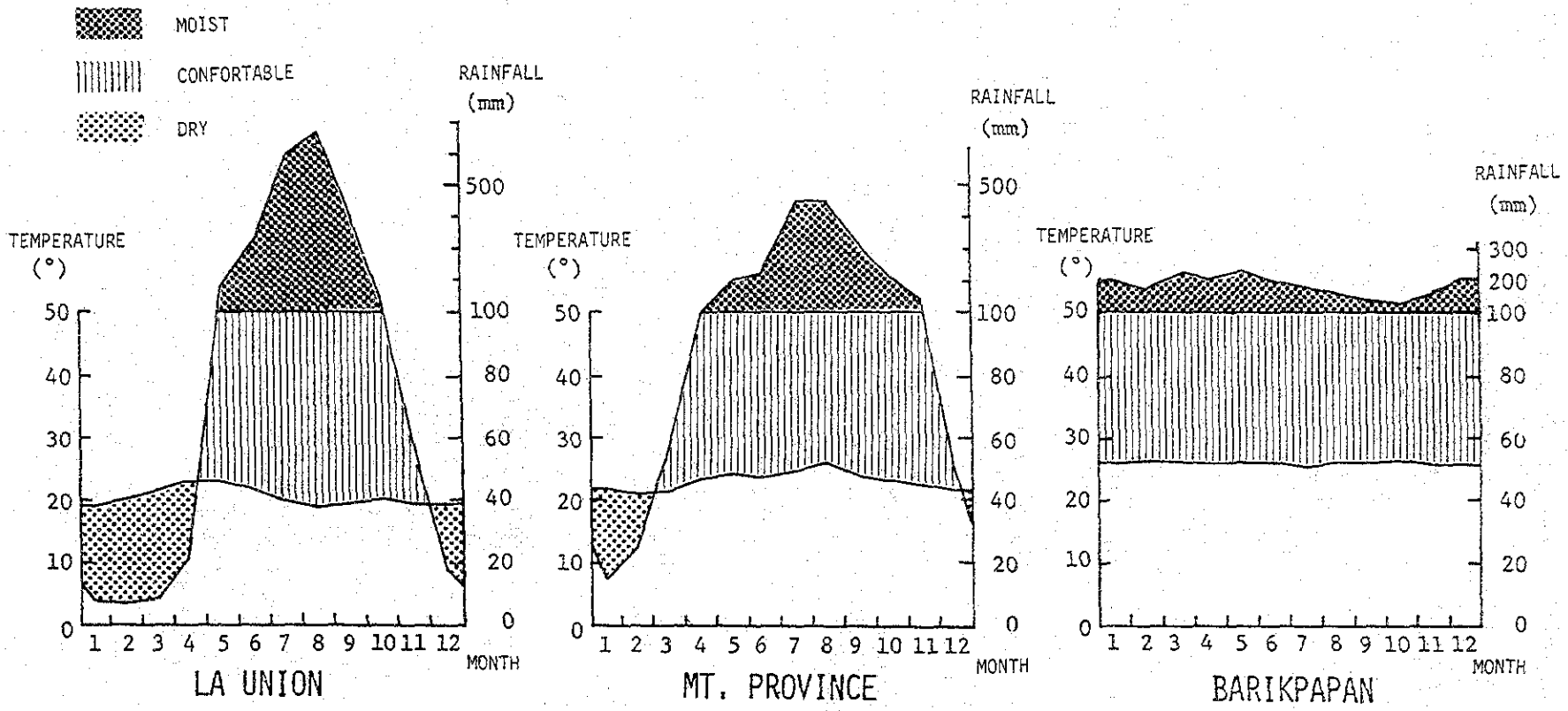
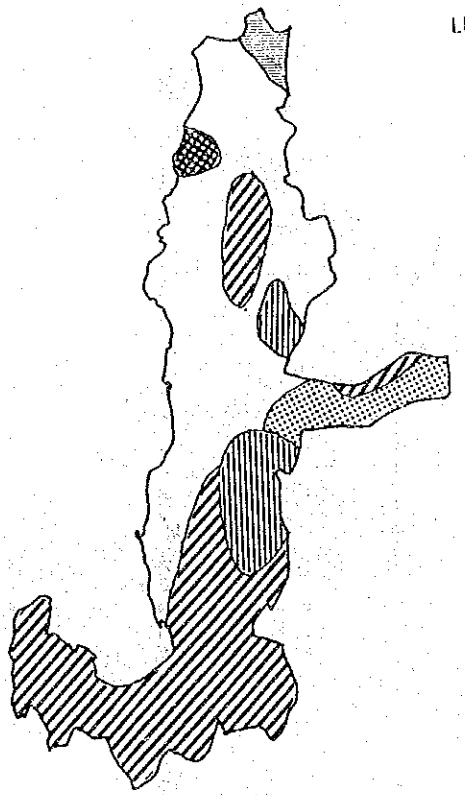


Fig. 3–2–1–b)

Comparison of Meteorological Features of La Union and other Districts

The rainfall features of Region I is as shown in the below Fig. 3 - 2 - 1 - c). Bacnotan, the site of this Project, belongs to Type - E which extends along the coast.



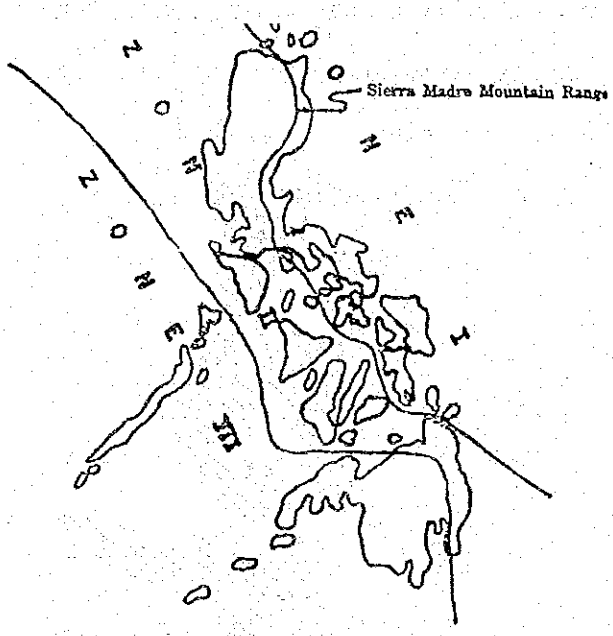
LEGEND

TYPE A WET	Rainy throughout the year with at 1-1/2 day month $Q \leq 0.143$
TYPE B HUMID	Rain evenly distributed throughout the year with at the most 3 day months $0.333 \geq Q > 0.143$
TYPE C MOIST	Rain sufficiently distributed with at most 4-1/2 day months $0.600 \geq Q > 0.333$
TYPE D DRY	Rain not sufficiently distributed with at most 6 day months $1.000 \geq Q > 0.600$
TYPE E ARID	There are more dry than wet at most there are 4-1/2 wet months $1.670 \geq Q > 1.00$
TYPE F BARREN	Deficient rainfall with less than 3 wet months $Q \geq 1.670$

$$Q = \frac{\text{Number of dry months}}{\text{Number of wet months}}$$

Fig. 3–2–1–c) Rainfall Map of the Ilocos Region

Furthermore, one of the features of the meteorology of the Philippines which should be emphasized is the "typhoon". The Philippines is situated in the so-called "Typhoon Belt" and is raided by Typhoon about 19 times every year, and damages caused by typhoons with maximum wind velocity of about 50 meters per second are reported every year. Above all, the typhoon which raided Virac in south-eastern part of Luzon Island in 1970 recorded a maximum wind velocity of as much as 104.2 meters per second and the typhoon "Clara" in 1967 recorded a rainfall of 1,215.7 millimeters per day, causing serious damages in Baguio. Typhoons bringing rainfalls of about 350 millimeters per day are common in ordinary years, and special attentions should be paid to these conditions especially in Program II along the coastline.



ZONE I

V = 200 KPH = 125 MPH
p = 300 kgm = 60 psf, h above 100'
p = 250 kgm = 50 psf, h 30' to 100'
p = 200 kgm = 40 psf, h 0' to 30'

ZONE II

V = 175 KPH = 108 MPH
p = 250 kgm = 50 psf, h above 100'
p = 200 kgm = 40 psf, h 30' to 100'
p = 150 kgm = 30 psf, h 0' to 30'

ZONE III

V = 150 KPH = 96 MPH
p = 200 kgm = 40 psf, above 100'
p = 150 kgm = 30 psf, 30' to 100'
p = 100 kgm = 20 psf, 0' to 30'

LEGEND:

KPH = Kilometers per Hour
MPH = Miles per Hour
kgm = Kilograms per Square Meter
psf = Pounds per Square Foot

Map 3–2–1–d) Wind Velocity Map

(source: the National Structural Code of Buildings)

3-2-2 Topology

The topology of the Philippines is characterized by mountains which occupy approximately three-fourths of the total land area, and the remaining part consists of plains between mountains, plains along the coast, and seashores of sand, coral reef and cliffs.

Most of the mountains are folded mountains rising from the ocean bottom by crustal activities in the first term of the Terriary period, while the plains between the mountains and along the coast, and the hills were formed by changes in geological structures caused by subsidence and re-elevation after the rising of mountains. To be specific, the plains among mountains and some of the coastal plains are of synclinal structure formed by subsidence, while hills are of mountaneous synclinal structure formed by re-elevation.

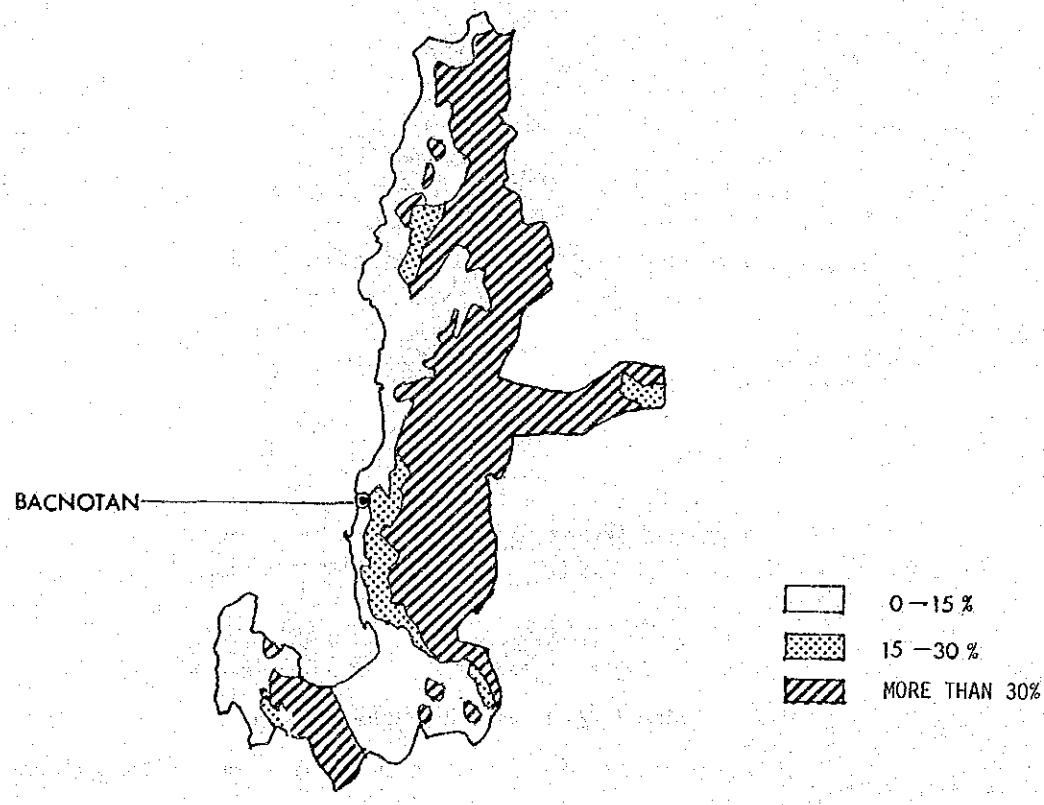


Fig. 3–2–2–a) Distribution of Slopes in Region I

3-2-3 Earthquakes

Earthquakes are usually active in island arcs along the sea trench and volcanic zones. The Philippines is situated in the circum-pan-Pacific earthquake belt and is subject to frequent earthquakes.

The Pacific coast of the Philippine islands form an island are along the Philippine sea trench and, together with the volcanic zone running north to south of the island arc, the country embraces a total of eleven active volcanos and is susceptible to earthquakes. Active volcanos today include those of Taal and Mayon in the southern part of Luzon island.

The distribution of great earthquakes of magnitude 7 or more since 1900 is shown in the map below, and in setting up this Project it is necessary to aim at a well-balanced structural plan as well as to abide by the regulations in the "National Structural Code for Buildings".

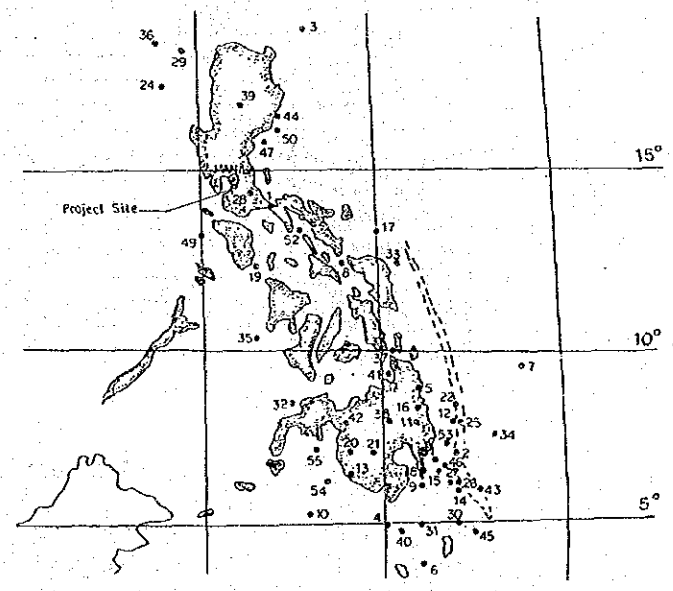


Fig. 3–2–3–a)

Major Earthquakes in the Philippines (1900–1976)

NO.	DATE	MAXIMUM INTENSITY	MAGNITUDE	DEPTH(KM)	REMARKS
1	1907 Dec. 14	VII	7.8	Shallow	Violent
2	1903 Dec. 28	VII	7.8	Shallow	Destructive
3	1907 Apr. 18	VIII	7.2	Shallow	Destructive
4	1910 Dec. 16	VIII	7.2	Shallow	Very violent
5	1911 July 12	II	7 3/4	Shallow	Destructive
6	1913 Mar. 14	II	7.9	Shallow	Destructive
7	1913 Apr. 24	VII	7.7	Shallow	Destructive
8	1915 Mar. 12	VI	7.0		
9	1918 Feb. 7		7.5	120	
10	1918 Aug. 15	I	8.3	Shallow	Tidal wave,50 victims
11	1919 Jan. 1	VI	7.4	Shallow	
12	1921 Nov. 12	VII	7.5	Shallow	
13	1923 Mar. 3	VI	7.2	Shallow	
14	1923 Mar. 17		7.0	Shallow	
15	1924 Apr. 15	II	8.3	Shallow	
16	1924 Aug. 30	II	7.3	Shallow	
17	1925 Nov. 15	VII	7.3	Shallow	Tidal wave, 7 victims
18	1927 Nov. 17	VI	7.0	50	
19	1928 June 15	VII	7.0	Shallow	
20	1928 Dec. 19	VI	7.3	Shallow	
21	1929 June 4		7.0	380	
22	1929 June 13	VII	7.2	Shallow	
23	1930 Dec. 21	VI	6.9	160	
24	1934 Feb. 14		7.6	Shallow	
25	1934 Apr. 16		7.3	Shallow	
26	1936 Jan. 21		7.1	80	
27	1936 July 6		7.3	60	
28	1937 Aug. 30	VII	7.5	Shallow	Destructive,2dies.
29	1938 May 23	VI	7.0	80	
30	1939 June 2		7.0	60	
31	1940 Oct. 7		7.0	100	
32	1942 Oct. 21		7.3	Shallow	
33	1943 May 3		7.4		
34	1943 May 26		7.8	Shallow	
35	1944 Jan.25		8.2	Shallow	
36	1948 Mar. 3		7.2	Shallow	
37	1948 Sep. 3		7.0		
38	1949 Apr.30	VI	7.0	130	
39	1949 Dec.29		7.4	Shallow	15 died
40	1950 Aug.31	IV	7.0		
41	1952 Mar.19	VI	7.5	Shallow	
42	1955 Apr. 1	VIII	7 3/4	Shallow	231 died,311 injured
43	1957 Sep.24	IV	7.6	Shallow	
44	1968 Aug. 2		7.1	36	More than 100 died in Manila
45	1969 Feb. 4	IV	6.1	33	
46	1970 Jan.10	VI	6.1	73	
47	1970 Apr. 7	VIII	6.4	37	
48	1972 Jan.25	V	7.5		
49	1972 Apr.24	IV	6.2	50	
50	1972 May 22	VI	6.9		
51	1972 Dec. 2	VI	7.4	33	
52	1973 Mar.17	VII	7.0		
53	1975 Jul.11	IV	7.2	86	
54	1976 Aug.17	VII	7.8	33	Tidal wave;8000 died
55	1976 Aug.17	VI	7.2	22	

Table 3–2–3 Earthquakes since 1901

* The ten-grade Roch Forrell Intensity Code has been in use until 1934, but a revised Roch Forrell Intensity Code of nine grades has been adopted since 1935.

The site of the Project faces the Philippines sea trench and the South China Sea on its opposite, adjacent to a continental shelf which has a firm ground, away from the volcanic zones and the active volcanos of Taal and Mayon which are located in the central and southern part of Luzon. So it is naturally presumed that the possibility of a major earthquake in this area is meager.

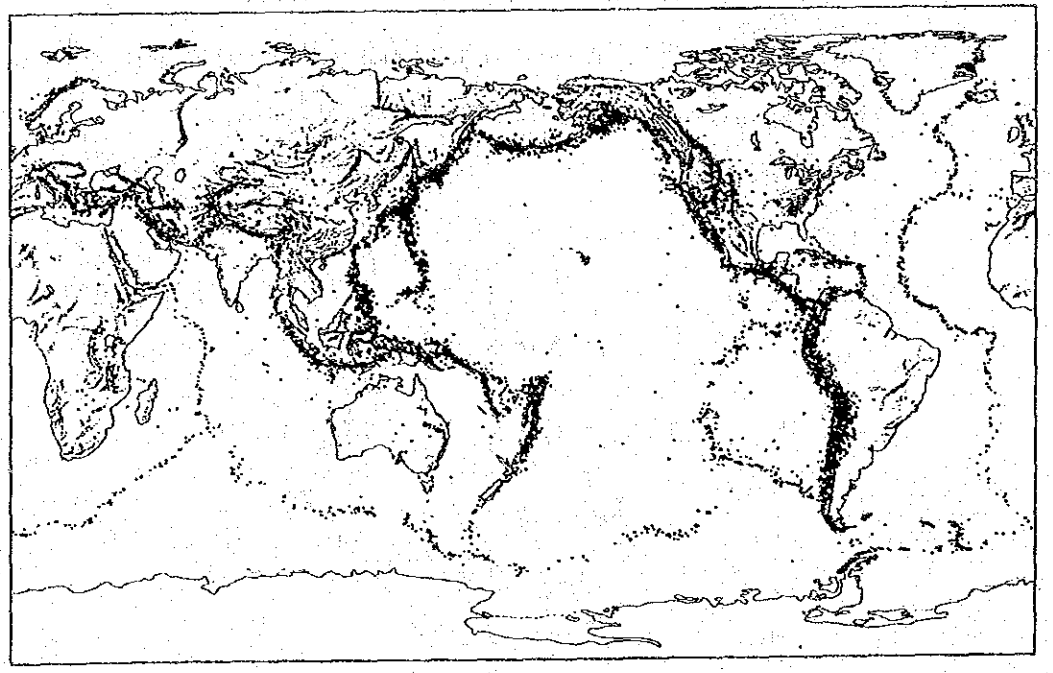


Fig. 3–2–3–b) The World's Volcanic Zones

(Earthquakes of magnitude 4 or over with focal points of and less than 100km below surface occured during 1961 – 1967)