REPUBLIC OF THE PHILIPPINES
DEPARTMENT OF AGRICULTURE AND NATURAL RESOURCES
BUREAU OF SOILS
MANILA

Soil Report 46

SOIL SURVEY OF QUEZON PROVINCE PHILIPPINES

Reconnaisance Soil Survey and Soil Erosion Survey

BY

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Chief of Party

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SOIL SURVEY OF QUEZON PROVINCE [1]

CONTENTS

[1] Report updated and edited by Mr. Timoteo P. Demen, Supervising Soil Technologist and Mrs. Magdalena Q. Favis, Soil Technologist II, Bureau of Soils, Manila.

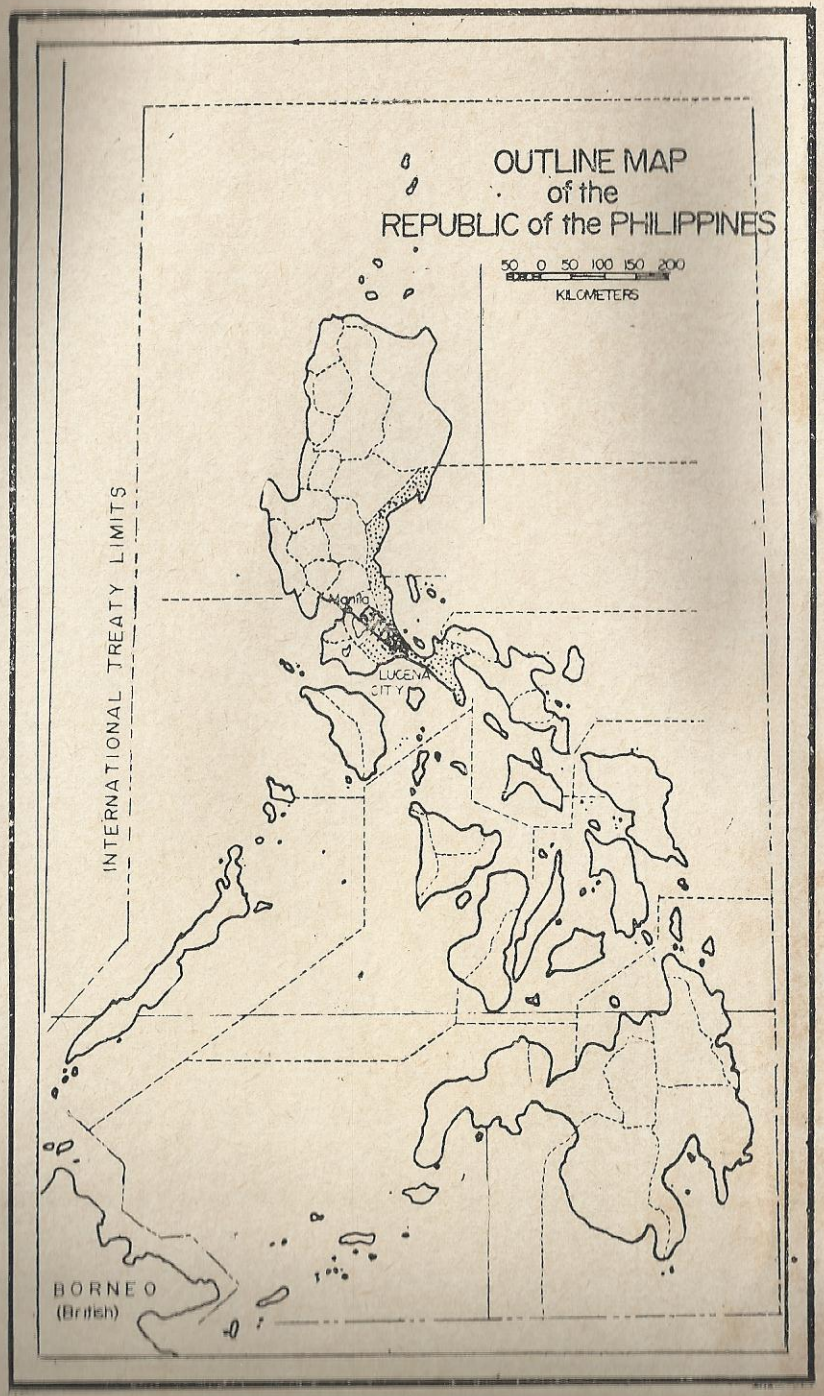

Fig. 1. Outline map of the Philippines showing the location of Quezon Province.

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DEPARTMENT OF AGRICULTURE AND NATURAL RESOURCES

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BUREAU OF SOILS

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Director

ILLUSTRATIONS

HOW TO USE THE SOIL SURVEY REPORT

Soil Surveys provide basic data for the formulation of land-use programs. This report and the accompanying map present general and specific information about the soils, the crops, and the agriculture of the area surveyed. The individual reader may be interested in the whole report or in only some particular parts thereof. In either case, he will be able to obtain the information he needs. Prepared for both general and detailed use, the report is designed to meet the needs of a wide variety of readers under three general groups: (1) those interested in the area as a whole; (2) those interested in specific parts of it; (3) students and teachers of soils science and related agricultural subjects. An attempt has been made to meet the needs of all these groups by making the report comprehensive for reference purposes.

Readers interested in the area as a whole include those concerned with general land-use planning—the placement and development of highways, power lines, urban sites; industries, community cooperative, resettlement projects, and areas for forest and wildlife management and for recreation. The following sections are intended for such users: (1) Description of the Area, in which physiography, relief, drainage, vegetation, climate, water supply, history, population, industries, transportation, markets and cultural developments are discussed; (2) Agriculture, in which a brief history of farming is given with a description of the present agriculture; (3) Productivity Ratings, in which the productivity of the different soils are discussed and presented, (4) Land Use and Soil Management, in which the present uses of the soils are described, their management requirements discussed and suggestions made for improvement; and (5) Water Control on the Land, in which problems pertaining to drainage and control of run-off are treated.

Readers interested chiefly in specific areas such as particular locality, farm, or field, include farmers, agricultural technicians interested in planning operations in communities or on individual farms, and real estate agents, land appraisers, prospective purchasers and tenants, and farm-loan agencies. These readers should (1) locate on the map the tract concerned; (2) identify the soils on the tract by referring to the legend on the margin

of the map and looking at the symbols and colors that represent them; and (3) locate in the text under the chapter on Soils the descriptions of each soil type and additional information on its suitability for use and its relation to crops and agriculture. They will also find useful specific information relating to the soils in sections on Productivity Ratings, Land-Use and Soil Management and Water Control on the Land.

Students and teachers of soil science and allied subjects, including crop production, animal husbandry, economics, rural sociology, geography, and geology, will find useful information in the chapters on Soils and Agriculture, where the general scheme of classification of the soils of the province and a detailed discussion of each type are presented. For those not familiar with the classification and mapping of soils, these subjects are discussed under Soil Suvery Methods and Definitions and Mechanical Analysis. Teachers of other subjects will find the sections on Description of the Area, Agriculture, Productivity Ratings and the first part of the section on Soils of particular value in determining the relation between their special subjects and the soils of the area.

—Adapted from the U.S.D.A.

INTRODUCTION

Increased food production is one of the perennial problems confronting our country today. With our fast growing population each year, something should be done to increase food production to ward off food shortage, if we want our people to survive. Our vast agricultural land areas can produce more or even double their present production, through the adoption of modern agricultural methods and scientific farming principles. However, intensive knowledge of the characteristics and properties of the soil, both physical and chemical, is fundamental in good farming practices and in the proper management of the soils. Therefore, a formal study and classification of the soils are necessary. The soil survey of every province of the Philippines is a step towards the solution of the many problems that beset our farmers in their agricultural endeavors.

The soil classification survey of Quezon Province was conducted from November 17, 1964 to June 30, 1965, then from August 1 to September 30, 1965 by Messrs. Luis R. Renales, Librado R. Rosales, Galo Aragones, Alfonso Crucena, Dante Cabrera and Pedro del Mundo, all of the Bureau of Soils, during the incumbency of Mr. Artemio E. Gesmundo, Assistant Director and Officer-In-Charge, Bureau of Soils and the Honorable Jose Y. Feliciano as Secretary of Agriculture and Natural Resources.

The reconnaissance erosion survey of the province was also undertaken simultaneously with the soil classification study to determine (1) the character and extent of soil erosion taking place in the province; (2) the factors that had caused the erosion, and (3) the measures necessary to minimize the erosion going on.

SUMMARY

Quezon Province, formerly known as Tayabas, is the longest province in the country. It lies along the eastern seacoast of Luzon. It has an area of about 1,194,615 hectares which includes the islands of Polillo, Patnanongan, Jomalig, Pagbilao Chica, Pagbilao Grande, Alabat, and other smaller ones. Lucena City, the capital of the province, is about 137 kilometers from Manila by road and/or railroad.

Generally, the province has a rugged terrain with a few flat lands, valleys, and swamps which are subject to flush floods. The Sierra Madre Range runs along the whole length of the province. Mt. Banahaw, located at the southeastern part of the province, is the most prominent mountain peak of the province—towering about 7,382 feet above sea level.

The mountains and hills are mostly underlain by primary rocks such as basalt, andesite and volcanic tuff; and secondary rocks like shale, limestone, sandstone and conglomerates.

The valleys and plains are of recent alluvial deposits and of water-laid volcanic tuff. The plains which are found mostly along the coasts are narrow.

The important rivers of the province are Cabatangan, Agos, Calabgan, Ditali, Ramaga, Dibalo, Dingalan and Umiray. These rivers drain the province into the Pacific Ocean and Ragay Gulf.

Forest lands, open grasslands, cultivated lands, swamps and mangroves are existing in the province. The Sierra Madre Range and Mt. Banahaw are thickly covered with primary forest. Thus, commercial timbers are abundant. Portions of the rolling areas are under cogon grass and other parts are covered by second-growth forest, especially those in the Bondoc Peninsula. The narrow plains and valleys are devoted to the cultivation of crops like coconut, rice, corn, fruit trees, abaca, vegetables, root crops and coffee. The cleared portions of the rolling areas are also planted to coconuts and fruit trees. The vegetation found in the swamps are mostly nipa palms and mangroves.

Quezon Province, formerly known as Tayabas was explored by the Spaniards in 1571 and 1572. Formerly, the territory that constituted the province of Quezon was one time under the

jurisdiction of various provinces. The southern and central portions were under the jurisdiction of the province of Bonbon, sometimes called Balayan; and the northern portion was under Laguna and Nueva Ecija. In 1591, Tayabas was created into a province under the name Kalilaya, with Kalilaya, now Unisan, as its capital. Later, in the 18th century, the capital was transferred to the town of Tayabas, which gave the new name Tayabas for the province. In 1901, Lucena was made as its capital. In 1902, the districts of Principe (formerly a dependency of Nueva Ecija) and Infanta and Polillo (formerly dependencies of Laguna) were annexed to the province of Tayabas. Six months later, Marinduque, which was a separate province at that time, was annexed to Tayabas.

On September 7, 1946, the province was renamed Quezon after the late President Manuel Luis Quezon. Later, Marinduque was separated from Quezon, thus became a regular province also.

The population of the province in 1903 was 153,065 persons; in 1918, 212,017; in 1939, 358,553; in 1948, 416,719; and in 1960, 653,426. The increase in population from 1903 to 1960 was 500,361 persons or 326 per cent.

The transportation facilities of the province are provided by a number of land transportation companies. Aurora Sub-province is served by Victory Liner and MBC; while the southern part, including Infanta area, is served by BLTB Company and Philippine National Railways. There is an existing airport in Aurora Sub-province, but during the survey, no flight of any domestic air transportation in the area is observed. The islands of Polillo, Alabat, Pabilao Grande and Pagbilao Chica are served by motor boats plying daily the routes from the mainland. The ports of Casiguran, Hondagua and Plaridel are often visited by foreign vessels aside from domestic ones.

Telegraph and mailing services thru the Bureaus of Post and Telecommunication are available in all the municipalities.

Most of the towns have secondary schools. Elementary schools are maintained in all towns and barrios. The secondary schools are mostly operated by the Catholics. The Luzonian Colleges, a private school offering various college courses, is found in the capital.

The Bureau of Health maintains provincial hospitals in Lucena City, Baler and Lopez. All towns and some barrios have Health Centers. The Philippine National Red Cross has a Chapter in Lucena City.

Agriculture is the most important industry of the province. Other industries are lumbering, livestock raising, fishing, weaving and manufacturing.

Two types of climate, based on rainfall distribution, prevail in the province. They are the second and fourth types. The second type, characterized by a very pronounced rainfall from October to January and no dry season, occurs in the southeastern coast of the province including the Islands of Polillo, Alabat, Jomalig and Patnanongan and the southwestern part of the province from Lucena City towards Batangas–Laguna–Quezon boundaries. The fourth type, which has a more or less evenly distributed rainfall throughout the year, occurs in the northern part of the province—the sub-province of Aurora and the Bondoc Peninsula.

The province has a wide variety of crops, but coconut is the principal crop grown. Approximately, 12 per cent of the total land area of the province and about 75 per cent of the cultivated part are grown to coconuts. Other crops grown are corn, abaca, banana, fruit trees, vegetables, root crops, rice, sugar cane, tobacco and legumes.

The farmers employ the usual method of tillage, using the animal-drawn implements and the carabao as the source of power. The use of farm machinery is practiced by some farmers though. The primary needs of the farmers in the province are work animals, capital for purchasing machinery and fertilizers, and construction of irrigation systems. Likewise, the construction of more feeder roads will greatly enhance the development of the agricultural areas.

The total farm area of the province is 267,429 hectares, which is 22.38 per cent of the total land area of the province. The census of 1960 shows that of the 58,158 farms in the province, 22,793 farms are operated by owners; 6,599 farms by part owners; 28,305 farms by all types of tenants; 61 farms by managers; and 400 farms by other forms of tenure.

The soils of Quezon are classified based on relief into three distinct groups; namely, (1) soils of the plains and valleys; (2) soils of the uplands, hills and mountains; and (3) miscellaneous land types.

The soils of the plains and valleys have an approximate area of 60,208.7 hectares or 5.04 per cent of the total land area of the province. There are 14 soil types mapped under this group of which Umingan loam, with a total of 12,662.90

hectares or 1.06 per cent of the total land area of the province, is the largest. This particular soil type is devoted to coconut, lowland rice, fruit trees, legumes and coffee. The other soil types are Baler silty clay loam, Bay loam, Bigaa loam, Bugko sand, Buguey loamy sand, Catanauan clay loam, Laylay silt loam, Piris clay loam, Polillo sandy clay loam, Quingua silt loam, Quingua sandy clay loam, San Manuel sandy loam, and Umingan sandy loam. These soil types are primarily planted to coconuts, rice, corn, root crops, legumes, fruit trees and vegetables. They are suited to a wide variety of crops.

The soils of the uplands, hills, and mountains have a total land area of 730,984.7 hectares or 61.19 per cent of the total land area of the province. There are 25 soil types under this group. Faraon clay has the biggest area, 204,159.7 hectares or 17.09 per cent of the total land area of the province. The other soil types under the group are Alaminos clay, Alimodian sandy loam, Annam clay loam, Annam silt loam, Antipolo sandy clay, Bantay clay loam, Bauang clay loam, Boac clay, Bolinao clay loam, Castilla clay, Cervantes sandy loam, Guadalupe clay loam, Guadalupe loam, Guimbalaon sandy clay, Ibaan loam, Ibaan silty clay loam, Lipa loam, Luisiana sandy clay loam, Macolod clay loam, Rizal clay, Sariaya sandy loam, Sevilla clay loam, Siain silt loam, and Tagkawayan sandy loam. These soils are devoted principally to the growing of coconuts, rice, fruit trees, root crops, banana, and for grazing.

Beach sand; hydrosol; mountain soils, undifferentiated; and riverwash belong to miscellaneous land types which cover an approximate area of about 403,421.6 hectares or 33.77 per cent of the total land area of the province. The mountain soils, undifferentiated are mostly covered with primary and second growth forests and grasses.

The soils of Quezon Province are of primary and secondary origin. Their parent materials have different physical and chemical composition and mineralogy.

The productivity ratings of the various soil types in the province are shown in Table 5. These ratings are obtained on the basis of the average yields of crops where farm practices do not include the use of commercial fertilizers or amendments.

Based on the physical suitability for crop production, the soils of Quezon Province are classified into land capability classes and subclasses; namely, A, Be, Bs, Bw, Ce, Cs, De, Ds, M, N, X and Y. Land capability class A and subclasses Be, Bs, Bw, Ce, De, Ds are used as croplands; while Class M and N are for pasture or permanent vegetation; Class X for fishpond or wildlife; and Class Y is for recreation or wildlife.

The erosion classes to which the soils of the province have been subjected to are erosion classes O, 1, 2, 3, and W or normal erosion. The principal factors that affect soil erosion and the effects as well as the possible control measures are discussed in the erosion part.

A soil map, showing the distribution of the different soil types and miscellaneous land types in the province, accompanies this report.

I. RECONNAISSANCE SOIL SURVEY

DESCRIPTION OF THE AREA

Location and Extent.—Quezon Province, formerly known as Tayabas, is the longest province in the country. It has a total area of about 1,194,615 hectares or 4.02 per cent of the total area of the country and is considered the sixth largest province. It stretches along the eastern coast of Luzon from Camarines Norte in the south to Isabela in the north. It occupies the greater portion of the Sierra Madre Range. The province is very narrow, averaging about 30 kilometers more or less on its width. The coast is indented by many open bays, such as Baler, Dingalan, Lamon, Tayabas, and Ragay Gulf. The province lies between 13° 10' and 16° 15' latitude; and 121° 20' and 122° 21' longitude. Lucena City, the capital, is about 137 kilometers or 86 miles from Manila.

Relief and drainage.—Generally, the province has a rugged terrain with few plains, valleys and swamps which are subject to flush floods. The Sierra Madre Range runs along the whole length of the province. Only narrow strips of land along the coast and river valleys are available for growing crops. The undulating lowlands along the coast are well-drained.

Mount Banahaw, located at the southwestern part of the province, is the most prominent mountain peak of the range, towering about 7,382 feet above sea level. Other mountain peaks within the range have altitudes ranging from 1,500 to 6,000 feet. The Bondoc Peninsula, a southward continuation of the Sierra Madre Range, has lower altitude. Polillo Island is low with several summits above 700 feet high.

The Jomalig Island is low-lying with undulating to rolling relief. Alabat Island is a rugged isometrical ridge, steep on the northeast portion and gentle on the southwest part. Its summits attain an altitude of about 1,000 feet.

A number of short but navigable streams traverse the whole province, the most important of which are Umiray, Agos and Kanan Rivers. The short and navigable rivers and their tributaries help drain the soils of the province.

Owing to the hilly and mountainous relief of the province, the external drainage of most area is rapid to excessive; while the internal drainage is good to fair in most cases, except in some level areas where said internal drainage is expressive

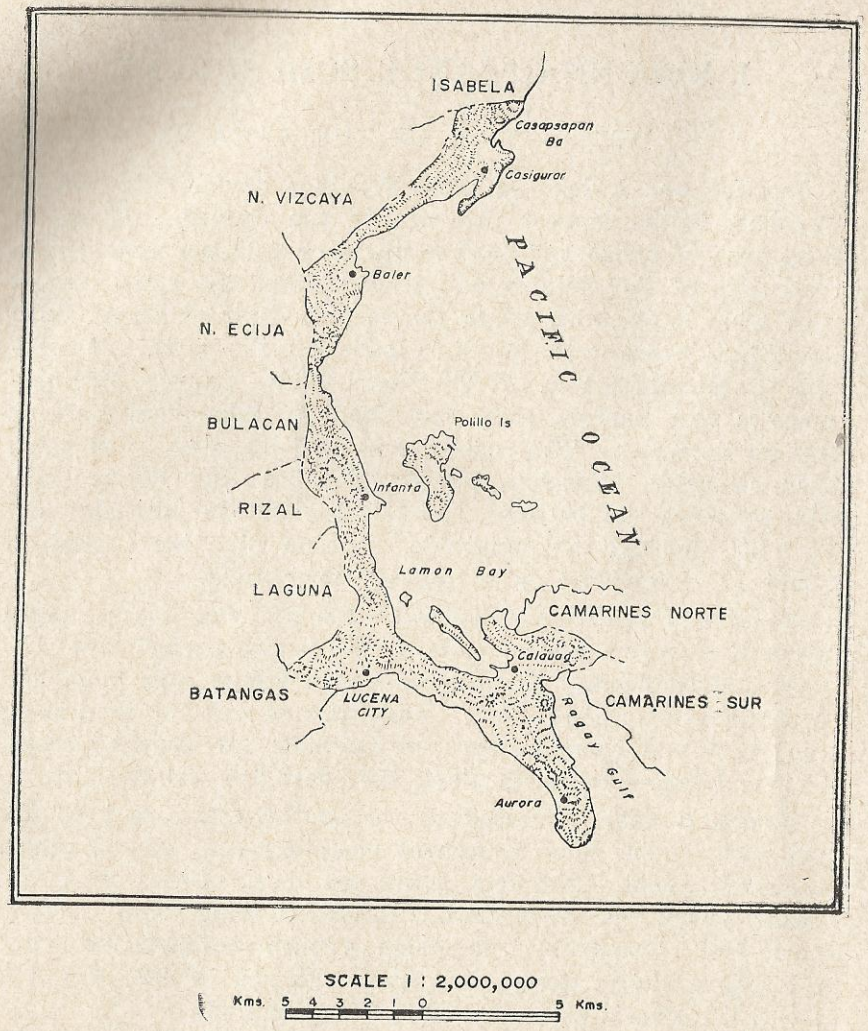

Fig. 2.—Map of Quezon Province showing the relief and natural drainage pattern.

Organization and population.—Tayabas, now Quezon Province, was exploited by the Spaniards in 1571 and 1572.

The territory which constituted the province of Tayabas then was one time under the jurisdiction of various provinces. In 1585, the southern and central portions were under the jurisdiction of the province of Bonbon sometimes called Balayan, and now Batangas; and the northern portion was under the provinces of Laguna and Nueva Ecija.

In 1591, Tayabas was created into a province under the name of Kalilaya. Its capital then was the town of Kalilaya now Unisan. However, about the middle part of the 18th century the capital was moved to the town of Tayabas. The new capital, in the course of time, gave the province its name Tayabas.

Another important event in the annals of Tayabas was the revolt of the *Confradia* in 1841. This revolt was led by Apolinario dela Cruz, a lay brother in the San Juan de Dios Hospital. The rebellion spread to a few towns in the neighborhood and in the provinces of Laguna and Batangas. Apolinario was called by his followers "The King of the Tagalogs.'

Like many other provinces, Tayabas suffered from Moro depredations. In 1798, a fleet of some twenty-five Moro boats harassed the towns of Casiguran, Palanan and Baler, and took 450 inhabitants as captives. The towns along the southern coast of Bondoc Peninsula were also at their mercy. These depredations continued almost to the end of the Spanish rule. Tayabas was among the first provinces to join the revolution against the Spanish rule. On August 15, 1898, General Malvar took possession of Tayabas in the name of the Revolutionary Government.

On March 12, 1901, a civil government was established in Tayabas, with Lucena as the capital. On June 12, 1902, the districts of Principe, formerly a dependency of Nueva Ecija, and Infanta and Polillo, formerly dependencies of Laguna, were annexed to Tayabas. Six months later, Marinduque, which up to that time had been a separate province, was also annexed to Tayabas.

Tayabas, was renamed Quezon on September 7, 1946 after the late President Manuel Luis Quezon. Lucena, its present capital, became a chartered city on August 20, 1960; and a sub-province composing of Baler and the six neighboring municipalities, was created and named as sub-province of Aurora.

With the exceptions of the towns of Baler and Infanta, there were but few settlements in the western side of the province. Most of the important towns are located along the Coast of Tayabas and Lamon Bays. Lucena, the capital, is an important commercial city along the Manila-Hondagua railway line. It has a population of 11,939 inhabitants. The towns of Gumaca, Lopez, Mauban and Atimonan, protected from high winds by the Islands of Polillo and Alabat, are important trade centers along the coast of Lamon Bay.

All the Christian inhabitants of the province are found along the coastal towns, especially along Lamon Bay. Among them are Tagalogs, Bicolanos, Ilocanos and Visayans. The primitive tribes occupy the mountainous regions in the interior.

The population of Quezon Province is very sparse. In 1903 the province had an estimated population of 153,065; in 1918, 212,017; in 1939, 358,553; in 1948, 416,719; and in 1960, 653,426 inhabitants. The population from 1948 to 1960 had increased to 236,707, equivalent to 56.8 per cent; and from 1903 to 1960 the increase was 500,361 or 3.26 per cent.

The area and population of Quezon Province by municipalities, as recorded in the 1960 Census, are as follows:

Municipalities	Area in Hectares	Population
Agdangan	3,482	5,410
Alabat	9,146	8,529
Atimonan	18,300	32,294
Aurora	46,293	8,406
Baler	10,850	10,350
Buenavista	15,197	6,438
Burdeos	17,376	7,855
Calauag	40,403	37,101
Candelaria	14,874	29,928
Casiguran	83,426	6,900
Catanauan	17,950	17,168
Dilasag	41,365	2,481
Dingalan	40,221	3,368
Dipaculao	50,727	5,149
Dolores	5,300	9,143
General Luna	13,772	8,123
General Nakar	134,331	5,494
Guinayangan	14,810	16,428
Gumaca	22,223	27,284
Infanta	69,842	21,868
Lopez	39,511	31,558
Lucban	6,932	17,452
Lucena City	6,850	49,264
Macalelon	9,406	10,025
Maria Aurora	36,769	10,182
Mauban	41,599	18,703
Mulanay	31,296	9,859
Padre Burgos	6,913	16,262
Pagbilao	17,096	17,303
Panukulan *	24,580	2,704
Perez	5,860	4,741
Pitogo	9,040	9,229
Polillo	88,977	11,978
Quezon	5,404	8,095

* Municipal district.

Municipalities	Area in Hectares	Population
Sampaloc	7,379	6,538
San Andres *	19,885	2,815
San Antonio	5,404	9,847
San Luis *	60,592	4,397
San Narciso	20,243	7,877
Sariaya	24,525	42,089
Tagkawayan	64,703	28,664
Tayabas	31,830	25,758
Tiaong	5,768	26,084
Unisan	9,165	12,285
TOTAL	1,194,615	653,426

Vegetation.—The Sierra Madre Range including Mt. Banahaw is thickly covered with primary forest with abundant commercial timbers. Portions of the rolling hills are covered by secondary forest and cogon grass, especially in the Bondoc Peninsula, and the cleared areas are planted to coconuts and fruit trees. The narrow plains and valleys are planted to various crops, such as rice, coconuts, corn, abaca, vegetables, root crops, coffee, bananas, and fruit trees. The vegetation found in swamps are nipa palm, mangroves, *bakawan* and other brackish water-loving plants.

Geology [1].—The Tayabas Isthmus, extending south from Sampaloc River to the latitude of Aloneros, is the narrowest part of Quezon Province. The dividing line between the two stratigraphic and topographic regions of Tayabas Isthmus runs from Atimonan to Unisan. The coasts are fringed with extensive coral reefs and swamps, but cliff exposures are absent. The matured river courses present no exposures. The area east of the line connecting Atimonan and Unisan shows topography of low relief.

The northern half of the Isthmus, west of the line connecting Atimonan and Unisan, is mountainous with elevations up to about 400 meters. The main ridge before reaching the railroad line plunges under young sediments. The topography is characterized by steep, rugged slopes and rapid streams entrenched in V-shaped canyons. Northward, this mountainous area gradually merges with the Calilaya Plateau east of Lucban. A high, mountainous region covered with limestones is found south of a line connecting Lopez and Guinayangan.

The large areas of very old diorites, schists, and gneisses are found on Tayabas Isthmus. The rock in this area is mostly of coarse crystalline diorite, intensely fractured locally and filled with secondary quartz veins. Patches of green schists

are often found. Along the coast, northwest of Atimonan, altered green basic lavas with some serpentine and gray schists are present. The basement rocks on Alabat Island are of this type; these occasionally contain mineralized veins. The other large area of basement complex along the south coast between Pinacapulan Pt. and Pitogo, and extends inland about five kilometers. Except for an outcrop of schist about two kilometers wide, the rocks are all of coarse crytalline diorite, not sheared and gneistic, like those of the northern area. Small, thin mineralized veins carry copper stains.

The Tayabas coal measures consist of well-folded, dark brown carbonaceous sand, silt, and black shale, some of which yield fossil fragments and well-preserved mollusks. Several thin gritty calcareous sandstones, called the Tayabas sandstones, are exposed along the road from Gumaca to Pitogo. These rocks are extensively quarried for road materials. Coarse gravels and conglomerates are not present. These coal measures are extensively folded, and generally exhibit steep dips. Foraminifera are present in many of the carbonaceous shales. The thickness of the formation may be about 2,200 meters, but the structure is so complex and the reliable dips so few that estimates are unreliable. The age of the formation is Tertiary W to lower X.

The limestone found in the province and designated as Tayabas limestone are of the several limestone members found in the Tayabas coal measures. Along the north coast of the Isthmus opposite Alabat Island, from Gumaca to Atimonan, is a basal bed resting on schist and gneiss belonging to basement complex, which consists of a gritty limestone containing pebbles of these basement rocks. Not far from the contact the limestone is massive. On the south flank of the Siain syncline, on the railroad line south of the summit, an excellent exposure of Tayabas limestone is found. A small inlier of limestone grit, overlying volcanoes along the axis of the Pitogo anticline, yielded orbitoids of Tertiary W age. This limestone grit, though lithologically similar to some Tayabas limestone, may well belong to a different formation.

The Aloneros conglomerates are coarse sandy gravels, chiefly of non-marine origin, interbedded with large amount of clay and silt of volcanic origin. This type of formation is found along the railroad between Santo Domingo and Aloneros. Three other large areas of similar rocks are found at Aloneros. The first of this area lies immediately off Lopez, where gravels are

exposed along the railroad line of Hondagua and along the highway to Calauag. It lies beneath the Hondagua silt to the north and above the Tayabas coal measures to the south. The second and largest of these areas occurs just north of the Pitogo and extend eastward beyond Macalelon. A few marine sands carrying shell fragments were found here. These gravels rest on Tayabas coal measures and Tertiary pebbles. The third area occurs on Alabat Island; here no marine bed was found. The abundant quartz pebbles maybe the source of the small quantities of placers gold found in most of the southerly streams. These beds on Alabat Island maybe equivalent to the Tayabas coal measures. This formation is everywhere characterized by large quantities of weathered bentonetic clay, usually impure, interbedded with gravel.

Hondagua silt is found between Lopez and Calauag along the railroad line and main highway. The formation consists chiefly of thin bedded gray silt; in the vicinity of Hondagua Railway Station many thin but massive beds are present. The Hondagua silt has an approximate thickness of 1,000 meters. Its age is Tertiary Upper X and Y. Hondagua silt is overlain by Sumulong formation.

The Sumulong formation, overlying the Hondagua silt, is a silty diotomite containing Foraminifera and a few megofossils. Reliable dips were not found, but the beds are probably steeply inclined. The color of the formation varies from white to light buff or pink. The Sumulong formation is overlain, apparently unconformably, by the calcareous sandstone and coralline limestone of the Vimas formation. Southward, toward Sumulong, some coarse gravelly oyster-bearing sandstone reefs and sands are overlying the Sumulong formation at steep angles, this maybe basal beds of the Vimas formation. The thickness of the Sumulong formation is approximately 500 meters. It is Tertiary Lower 7 in age.

The Vimas formation consists of a sequence of poorly bedded and unconsolidated sands, silts and gravels of marine origin. The formation is rich in Foraminifera. The dip is generally not steep. The usual color is gray to light buff or brown. This formation occupies the area between Sumulong and Vimas on the main highway. The thickness probably averages 250 meters and is Tertiary 7.

Limestone apparently overlying the Vimas formation at the easternmost end of the Tayabas Isthmus had a rugged terrain as the typical Malumbang formation. It appears to be a north-

eastward continuation of the typical Malumbang formation in the Bondoc Peninsula.

The Quezon formation named from the type found in Quezon National Park on the Atimonan Road, extends from the base of the grade on the Atimonan side to just below the summit. The Mt. Lookout limestone, named after the El Mirador Lookout Station in the Quezon Park, is the massive limestone that forms the crest of the ridge. From the Lookout Station this limestone formation can be seen extending for some miles to the northwest and southwest portion. It forms spirolike pinnacles which rise above the thick virgin forest. It contains caves and a few underground streams. The limestones are fractured, veined, and recrystallized. The predominant color is white. Both large and small orbitoids are plentiful in it. The Mount Lookout limestone extends out to the southeast; little is known of the area to the northeast. The thickness of the limestone which stands nearly vertical is approximately 1,500 meters.

The upper part of the Quezon formation is composed of lava flows, agglomerates, conglomerates, sandstones and cherty tuffs. The conglomerates, sandstone, and chert are the nonmarine, water-laid equivalents of the volcanic material. The formation is partly metamorphosed and frequently highly contorted. The cherts are thin-bedded, usually green and glassy where unoxidized and dirty-brown and dense where oxidized. The thickness of the Quezon formation is variable because of the overlying unconformity, but probably varies from 2,500 to 3,000 meters.

The Pagbilao limestone, named after the two islands off Padre Burgos, Pagbilao Grande and Pagbilao Chica, largely covers the two islands. The rock is massive or bedded, and often tuffaceous. On the east and south sides of Pagbilao Chica, the metamorphosed volcanics of the Quezon formation underlie the limestone. On the mainland this limestone extends intermittently from the vicinity of Yawe, on the railroad line, to Malicboy, where the pink limestone containing schist pebbles is quarried. The nest line of outcrops extends north-northwesterly from the vicinity of the municipality of Pagbilao. The Pagbilao limestone is in part equivalent to the Tayabas limestone which reaches about 1,000 meters. On the Pagbilao Island, where the thickness is greatest and where it appears to represent a localized reef formation, it is gently but irregularly warped. The Pagbilao overlies the Quezon formation with a 90 degree uniformity.

Above the Pagbilao limestone area along the railroad line near Padre Burgos, is a series of tuffaceous sandstones and shales with occasional lava flows. This well-bedded and gently folded volcanic groups, though obviously waterlaid and could be non-marine, is very similar to the San Miguel tuff of the Batan Island groups. From Malicboy to Pagbilao, the Pagbilao limestone and older formation are locally carrying abundant pebbles. Both of these formations are believed to be sedimentary equivalents of the Laguna tuffs but the former maybe older.

The extensive area of alluvium is present on the Tayabas Isthmus. However, all the rivers are matured and drowned, and consequently alluviated for great distance. The north shores are paralleled by extensive littoral deposits, coral reefs, and mangrove swamps and flats.

The Sampaloc River has cut a large window on the Laguna tuffs, exposing a section of coal measures resting on the Quezon formation.

The Sampaloc coal measures are probably equivalent in age to the Tayabas coal measures. Fine carbonaceous sands and silts predominate, but black carbonaceous shales are occasionally found. Megafossils and Foraminifera are rare. Several carbonized tree trunks and branches were found in the sequence near Sampaloc. The thickness, exclusive of the limestone, is about 1,750 meters. Limestone, conglomerate and the coal measures together, appear to aggregate 5,000 meters or more.

The Laguna formation covers an immense area, forming a thick blanket that is unbroken except by a few isolated windows. The formation is well exposed on the road from Lucban to Sampaloc. It consists of an assemblage of flat volcanic tuffs, agglomerates with occasional flows.

The area between Atimonan and Pagbilao is a steep monocline of metamorphosed sediments resting on basements of diorites, gneisses and schists. The Quezon formation is usually contorted and frequently overturned. Gentle irregular folds are present on the Pagbilao Islands. There is no evidence of major faulting anywhere on the isthmus.

The basement rocks and the overlying sequence of metamorphosed volcanics found on the western isthmus plunge under the sediments of the eastern isthmus. A large syncline between Gumaca and Pitogo lies between two areas of basement rock. The folding is steep and minor crumpling is common.

The southeast plunging syncline extends northwest to Atimonan. The structure between Pitogo and Guinayangan is that of an intensely folded through. A small fold maybe present on the peninsula north of Hondagua.

Igneous rocks such as basalts and andesite, diorite, and other volcanic rocks are found in the mountains and hills in the central and northern portions of the province.

Cultural Development and Improvement.—In the school year 1959—1960, the total enrollment in public elementary and secondary schools of the province was 76,247 students which indicate a substantial drop of 11,855 students from the 1957—1958 total enrollment of 88,102. No reason for the decrease in enrollment was given. In 1959—'60 enrollment figure, about 11.5% of the pupils were enrolled in public schools, or about 1% less than the 12.5% average for the whole country. In 1960, the province has 625 public elementary schools, 7 public secondary school and one vocational school. The latter has an enrollment of 70 students.

Except at the elementary level, there are more private than public schools in the province, consisting of 50 secondary schools, 7 colleges and 15 special vocational schools. Almost all municipalities have at least both elementary and secondary schools. The private elementary and secondary schools have a total enrollment of 14,782 students in the school year 1957—'58 which represent about 2.3% of the total population of the province. This is a favorable condition as compared to 3.1% average for the country considering the fact that a considerable number of students from the province are attending private high schools in Manila. In the school year 1957—'58 there were 1,197 students enrolled at the collegiate level and 296 students in private vocational schools. A greater number of students pursue higher education at the colleges and universities in Manila.

On the whole, the present educational set up in the province meets the present needs of the people.

Transportation and Markets.—Considering the area of Quezon Province, its present transportation facilities are inadequate. Certain areas are inaccessible by land routes from urban center because of lack of roads. The total span of first, second and third class roads is only 756 kilometers. It is true that the first class roads represent 63% of the total national and provincial road system of the province but construction of new roads and the improvements of existing ones

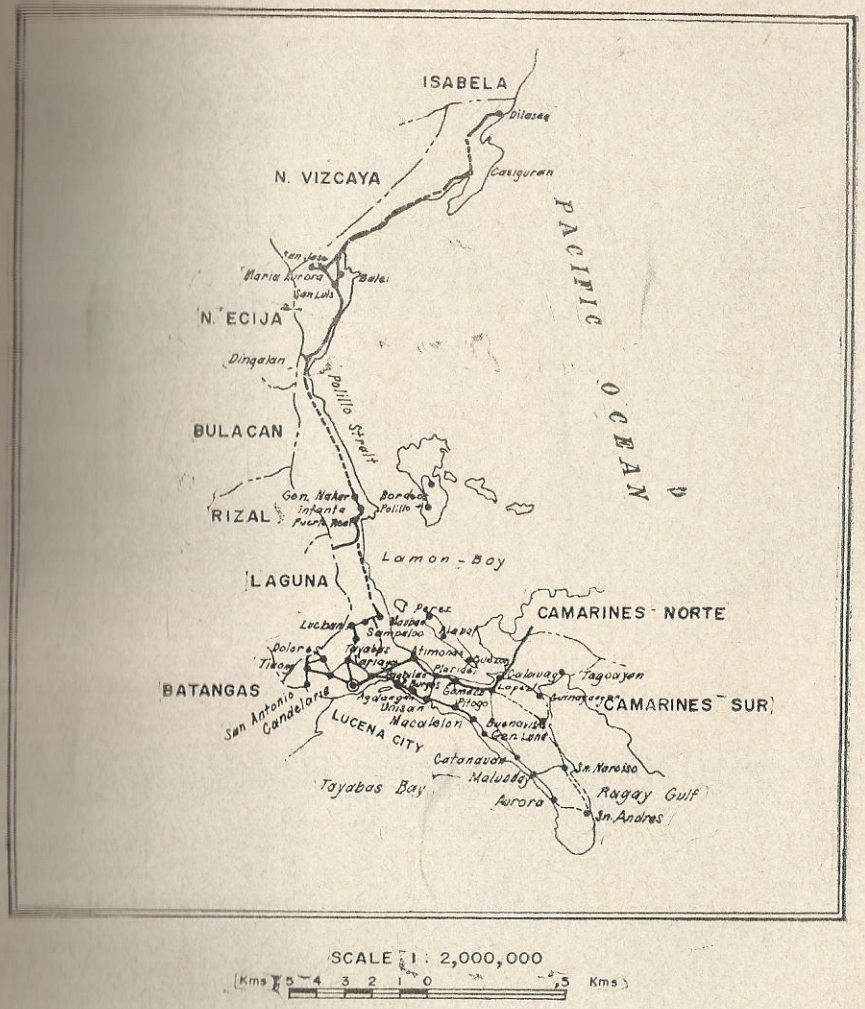

Fig. 3.—Road map of Quezon Province.

are needed to facilitate the marketing of the agricultural products from the more remote area. During rainy season some roads are impassable because of their muddy condition. The present road system is concentrated in the southern portion of the province. There is no road north of Mauban, except the one being constructed that will link Mauban to Infanta—a distance of 60 kilometers. A road system to cover the remaining distance of more than 300 kilometers that will connect the southern towns of the province to the northern border is much needed.

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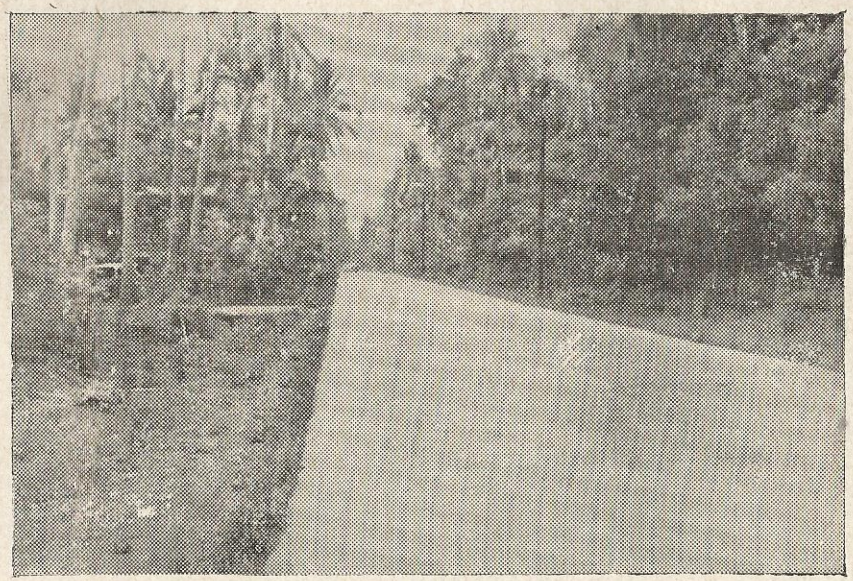


Fig. 4.—A portion of the first class road in Quezon Province taken at the outskirts of Lucena City.

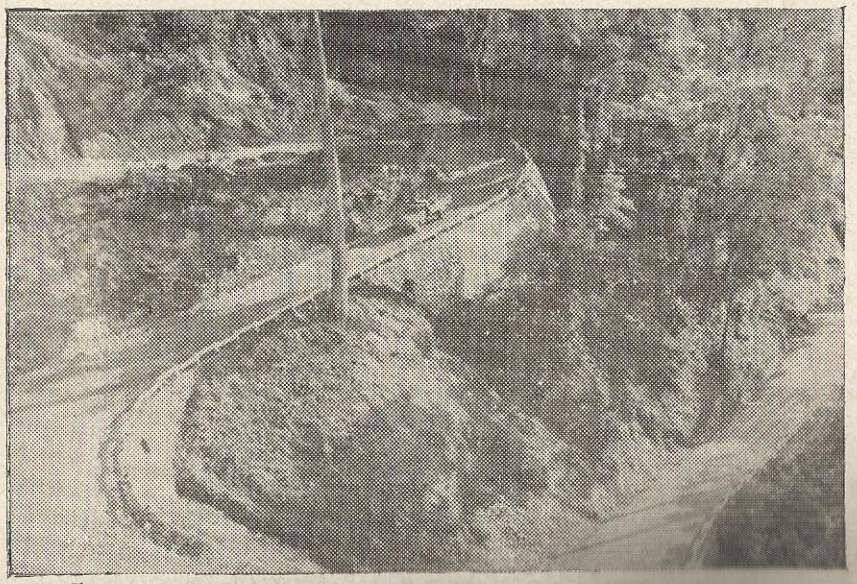


Fig. 5—A portion of the zigzag road at Malicboy, Pagbilao towards Atimonan, Quezon.

Certain towns in the southern section enjoy a distinct advantage because the Philippine National Railway passes through them. This make them readily accessible from Manila. The BLTB Company is the only land transportation company plying the accessible routes in the southern section of the province including Infanta. Jeepneys, tricycles and *calesas* are used in short distant routes. The sub-province of Aurora is served by Victory Lines and MBC Companies.

Because of the presence of bays and sheltered harbors, the province is afforded with 6 ports. These ports are as follows: Hondagua, Atimonan, Siain, Lucena City, Port Real and Gumaca. Other small ports serve its domestic trade. However, the shallowness of the water in some of these ports force foreign vessels to anchor a considerable distance from the pier which necessitates the use of lighter craft to carry the copra produced in the province to the ship for loading. Every month 3 to 4 foreign vessels call at Siain (now Plaridel) to load copra. Some of the ports of the province have open harbors so that operations are hampered during stormy weather.

Big motor launches ply the routes from the ports of Real, Gumaca, Atimonan, Mauban and Calauag to the islands of Polillo and Alabat.

The Commercial Centers of Quezon Province are Lucena City, Catanauan, Gumaca, Lopez, Calauag, Infanta and Baler. Most of the products sent to Manila are shipped through the railroad and motor vessels.

Water Supply.—Waterwork systems at various points in the province serve 31 municipalities and barrios with potable water. They serve approximately 535,000 inhabitants or 81% of the total population. In addition, as of 1959–1960, artesian wells of NWSA serve approximately 14,850 persons in certain areas; and 74 completed spring development projects serve a total population of 26,000. These additional sources serve approximately 6.5% of the population of the province which bring the total percentage to about 88 per cent. Although Quezon Province is one of the best situated provinces in this respect, Lucena City and some other areas suffer shortage of water due to low water pressure.

Communication.—Government-owned postal and telegraph services serve the communication needs of the province. Private telegraph like RCPI and Telefast also operate in Lucena

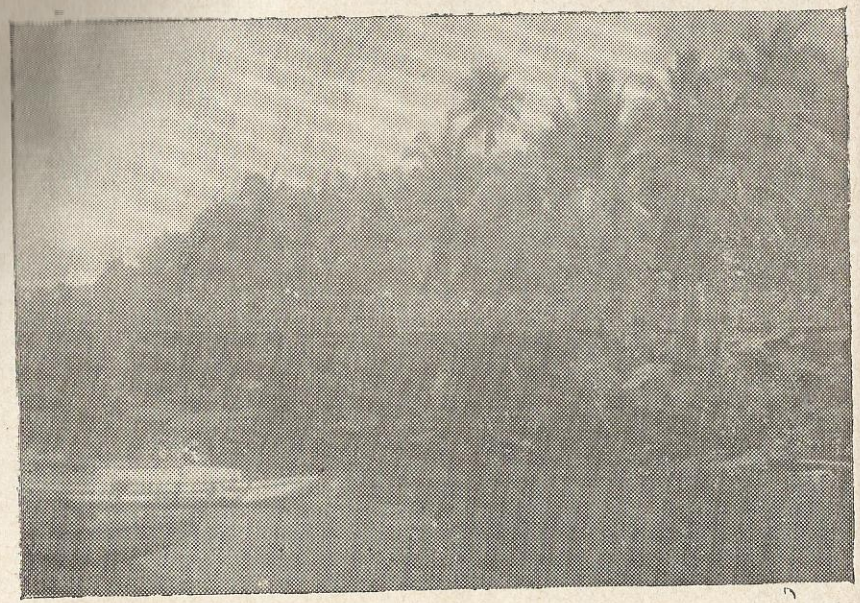


Fig. 6.—This suspended foot-bridge in Atimonan, Quezon facilitates communication and trade between two barrios separated by a wide river.

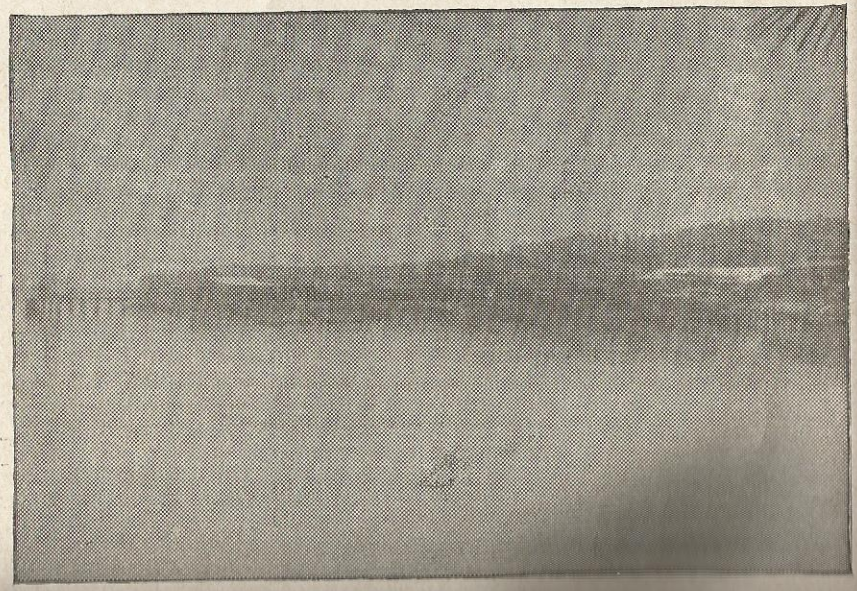


Fig. 7.—The port of Atimonan, Quezon is one of the busiest ports in the province.

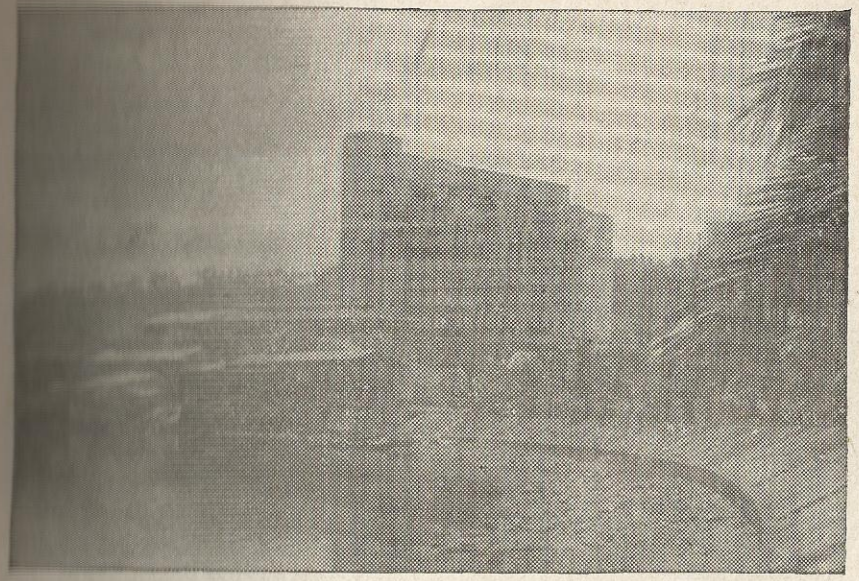


Fig. 8.—The Hondagua Port at Lopez, Quezon. At the background is the Philippine Flour Mills.

City. The Philippine Long Distance Telephone Company maintains telephone service within Lucena City and Baler with connections to Manila. A domestic telecommunication system operates in Lucena City which connects all important cities in the Philippines and overseas connection through the facilities of the American Cable and Radio System. One radio broadcasting station is operated in Lucena City. Because of the proximity of Quezon Province to Manila, broadcasting from the numerous radio and TV stations in Manila can be tuned and heard in the province. Television set can be found in most homes in Lucena City and towns nearer Manila.

Industries.—Farming is the principal industry of the people in the province. Logging, fishing and mining are the other important industries in the province. There are a number of logging companies and sawmills in the province. The bigger outfits are located in Llabac, Infanta, Baler and Dingalan; and the smaller outfits are found in Mauban, Sampaloc, Tagkawayan, Calauag, Polillo and General Nakar. The Facts and Figures about the Republic of the Philippines of 1963 has recorded the following vital information:

A. Timber concessions, 1963

Number	78
Area in hectares	414,365
No. of sawmills	13

B. Productions

Timber (cu. m.)	39,633,054
Lumber (bd. ft.)	45,797,316
Plywood (sq. ft.)	97,378,062
Veneer (sq. ft.)	42,751,104

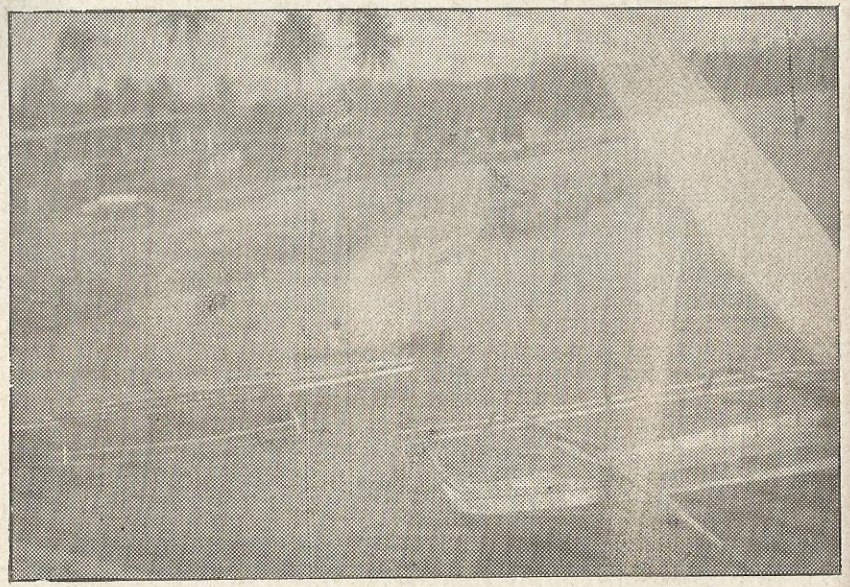


Fig. 9.—A fishing village at Polillo Island.

The fishing industry provides the people of the province with principal as well as supplementary source of income. At Lucena City alone in 1959, the quantity of fish caught by commercial fishing vessels totalled 990,780 kilograms. This figure excluded those caught by small operators and offshore fishermen. The excellent fishing grounds in the province are Lamon Bay, Tayabas Bay and Ragay Gulf. In 1959, the Fisheries Commission has reported the quantity of fish caught in these places as follows: (a) Lamon Bay—811,550 kilograms, (b) Tayabas Bay—2,687,120 kilograms, and (c) Ragay Gulf —1,385,380 kilograms of fish.

Bangus raising in fishponds is popular in the province. The fishponds which range from 19 to 125 hectares of land leased from the government are distributed in 18 towns. Some 16,189

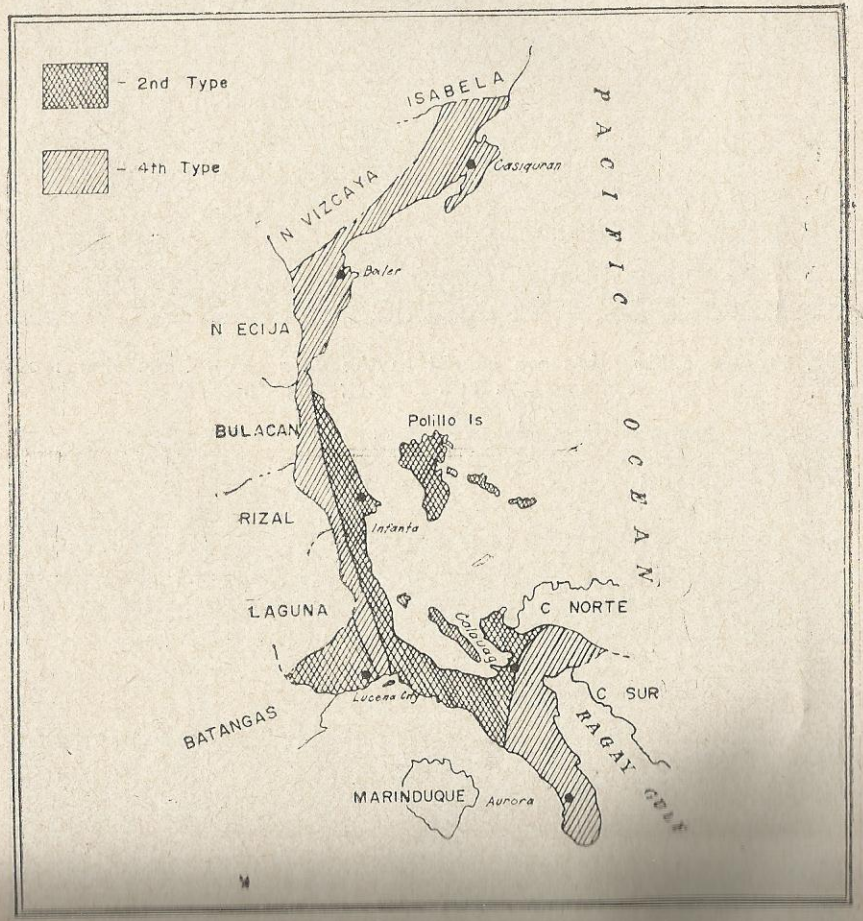
hectares of mangrove swamps are still available for conversion into fishponds in the province.

Other marine products such as shark fins, sponges, trepangs, sea weeds and shells provide minor sources of income for inhabitants.

Fig. 10.—These big fishes are caught in the deep sea off the shores of Patnanongan and Jomalig Islands.

In the mining industry, the Guanzon Lime Development Co., Inc. in Tayabas is processing rock lime—the great bulk of which are used for construction materials and the other by-products for agricultural and industrial needs. Oil exploration is going on now in the Bondoc Peninsula, but no conclusive finding has been reported. Polillo Island has 1,145 metric tons of recoverable coal resources and 2,295 metric tons additional reserve.

Deposits of high grade silica sand, the raw material for the manufacture of lenses and other plain products, are located in Balisin Island. In Tagkawayan, quartz is being mined and sent to Iligan City for the manufacture of wares.



Other minor industry of the inhabitants of the province are mat and hat weaving, charcoal making and making nipa thatches for roofing. Additional incomes are derived from these industries at home.

CLIMATE

Climate in the Philippines is classified into four types depending upon the characteristics of rainfall received in the particular place during the different months of the year. Based on this classification, two distinct types of climate occur in the province which are as follows:

Second type.—The second type of climate is characterized by no dry season with pronounced maximum rain period. The places that are within this type of climate are the southeastern portions of the mountain ranges. It is represented by weather data from Infanta, Calauag and Lucena City, as shown in Table 1. Infanta has a record for 28 years; Calauag for 11 years; and Lucena City for 33 years. The maximum rain period occurs from October to January.

Fourth type.—The fourth type of climate in the Philippines is characterized by a more or less even distribution of rainfall throughout the year. The regions affected by this type are the northern and southern portions of the province. It is represented by weather data from Baler, Casiguran, and Aurora, as shown in Table 1. Baler has 50 years record; Casiguran, 14 years; and Aurora, 12 years.

It will be noted on the climatic map of Quezon Province that the dividing line of these two types of climate runs north to south. This is due to the fact that most of the mountain ranges in the province runs north to south.

Climate largely determines the nature of the vegetation, the characteristics of the soils, the kind of crops to be grown in the particular place, and the type of farming practices to be employed in a region. It is, therefore, of primary importance to agriculture. Risk in farming could be minimized if our farmers would consider the weather forecast for a certain place over a certain period as guide in their farm operations.

Precipitation is the most important factor in determining the plant and/or crop distribution within localities of almost similar or equal temperature conditions. Although the soils

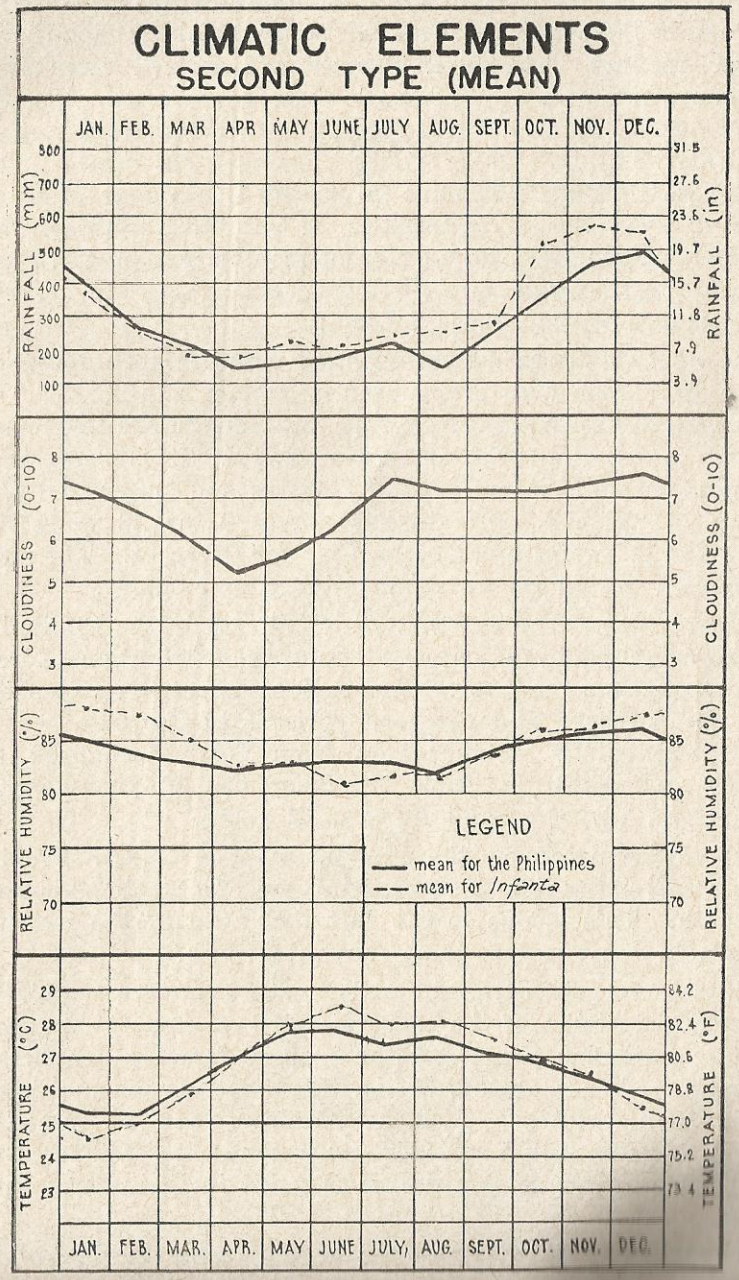


Fig. 13.—Graph of the second type of climate of the Philippines and of Infanta, Quezon.

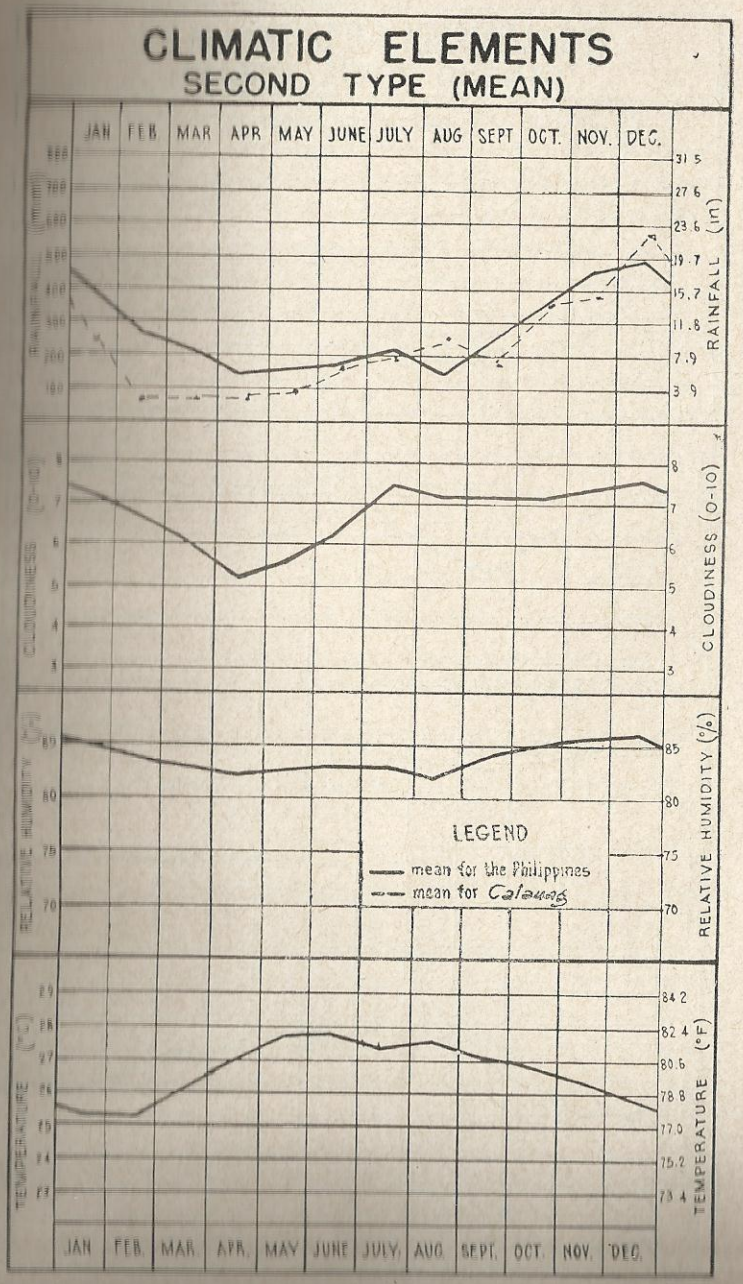


Fig. 14.—Graph of the second type of climate of the Philippines and of Calauag, Quezon.

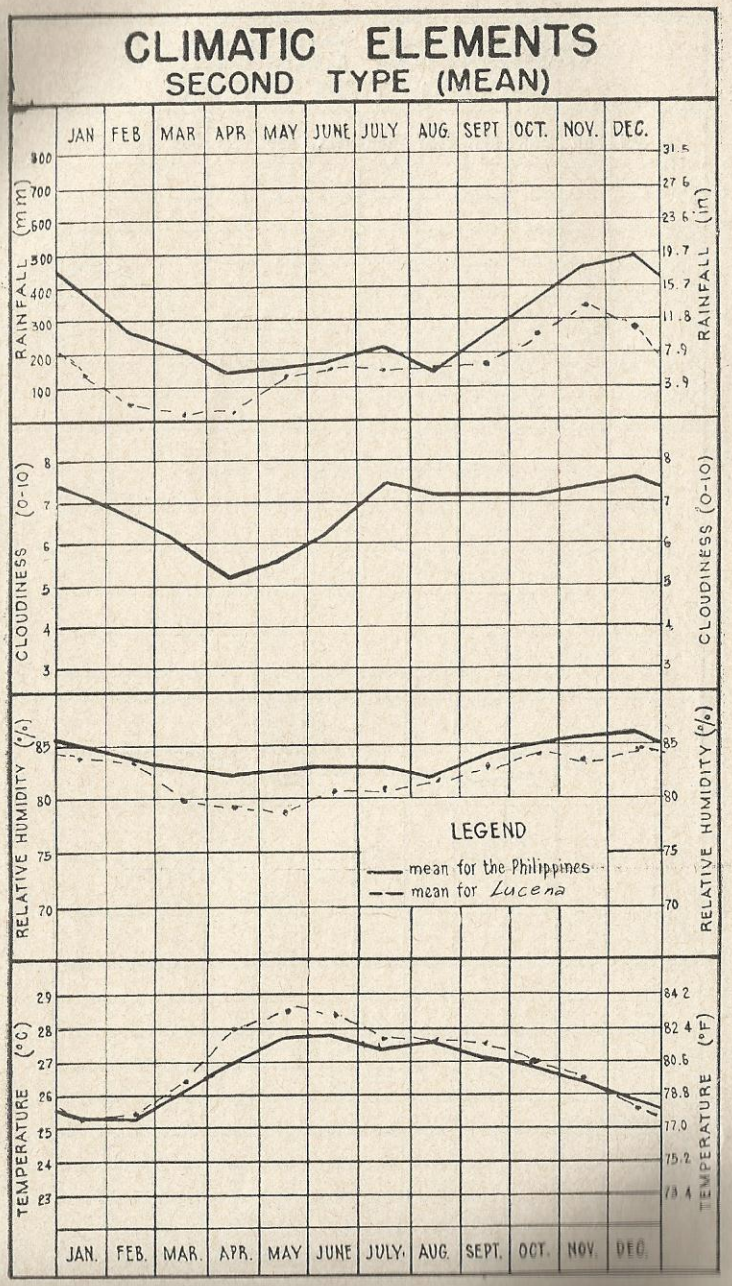


Fig. 15—Graph of the second type of climate of the Philippines and of Lucena City.

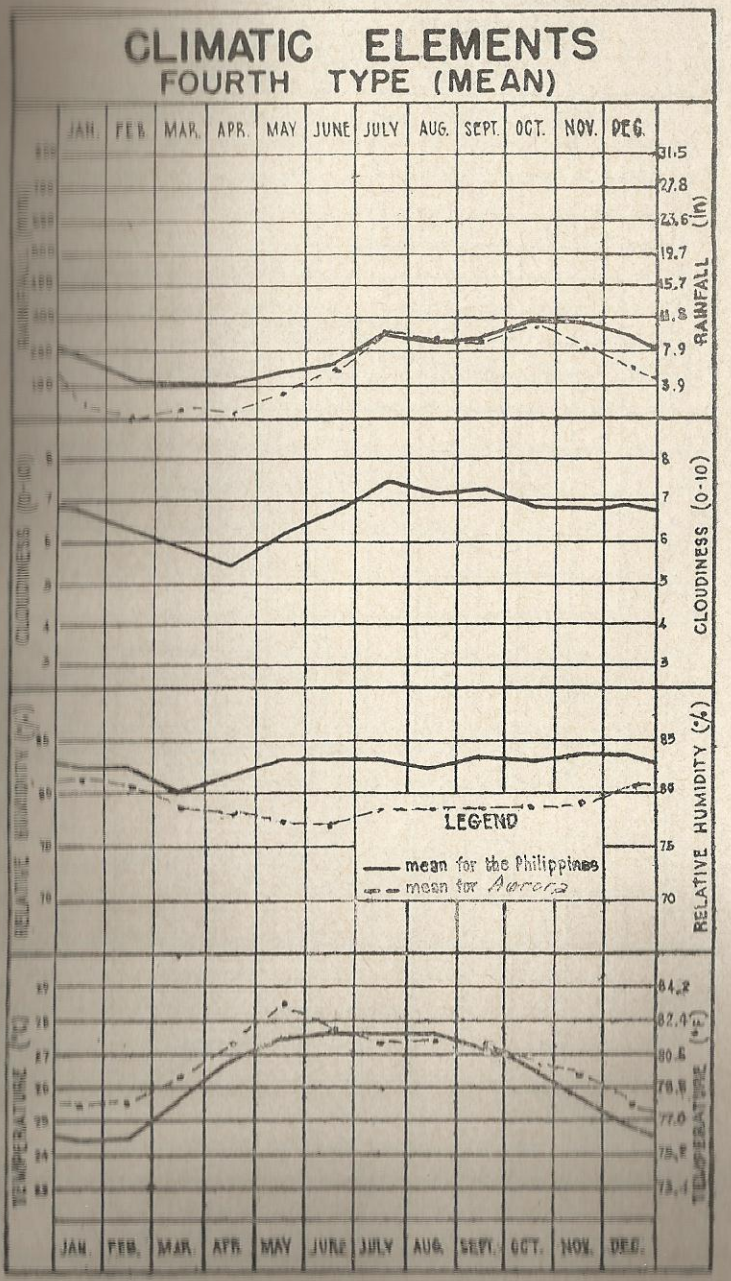


Fig. 16.—Graph of the fourth type of climate of the Philippines and of Aurora, Quezon.

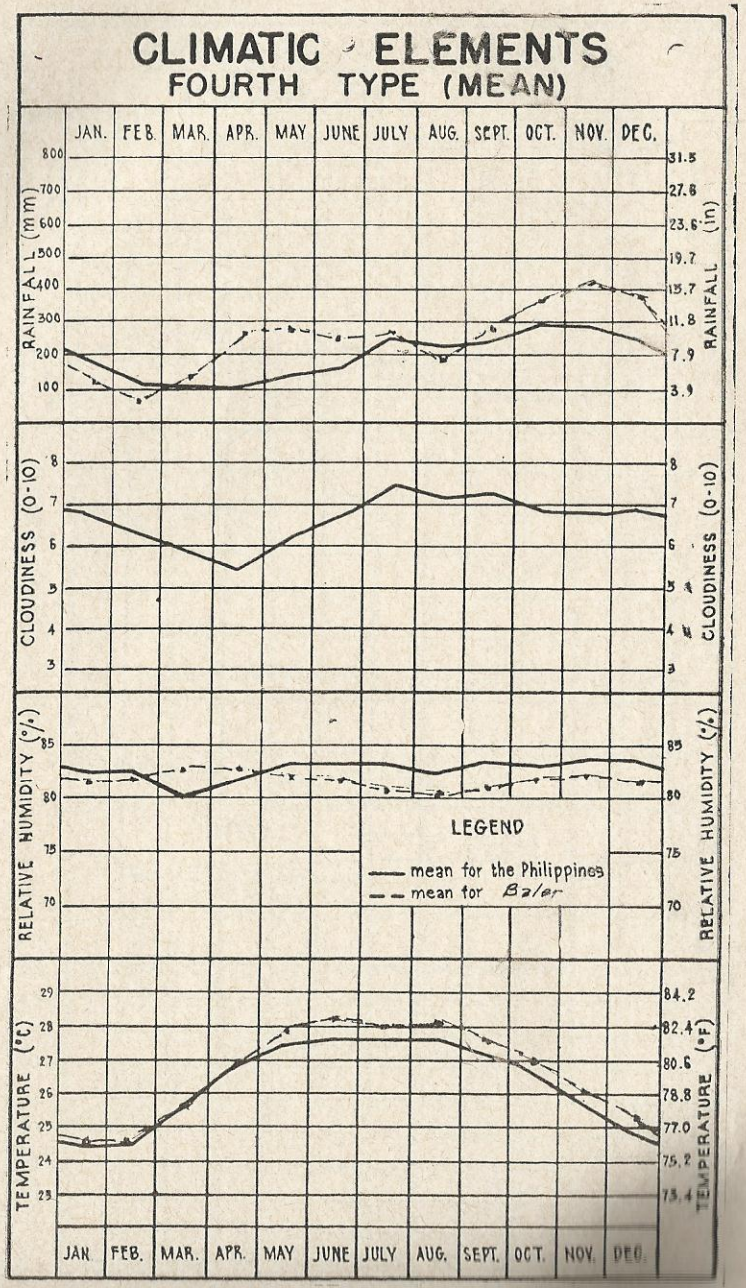


Fig. 17.—Graph of the fourth type of climate of the Philippines and of Baler, Aurora Subprovince, Quezon.

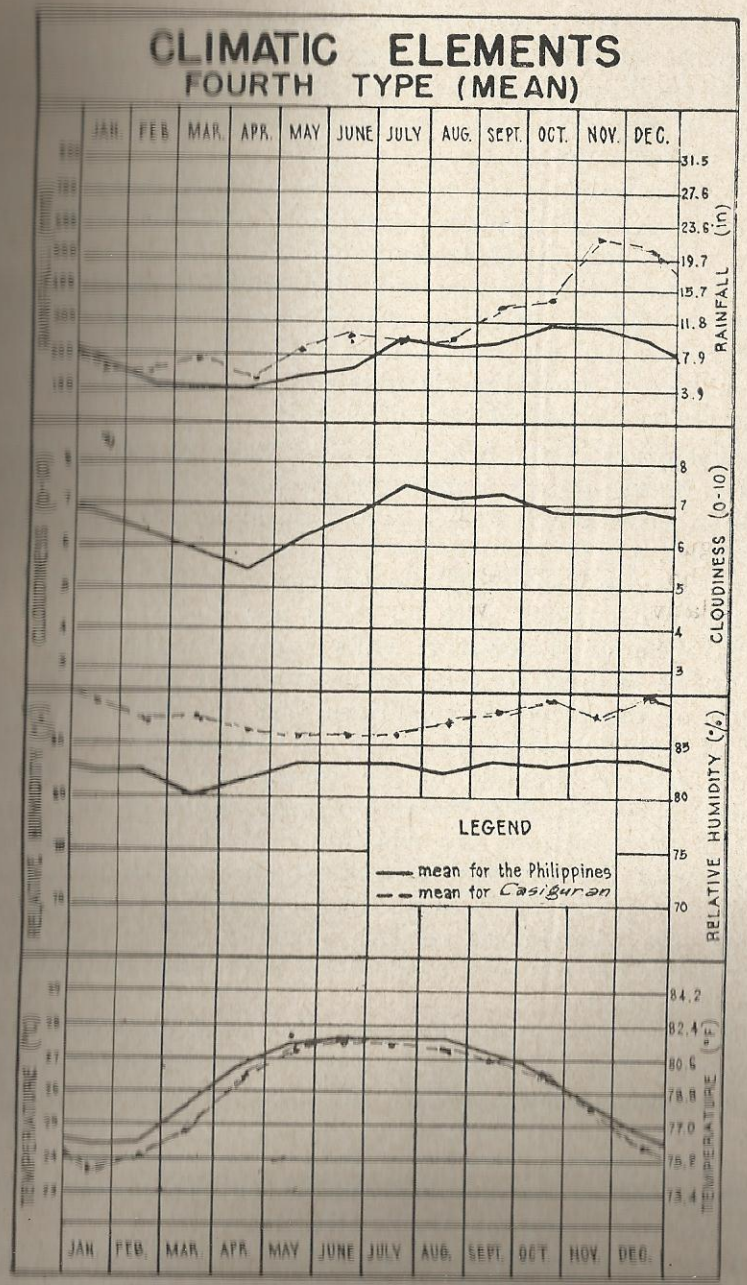


Fig. 18.—Graph of the fourth type of climate of the Philippines and of Casiguran, Aurora Subprovince, Quezon.

and their inherent fertility are important factors in determining the adaptability of agricultural crops in a locality, the climate obtaining in a place and the resultant water supply should be considered first in the determination of the suitability of the crops.

Since the province has two types of climate, there are corresponding variation in the agricultural potential of the province. The amount of precipitation and temperature in the two regions of the province have distinct effects on the growth of crops planted. In areas where rainfall is evenly distributed throughout the year, a wide variety of crops are grown and a higher production is obtained as compared to those areas under the second type of climate.

Temperature in the province ranges from 23.7°C to 28.7°C. This is more or less a mild temperature. The cool months occur in December to February and warm periods are in April to August.

As shown in Table 2, Casiguran has more or less the highest relative humidity with 86 to 90 per cent range, and an annual mean of 87 per cent; while Aurora has the lowest with a range of 74 to 82 per cent and an annual of 78 per cent.

One of the principal conditions that determine the quantity of water removed from the soil surface by evaporation is the relative humidity of the atmosphere. Fluctuations in relative humidity affect the rate of evaporation in such a way that if other factors, like moisture content of soil and temperature of the air, are momentarily held constant a lower relative humidity tends to enhance evaporation; while in extreme case wherein the relative humidity of the atmosphere approaches 100 per cent, evaporation may cease and condensation is induced.

There are several distinct prevailing wind directions in the province. The northeast monsoon sets in November to May. This monsoon blows between north and northeast with tendency to go easterly direction at the end of the season. It has a normal average velocity of 4 to 7 miles per hour. This monsoon brings the heaviest rainfall on the eastern side of the province facing the Pacific Ocean.

After the northeast monsoon, comes the southwest monsoon which blows during the months of June to September reaching a mean average velocity of 5 to 7 miles per hour. This southwest monsoon brings also torrential rains, but not evenly

TABLE 1.—*Monthly average and annual rainfall, and number of rainy days in Quezon Province*[1]

Month	Second Type of Climate						Fourth Type of Climate					
	Infanta (28 yrs.)		Calauag (11 yrs.)		Lucena (33 yrs.)		Aurora (12 yrs.)		Baler (50 yrs.)		Casiguran (14 yrs.)	
	Rainfall (Inches)	No. of Rainy Days	Rainfall (Inches)	No. of Rainy Days	Rainfall (Inches)	No. of Rainy Days	Rainfall (Inches)	No. of Rainy Days	Rainfall (Inches)	No. of Rainy Days	Rainf.ll (Inches)	No. of Rainy Days
January	15.91	25	8.42	20	4.45	17	2.29	12	7.95	15	9.08	18
February	10.35	20	3.44	11	2.18	9	0.83	6	6.96	14	8.84	16
March	7.48	18	3.51	11	1.97	9	1.75	8	8.70	16	10.57	17
April	7.88	17	3.35	7	2.24	6	1.20	5	11.22	18	6.54	15
May	8.37	19	3.86	9	4.22	10	3.72	9	11.29	18	7.93	18
June	8.19	18	6.57	15	6.65	14	6.05	13	9.10	16	10.15	16
July	9.02	19	7.89	15	6.33	16	9.52	19	10.16	17	8.49	16
August	9.15	18	9.85	11	7.17	15	8.37	17	7.83	15	9.63	18
September	11.06	19	7.09	16	7.28	16	8.36	18	11.36	17	12.73	19
October	19.17	24	13.70	20	10.50	19	10.30	19	14.77	18	14.85	19
November	21.88	25	14.85	18	12.24	19	7.95	15	15.89	16	22.81	18
December	20.44	27	22.55	18	10.10	20	6.57	14	14.90	17	20.82	21
Annual	149.50	249	105.08	171	75.33	170	66.91	155	130.13	197	142.44	211

[1] "Weather Bureau, "Monthly Average Rainfall and Rainy Days in the Philippines." (Manila : Weather Bureau, 1962) (Mimeographed).

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TABLE 2.—*Monthly average temperature (°C)[1] and mean relative humidity (%)[2] in the different synoptic stations, Quezon Province.*

Station	Infanta		Lucena City		Aurora		Baler		Casiguran	
Years of record	24 years	14 years	24 years	14 years	12 years	12 years	26 years	24 years	12 years	14 years
Month	Degree Centigrade	Per Cent	Degree Centigeade	Per Cent	Degree Centigrade	Per Cent	Degree Centigrade	Per Cent	Degree Centigrade	Per Cent
January	24.6	88	25.3	84	25.4	82	24.5	83	23.7	88
February	25.0	87	25.8	84	25.7	81	46.7	83	24.0	87
March	25.9	85	26.7	80	26.3	78	25.6	84	24.9	87
April	27.1	83	28.0	79	27.3	76	26.9	84	26.4	86
May	27.9	83	28.7	78	27.9	74	27.9	83	27.2	86
June	28.4	81	28.3	81	27.8	74	28.2	82	27.6	86
July	28.0	82	27.8	81	27.3	77	29.0	81	27.4	86
August	28.0	82	27.7	82	27.3	77	28.1	80	27.2	87
September	27.6	83	27.6	83	27.1	77	27.7	82	27.0	88
October	26.9	86	27.0	84	26.8	77	27.0	83	26.5	88
November	26.3	86	26.5	83	26.5	79	26.1	84	25.5	87
December	25.3	87	25.5	84	25.7	81	25.2	83	24.3	90
Annual mean	26.8	84	27.1	82	26.8	78	26.7	83	26.0	87

[1] Weather Bureau, "Monthly Average Temperature in the Philippines". (Manila: Weather Bureau, 1962) (Mimeographed).
[2] Weather Bureau, *Annual Climatological Review for 1961*. (Manila: Weather Bureau, n.d.).

distributed. The east northeast monsoon blows in Baler area from January to May and November with tendency to go east at the end of the season. The rest of the months have the westerly winds. In the other areas there are also the southerly and westerly winds. The southerly wind blows from May to September and followed by north wind. This is true to the northern-most portion of Quezon.

When the northeast and southeast winds blow, the sea becomes very rough which makes navigation difficult. The west and southwest winds affect the western side of the province; while the northeast and east northeast winds affect the east side of the province.

Quezon is frequently visited by typhoons because of its geographical location.

AGRICULTURE

Agriculture is the principal source of livelihood of the people of Quezon. Long before the arrival of the missionaries in the Philippines, the natives were already cultivating soils along the river banks and coastal areas. People from other provinces migrated to the province of Quezon and opened new lands for agricultural purposes. Diversified farming is being practiced.

CROPS

According to the 1960 Census of Agriculture, the leading economic crops of Quezon Province are as follows:

Crop	*Area-ha.*	*Production*	*Value (Pesos)*
Coconut	141,714.5	648,239,159 nuts	47,773,448.00
	(Tuba)	1,488,970 liters	336,934.00
Palay	60,633.9	1,346,649 cav.	11,970,154.00
Banana	6,861.5	24,036,830 kgms.	1,953,738.00
Corn	4,686.7	52,957 cav.	408,720.00
Camote	1,282.2	2,925,430 kgms.	321,426.00
Coffee, Arabica	412.9	63,950 kgms.	274,604.00
Other var.	755.4	117,866 kgms.	
Pineapple	369.0	1,239,669 kgms.	264,073.00
Cassava	1,032.2	3,057,761 kgms.	208,986.00
Eggplant	300.8	640,691 kgms.	156,651.00
Mongo	423.5	195,809 kgms.	119,076.00
Mango	401.6	402,913 kgms.	117,803.00
Mandarin	401.8	243,712 kgms.	76,518.00
Sugar cane	156.2	3,048 m. t.	51,221.00
Orange	178.1	116,876 kgms.	30,468.00
Avocado	162.8	218,519 kgms.	28,542.00

Coconut.—The number one principal crop of Quezon Province is coconut. In 1960, about 141,714 hectares are planted to this crop which gave a total production of 648,239,159 nuts valued at ₱47,773,448.00. Aside from these nuts a total of 1,488,970 liters of *tuba,* a native liquor, gave an added income of ₱336,934.00.

Palay.—Palay is the next leading crop of the province. This crop was planted to about 60,633 hectares in 1960 which gave a total production of 1,346,649 cavans of 44 kilos each with a total value of ₱11,970,154.00.

The different rice varieties planted were Elon-elon, Ramay, *Inadhika,* Macan, *Binamban,* Intan, Peta, FB–76, Sipot, *Sinaging,* Mangasa, *Pinursigue,* and others.

Banana.—Banana ranks third among the leading economic crops in the province in terms of value of produce in 1960.

Corn.—Corn is another staple crop grown in the province. It ranks fourth among the economic crops grown. In 1960, the total area devoted to this crop was 4,686.7 hectares with a total production of 52,957 cavans of 57 kilos each valued at ₱408,720.00.

Legumes and other root crops.—Among the miscellaneous crops grown in the province the following legumes and root crops gave the highest income for the province in 1960:

Crop	*Area-ha.*	*Production*	*Value (Pesos)*
Peanut, unshelled	271.3	169,505	69,497.00
Gabi	273.3	466,725	60,674,00
Ubi	20.8	83,855	20,964.00
Cowpeas	51.1	45,456	10,909.00

Trees and other cultivated fruits.—Aside from the cultivated fruits/fruit trees listed under the economic crops of Quezon Province the following also gave sizeable incomes for the province in 1960:

Trees and other cultivated fruits	*Area-ha.*	*Production*	*Value (Pesos)*
Bamboo	172.1	301,052 poles	213,747.00
Papaya	152.9	1,633,687 Kgms.	163,369.00
Jackfruit	167.9	851,920 Kgms.	119,269.00
Cacao	143.5	15,310 Kgms.	58,178.00
Lanzones	81.1	48,784. Kgms.	30,246.00
Pili nut	126.3	65,530 Kgms.	29,489.00
Santol	39.0	127,814 Kgms.	14,060.00

Fig. 19.—Coconuts grown on Bugko sand along the coast of Bo. Mijares, Dipaculao, Aurora Subprovince, Quezon. In the foreground are fishing nets being sun-dried.

Fig. 20.—The "Tapahan" method of copra making is very common in the province.

AGRICULTURAL PRACTICES

Agricultural practices in Quezon Province are similar to those in the other provinces of the country. The use of the native plow and harrow as the main implements and the carabaos and cows as the source of power, is still practiced. However, there are few farmers who are now using farm machinery in the cultivation of the land, especially in the lowland areas.

The application of fertilizer is not yet a common practice among the farmers. It is worthy to note, however, that there is a growing interest among the farmers in the use of fertilizers now. Such interest should be properly guided and the farmers should be convinced that this practice if properly implemented will greatly help them increase their crop yields. Some innovations that are now being noticed among the farmers are the use of improved and better seeds and clean culture cropping, especially in the towns of Tiaong, Candelaria, Sariaya, Lucena City, Pagbilao, Tayabas, Infanta, Gumaca, Lopez and Baler.

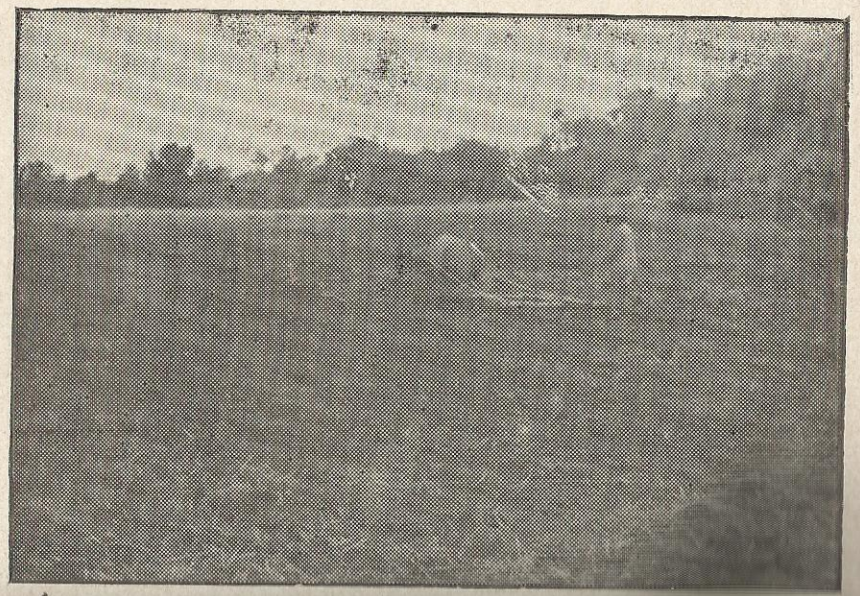

Fig. 21.—Animal-drawn implements with the carabao as the main source of power are commonly used in the land preparation in the province.

Cultivation up-and-down the slopes is being practiced in the rolling areas which promotes soil erosion in those areas. A program of soil and water conservation, therefore, is needed to safeguard these fertile arable lands from further destruction.

Crop rotation is practiced in limited extent. Majority of the farmers plant different kinds of crops without observing a system of crop rotation. Legumes are planted in most areas not as green manure crops but as source of food. Green manuring and cover cropping are practiced in the government projects in Tiaong and Pagbilao. Strip cropping and employment of contour paddies are being done in the lowland rice fields at the base of Mt. Banahaw. On the other hand, *kaingin* system of farming is still rampant in the rolling portions of the province. If this kind of farming will continue, vast areas of agricultural lands will be wasted. *Kaingin* system of farming, therefore, must be stopped by all means.

LIVESTOCK AND POULTRY INDUSTRY

Livestock and poultry raising can be another source of income of the farmers in addition to their income from the regular field crops. They would have a steady supply of milk, eggs, and meat, and other products for the kitchen, aside for the farm manures that can fertilize their fields. From the sale of livestock and poultry products, additional income can be obtained.

The carabaos raised in the province are mostly utilized for farm operations. The cattles are oftentimes used in the farms, but in most cases they are raised for meat and milk. The horses are raised for special purposes, such as for pulling vehicles called *calesa* and *tartanilla* to transport passengers, for racing and for transporting farm products in remote areas where motor vehicles cannot be used.

Poultry which include ducks, geese, turkeys, and few pigeons, are raised for meat and eggs.

Relatively, the small extent of grazing lands in the province limits the raising of cattle in commercial scale. The foreign breeds used as foundation stocks for improving the native breeds were slaughtered by the owners and the enemies alike during World War II. This has set back the industry. After the war, both public and private entities took steps to rehabilitate the livestock industry. The government through the

Bureau of Animal Industry instituted the "Operation Dispersal" by distributing breeding animals to different parts of the country, especially to the rural areas. In this program, the breeding of the native carabaos or cattle or swine with the foreign breeds, are done. The foreign breeds being used are the Holstein, Nellore, Red Scini for cattle; and Duroc-Jersey, Poland China, Berkshire and Landrace for hogs. New Hampshire, Rhode Island Red, White Leghorn and other foreign breeds of chicken are used for crossbreeding the natives for improving the stock.

The number and value of livestock and poultry raised in the province according to the 1960 census figures are as follows:

Livestock and Poultry	*Number*	*Value*
Carabaos	77,394	₱16,508,397
Hogs	115,486	5,527,325
Cattle	24,281	4,894,406
Horses	13,318	2,283,543
Goats	10,993	129,753
Sheeps	160	2,680
Chickens	908,294	1,464,377
Ducks	11,928	20,348
Turkeys	1,144	15,194
Pigeons	4,276	5,077
Geese	1,404	4,459

FARM TENURE

Farm tenure refers to the manner in which a farm is held by its operators. During the 1960 census year the Bureau of the Census and Statistics has classified farm operators in Quezon into five categories; namely, (1) full-owners, (2) part-owners, (3) tenants, (4) farm managers; and (5) other farm operators under other conditions. Tenants are further classified into: (a) cash tenants, (b) fixed-amount-of-produce tenants, (c) share-of-produce tenants, (d) cash-and-fixed-amount-of-produce tenants, (e) cash and share-of-produce tenants, and (f) rent-free tenants.

The total number of farms and the total area of the farms by tenure of farm operator in Quezon Province according to census figures of 1960 are as follows:

Tenure of Farm Operator	*Total No. of Farms*	*Total Area of Farms-Ha.*
Full owners	22,798	129,704.4
Part owners	6,599	35,262.8
Tenant:		

Tenure of Farm Operator	*Total No. of Farms*	*Total Area of Farms-Ha.*
Cash tenant	1,364	5,156.7
Fixed-amount-of-produce tenant	1,106	5,271.4
Share-of-produce tenant	22,760	75,489.7
Cash-and-fixed-amount-of-produce tenant	24	133.7
Cash and share-of-produce tenant	1,146	4,760.7
Rent-free tenant	696	2,117.1
Other tenants	1,209	4,781.7
Manager	61	2,988.0
Other farm operators	400	1,763.3
Total	58,158	267,429.0

TYPES OF FARM

The Bureau of the Census and Statistics during the 1960 census year, classified farms into 14 types; 10 of which are grouped as crop farms. The 10 crop farms classified based on the first 10 major crops in the country, are as follows: (1) palay farm, (2) corn farm, (3) sugar cane farm, (4) abaca farm, (5) tobacco farm, (6) vegetable farm, (7) root crop farm, (8) coconut farm, (9) fruit farm and (10) coffee farm. The relationship between the physical area planted to a particular crop, on one hand, and the cultivated land in the farm, on the other, is taken into primary consideration. A crop farm is typed according to the particular crop which occupies 50 per cent or more of the cultivated part of the farm.

The four other types of farms are: (11) hog farms with 20 or more hogs regardless of area; (12) livestock farms which satisfy any of these conditions, namely, (a) the area is 10 hectares or more with at least 10 heads of any specific kind of livestock and the cultivated area is less than 20 per cent of the total area of the farm, or (b) the area is less than 10 hectares provided there are more than 20 heads of any specific kind of livestock (except hogs) and the cultivated area is less than 20 per cent of the total area of the farm; (13) poultry farms which do not qualify as crop farms but satisfy any of these conditions, namely, (a) there are more than 300 chickens regardless of area, (b) there are more than 100 laying chickens regardless of area, or (c) there are more than 200 other specific kinds of poultry other than chickens; and (14) other farms—those that could not be classified under any of the aforementioned thirteen types of farms, grouped as follows: (a) farms planted to palay, corn, coconut, abaca, tobacco, and/or sugar cane without any of them occupying 50 per cent

or more of the cultivated land, or (b) farms planted to other miscellaneous crops such as cotton, kapok, ramie, bamboo, etc., even if one of them occupied 50 per cent or more of the cultivated land.

The total number of farms and the total area of these farms by type of farm in Quezon Province, according to census figures of 1960, are as follows:

Types of farm	*Total Number of farms*	*Total Area of farms-ha.*
Palay	15,862	51,002.6
Corn	161	521.1
Sugar	6	54.0
Abaca	—	—
Tobacco	4	66.0
Vegetable	105	156.0
Root crops	96	364.9
Coconut	40,009	201,369.4
Fruit	504	1,716.1
Coffee	61	471.5
Hog	17	70.3
Livestock	32	4,118.4
Poultry	84	100.7
Others	1,217	7,418.0
Total	58,158	267,429.0

The total number of farms and the total area of these farms by size of farm in Quezon Province according to census figures of 1960 are as follows:

Size of farms (ha.)	*Total Number of farms*	*Total Area of Farms-Ha.*
Under 0.2	112	11.2
0.2 and under 0.5	336	104.4
0.5 and under 1.0	1,729	1,055.3
1.0 and under 2.0	11,915	14,910.1
2.0 and under 3.0	11,005	24,100.6
3.0 and under 4.0	7,787	24,651.5
4.0 and under 5.0	5,788	23,960.3
5.0 and under 10.0	14,068	91,885.5
10.0 and under 15.0	3,900	43,952.1
15.0 and under 20.0	727	11,987.9
20.0 and under 25.0	411	9,135.4
25.0 and under 50.0	281	9,052.6
50.0 and under 100.0	60	3,746.2
100.0 and under 200.0	26	3,055.3
200.0 and over	13	5,820.6
Total	58,158	267,429.0

SOIL SURVEY METHODS AND DEFINITIONS

Soil surveying consists of (1) the determination of the morphological characteristics of soils; (2) the grouping and classification of soils into units according to their characteristics; (3) their delineation on maps; and (4) the description of their characteristics in relation to agriculture and other activities of man.

Soils, their landscapes and underlying formation, are examined in as many sites as possible. Borings with the soil auger are made, test pits are dug, and exposures such as road and railroad cuts are studied. An excavation or road cut exposes a series of layers collectively called the soil profile. The horizons of the profile, as well as the parent material beneath, are studied in detail and the color, structure, porosity, consistency; texture, and the presence of organic matter, roots, gravels, and stones are noted. The reaction of the soil and its content of lime and salts are determined either in the field or in the laboratory. The drainage, external and internal, and other features such as the relief of the land, climate, natural and artificial features are taken into consideration, and the relationship of the soil and the vegetation and other environmental features are studied.

On the bases of both the external and internal characteristics, the soils are grouped into classification units, of which the three principal ones are (1) soil series, (2) soil type and (3) soil phase. When two or more of these mapping units are in such intimate or mixed pattern that they cannot be clearly shown on a small-scale map, they are mapped or grouped into a (4) soil complex. Areas of land that have no true soils, such as river beds, coastal beaches, or bare rocky mountain sides are called (5) miscellaneous land types. Areas that are inaccessible like mountains and great forest areas whose classification is of no agricultural importance for the present are classified as (6) undifferentiated soils.

A series is a group of soils that have the same genetic horizons, similar important morphological characteristic and similar parent material. It comprises of soils which have essentially the same general color, structure, consistency, range of relief, natural drainage condition and other important internal and external characteristics. In the establishment of a series, a geographic name is selected, taken usually from the locality where the soil was first identified. For example, the Tagka-

wayan series was first found and classified in the municipality of Tagkawayan, Quezon.

A soil series has one or more soil types, defined according to the texture of the upper part of the soil or the surface soil. The class name such as sand, loamy sand, sandy loam, silty clay loam, clay loam or clay is added to the series name to give the complete name of the soil. For example, Tagkawayan sandy loam, is a soil type within the Tagkawayan series. The soil type, therefore, has the same general characteristics as the soil series except for the texture of the surface soil. The soil type is the principal mapping unit. Because of its certain specific characteristics it is usually the unit to which agronomic data are definitely related.

A phase of a soil type is a variation within the type, differing from the soil type only in some minor features, generally external, that may be of special practical significance. Differences in relief, stoniness and extent or degree of erosion are shown as phases. A minor difference in relief may cause a change in the agricultural operation or change in the kind of machinery to be used. The phase of a type with a slight degree of accelerated erosion may differ in fertilizer requirement and cultural management from the real soil type. A phase of a type due mainly to degree of erosion, degree of slope and amount of gravel and stone in the surface soil is usually segregated on the map if the area can be delineated.

A soil complex is a soil association composed of such intimate mixture of series, types, or phase that cannot be indicated separately on a small-scale map. This is mapped as a unit and is called a soil complex. If, in an area, there are several series such as Alimodian, Annam and Alaminos that are mixed together, the complex must bear the names of the two dominant series, as the case may be. If there is only one dominant constituent, the complex bears the name of that series such as Alimodian or Alaminos complex.

Surface and subsoil samples for chemical and physical analyses are collected from each soil type or phase, the number being determined by the importance and extent of such soil types or phases. Profile samples are also obtained for further morphological studies of important soil types.

The soil survey party, composed of two or three technical men, maps the area and delineates the various soil types, phases, complex and miscellaneous land types. All natural and cultural

features found in the area are indicated on the soil map, such as trails, railroads, bridges, telephone and telegraph lines; barrios, towns, and cities; rivers and lakes; prominent mountains, and many others.

THE SOILS OF QUEZON PROVINCE

The soils of Quezon are developed from various kinds of parent material. The soils of the plains are of alluvial origin, while those of the upland areas, hills and mountains are of igneous rocks, limestone, shale and sandstone and old alluvium.

For convenience, the soils of the province are grouped into three categories, namely; (1) soils of the plains and valleys, (2) soils of the upland, hills and mountains and (3) miscellaneous land types. There are 14 soil types under the first category, 25 soil types under the 2nd category and four land types under the 3rd category. The different soil types and/or land types are given below.

1. *Soils of the Plains and valleys:*

	Soil Mapping Number
1. Baler silty clay loam	921
2. Bay loam	915
3. Bigaa loam	913
4. Bugko sand	1082
5. Buguey loamy sand	572
6. Catanauan clay loam	922
7. Laylay silt loam	907
8. Piris clay loam	923
9. Polillo sandy clay loam	924
10. Quingua silt loam	5
11. Quingua sandy clay loam	910
12. San Manuel sandy loam	96
13. Umingan sandy loam	100
14. Umingan loam	322

2. *Soils of the Uplands, Hills and Mountains:*

1. Alaminos clay	166
2. Alimodian sandy loam	798
3. Annam clay loam	98
4. Annam silt loam	914
5. Antipolo sandy clay	912
6. Bantay clay loam	259
7. Bauang clay loam	647
8. Boac clay	917
9. Bolinao clay loam	108
10. Castilla clay	421
11. Cervantes sandy loam	908

12. Faraon clay 132
13. Guadalupe clay loam 30
14. Guadalupe loam 616
15. Guimbalaon sandy clay 916
16. Ibaan loam 59
17. Ibaan silty clay loam 909
18. Lipa loam 62
19. Luisiana sandy clay loam 911
20. Macolod clay loam 143
21. Rizal clay 963
22. Sariaya sandy loam 925
23. Sevilla clay loam 1114
24. Siain silt loam 926
25. Tagkawayan sandy loam 927

3. *Miscellaneous land types:*

1. Beach sand 118
2. Hydrosol 1
3. Mountain soils, undifferentiated 45
4. Riverwash 152

Soils of the Plains and Valleys

The soils of the plains are formed from the accumulation of water-laid soil materials washed down from the surrounding elevated areas. These soils have varying colors ranging from brown, reddish brown to black with textures of silt loam, loamy sand, sandy loam, clay loam to clay, sandy clay loam and sandy clay. The soils of the plains and valleys constitute the most productive soils of the province. They occupy an aggregate area of about 60,208 hectares or 0.54 per cent of the total land area of the province.

BALER SERIES

Baler series is a new soil series identified in Aurora Sub-province. It occupies the major portion of the level areas of the sub-province, comprising the municipalities of Baler, San Luis, Maria Aurora, Dipaculao and Casiguran.

The soils of this series are of recent alluvial deposits washed down by water from the adjoining uplands. The relief is nearly level. The drainage condition is fair to good. Organic matter content is moderate. Baler series differs slightly from Quingua series in the color of the surface soil. The former has very pale brown surface soil while the latter has brown to yellowish brown surface soil. Baler series is, however, similar to Umingan series in the presence of water-worn gravels and stones

Table 3.—*Area and percentage extent of the different soils in Quezon Province.*[1]

Soil Mapping Unit	Area (hectares)	Per cent
Baler silty clay loam	10,990.5	0.92
Bay loam	1,791.9	0.15
Bigaa loam	3,583.9	0.30
Bugko sand	955.7	0.08
Buguey loamy sand	2,747.6	0.23
Catanauan clay loam	6,450.9	0.54
Caylay silt loam	1,433.6	0.12
Firla clay loam	2,150.3	0.18
Fulillo sandy clay loam	2,867.1	0.24
Quingua silt loam	7,167.7	0.60
Quingua sandy clay loam	2,269.8	0.19
San Manuel sandy loam	2,150.3	0.18
Umingan loam	12,662.9	1.06
Umingan sandy loam	2,986.5	0.25
Alamitos clay	38,108.2	3.19
Alimodian sandy loam	51,726.8	4.33
Annam clay loam	67,495.8	5.65
Annam silt loam	11,946.2	1.00
Antipolo sandy clay	85,534.4	7.16
Bantay clay loam	14,215.9	1.19
Bauang clay loam	32,493.5	2.72
Boac clay	2,150.3	0.18
Bolinao clay loam	37,869.3	3.17
Castilla clay	37,033.1	3.10
Cervantes sandy loam	1,433.6	0.12
Faraon clay	204,159.7	17.09
Guadalupe clay loam	9,915.3	0.83
Guadalupe loam	7,167.7	0.60
Guimbalaon sandy clay	9,676.4	0.81
Ibaan loam	13,260.2	1.11
Ibaan silty clay loam	6,450.9	0.54
Lipa loam	7,765.0	0.65
Luisiana sandy clay loam	40,019.6	3.35
Macolod clay loam	24,131.2	2.02
Rizal clay	4,300.6	0.36
Sariaya sandy loam	5,256.3	0.44
Sevilla clay loam	3,344.9	0.28
Siain silt loam	9,317.9	0.78
Tagkawayan sandy loam	6,211.9	0.52
Beach sand	3,464.4	0.29
Hydrosol	26,162.1	2.19
Mountain soils, undifferentiated	372,361.5	31.17
Riverwash	1,433.6	0.12
TOTAL	1,194,615.0	100.00

[1] Area was determined with the use of the planimeter. It included bodies of water.

below the subsoil. Only Baler silty clay loam is mapped under this soil series.

The typical profile characteristics of Baler series, represented by Baler silty clay loam are as follows:

Horizon	Depth (cm.)	Characteristics
Ap	0–30	Very pale brown (10YR 7/3) when dry and dark grayish brown (10YR 4/2) when moist, silty clay loam; medium granular structure; slightly sticky and plastic when wet and slightly hard when dry; root penetration is easy; boundary to next layer is clear and wavy.
B1	30—70	Dark yellowish brown (10YR 4/4) when moist, silty clay loam; with numerous reddish brown streaks; weak granular structure; slightly plastic when wet

		and hard when dry; boundary to lower layer is clear and wavy.
B2	70—100	Dark brown (7.5YR 4/4) silt loam, with reddish brown streaks; boundary to lower horizon is clear and wavy.
C	100—150	Strong brown (7.5YR 5/8) when moist, silty clay loam; friable when moist, slightly sticky and plastic when wet and slightly hard when dry. Beneath lies a band of water-worn gravels and stones, 50 centimeters thick, underlain by a compact heavy clay.

Baler silty clay loam (921).—This soil type has an aggregate area of about 10,990 hectares or 0.92 per cent of the total area of the province.

The major portion of this soil is grown to rice. Some patches, however, are devoted to coconut, root crops, citrus, banana and vegetables.

A number of rice varieties such as Intan, Peta and BPI–76 are grown on this soil type. The yield of these varieties ranges from 30 to 40 cavans per hectare without the use of fertilizers.

About three-fourths of the ricefields depend on rainfall for the supply of water. Due to the absence of irrigation facilities, the fields are usually fallowed after harvest until the next rainy season. However, some farmer plant corn and root crops in small scale after the palay is harvested.

BAY SERIES

This soil series is first established in Bay, Laguna. It is formed from recent alluvial deposits coming from the adjacent uplands. The relief is nearly level. External and internal drainage are poor. Organic matter content is moderate. Only one soil type is mapped under this series.

The typical profile descriptions of the series as represented by Bay loam are as follows:

Horizon	Depth (cm.)	Characteristics
Ap	0—25	Yellowish brown (10YR 5/6) when dry and olive brown (2.5YR 4/4) when moist, loam; slightly sticky and plastic when wet, hard when dry; boundary to subsoil is smooth and gradual.
B2g	25—60	Dark olive gray (5YR 3/2) to olive green, heavy clay; boundary to lower horizon is smooth and abrupt.
B3g	60—100	Bluish gray (5B 5/1) to grayish green sticky clay.
C	100—150	Coarse sand.

Bay loam (915).—This soil type has an area of about 1,791.9 hectares or 0.15 per cent of the total area of the province. It is mapped in the municipality of Alabat.

The crops grown are lowland rice, coconut, vegetables and citrus. Other crops grown in small scale are corn, cassava, camote and legumes like peanut. The corn yield is about 10 cavans per hectare. The rice varieties grown are *Pinursigue*, Peta, Intan, and others.

BIGAA SERIES

This soil series is first established in Bulacan Province. It is derived from recent alluvium washed down from the elevated areas. The relief is nearly level. The external and internal drainage are poor.

Bigaa loam is the only soil type mapped under this series. The typical profile characteristics of this soil type are as follows:

Horizon	Depth (cm.)	Characteristics
Ap	0—25	Dark yellowish brown (10YR 4/4 to 10YR 3/4) when moist, loam; with red streaks; coarse granular structure, sticky and plastic when wet, manganese concretions present.
Bg	25—120	Dark gray (10YR 4/1) when moist, heavy clay; sticky and plastic when wet; black manganese concretions are common.

Bigaa loam (913).—This soil type has an approximate area of about 3,583.9 hectares or 0.30 per cent of the total land area of the province. It is mapped in the municipalities of Lopez, Calauag, Mauban and Agdangan.

The crops grown are lowland rice, coconut and vegetables. The rice varieties grown are similar to those planted in Quingua and San Manuel soils. The yield of rice ranges from 40 to 50 cavans per hectare per year. No fertilizer is used on this soil.

BUGKO SERIES

This soil series occupies the narrow strip of land situated along the shores of Aurora Sub-province. This soil is an alluvial deposit coming from the adjacent sea and nearby rivers. Drainage condition is good to excessive. Bugko sand is the only soil type mapped under this series. The typical profile characteristics of Bugko sand are described below:

Horizon	Depth (cm.)	Characteristics
Ap	0—40	Dark grayish brown (10YR 4/2) moist, fine sand to sand; loose and structureless; boundary to lower layer is smooth and diffuse.
B	40—120	Grayish brown (10YR 5/2) moist, sand; loose, friable and structureless; boundary to lower layer is smooth and diffuse.
C	120—150	Light yellowish brown (10YR 6/4), sand to coarse sand.

Bugko sand (1082).—This soil type is mapped along the coasts of Dipaculao and Baler. It occupies the smallest area in the province. It covers an area of 955.7 hectares or 0.08 per cent of the total land area of Quezon Province.

The crops grown are coconut, banana, citrus and fruit trees. The yield of the crops is moderately good.

BUGUEY SERIES

This soil series is first established in Cagayan Province. The soils of this series are formed from recent coastal deposits of sandy materials from rivers and oceans. The distinguishing characteristic of this series is the presence of marine shells in the substratum. The relief is nearly level to slightly undulating. The external drainage is good and the internal drainage is excessive. Organic matter content is moderate. Only Buguey loamy sand is mapped under this series. The typical profile characteristics of this soil type are given below:

Horizon	Depth (cm.)	Characteristics
Ap	0—20	Grayish brown (10YR 5/2) moist, loamy sand; loose, friable and structureless; boundary to the next layer is clear and smooth.
B	20—120	Brown (10YR 4/3) moist, sand; structureless, with few marine shells in some places.
C	120—150	Characteristic is similar to that of the above horizon. Marine shells are common.

Buguey loamy sand (572).—This soil type has an aggregate area of 2,747.6 hectares or 0.23 per cent of the total land area of Quezon Province. It is mapped along the coasts of Sariaya and Lucena City, and on the eastern coast of Infanta.

The crops grown on this soil type are coconut, banana, root crops, and some vegetables in small scale. The yield of coconut is 3,400 nuts per hectare per year.

CATANAUAN SERIES

This soil series is identified and established in Catanauan, Quezon. It occurs on a valley. It is of recent alluvial deposits. The relief is nearly level. Drainage conditions are poor. Catanauan clay loam is the only soil type mapped under this soil series. The typical profile characteristics of the series as represented by Catanauan clay loam are as follows:

Horizon	Depth (cm.)	Characteristics
Ap	0—30	Dark brown (10YR 3/3) when dry and very dark gray (10YR 3/1) when wet, clay loam; with reddish brown streaks; fine granular structure; sticky and plastic when wet and very hard when dry; boundary to next layer is gradual and wavy.
A1g	30—60	Dark gray (10YR 4/1) clay loam; with yellowish brown streaks; very sticky and plastic when wet and very hard when dry; boundary to the next layer is gradual and wavy.
B2	60—100	Yellowish brown (10YR 5/6) moist, clay loam to clay; with numerous yellowish brown streaks; fine granular structure; slightly friable; boundary to lower layer is gradual and wavy.
B3	100—150	Yellowish brown (10YR 5/7) clay loam to clay; plenty of dark brown streaks; sticky and plastic.

Catanauan clay loam (922).—This soil type is found in the valleys located in the municipalities of Catanauan, Aurora, Mulanay, Calauag, Macalelon, Pitogo, Gen. Luna and Lopez. The aggregate area covered is about 6,450.9 hectares or 0.54 per cent of the total area of the province.

This soil type is used mostly for paddy rice. In Catanauan, the farmers plant local varieties called *Binuhangin* during the palagad season and *Inapostol* and *Senador* in the regular planting season. The yield of the rice ranges from 40 to 50 cavans per hectare. Other rice varieties planted are Peta, Intan and BPI-76. Generally, the yields of these varieties are similar to the local varieties mentioned above.

The ricefields are mostly rainfed so that after harvest they are either fallowed or are planted to other crops like corn and root crops in small scale. Fertilizers are not used by most farmers.

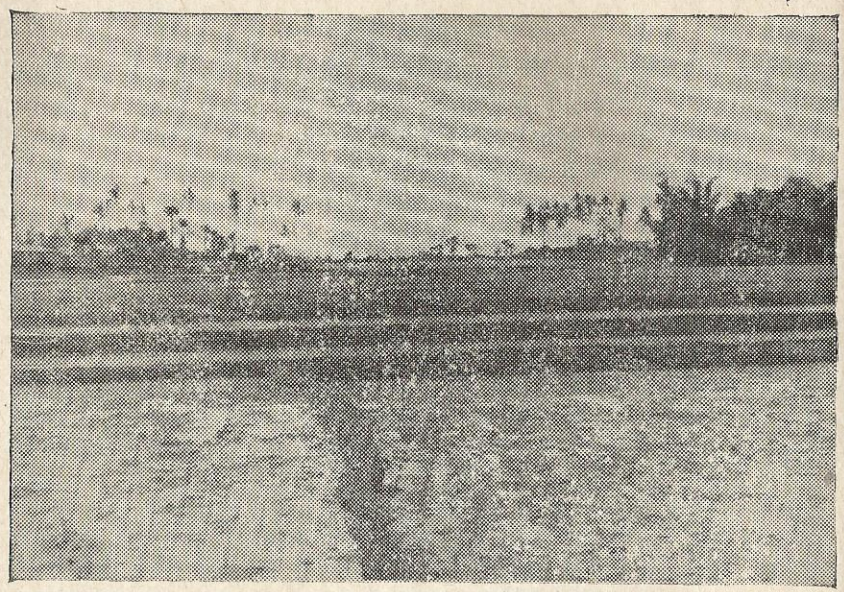

Fig. 22.—Typical landscape of Catanauan clay loam.

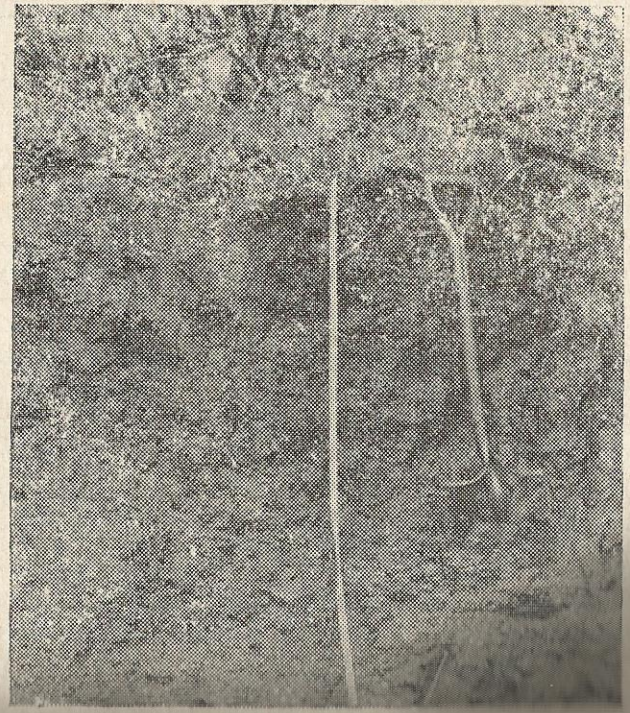

Fig. 23.—Typical profile of Catanauan clay loam.

LAYLAY SERIES

This soil series is first established in Marinduque Province. It is derived from recent coastal deposits. In Quezon Province, this series is found in Aurora Sub-province on a nearly level to slightly undulating relief. Drainage condition is good to excessive.

Laylay silt loam is the only soil type mapped under this series. The typical profile characteristics are given below.

Horizon	Depth (cm.)	Characteristics
Ap	0—30	Pale brown (10YR 6/3) when moist, silt loam; slightly compact; fair root penetration. Boundary to next layer is smooth and abrupt.
B2	30—65	Dark brown (7.5YR 3/2) when moist, sandy loam; with occasional water-worn gravels; structureless; boundary to lower subsoil is smooth and abrupt.
B3	65—100	Grayish brown (10YR 5/2) sandy loam to sand with abundant water-worn stones of varying sizes and shapes. Internal drainage is good to slightly excessive.
C	100—150	Yellowish brown (10YR 5/4) to grayish brown sand; structureless; with abundant water-worn stones and gravels.

Laylay silt loam (907).—This soil type is found in Bo. Mijares, Dipaculao, Aurora Sub-province. It has an area of about 1,433.6 hectares or 0.12 per cent of total area of Quezon Province.

The crops grown are coconut, root crops and citrus. The yield of coconut is 3,000 nuts per hectare.

PIRIS SERIES

Piris series is established in Buenavista, Quezon. It is also found in the municipalities of Guinayangan and Dilasag. Piris series is derived from recent alluvial deposits washed down from the adjacent uplands. The relief is nearly level to slightly undulating. Drainage conditions are fair to good. This soil series is characterized by the presence of particles of limestone materials in the subsoil and substratum.

The typical profile characteristics of this series as represented by Piris clay loam, the only soil type mapped under the series, are given below.

Horizon	Depth (cm.)	Characteristics
Ap	0—35	Very pale brown (10YR 7/3) when dry, light gray (10YR 6/1) when moist, clay loam, platy structure; slightly compact; with few particles of limestone materials; boundary to next layer is clear and smooth.
B2	35—90	Dark gray (10YR 4/1) clay loam when moist; with some reddish brown streaks and mottles; platy structure, slightly compact; with some particles of limestone materials; boundary to next layer is clear and smooth.
C	90—150	Light brownish gray (10YR 6/2) when moist, clay loam to clay, slightly compact; with numerous particles of limestone materials.

Piris clay loam (923).—This soil type is found in the northeastern and southeastern coasts of the province, occupying the plains in the municipalities of Guinayangan, Buenavista and Dilasag. The portion found in Dilasag constitutes the biggest single area covered by this soil type. The aggregate area, however, is about 2,150.3 hectares or about 0.18 per cent of the total area of the province.

This soil type is not yet extensively developed agriculturally. At present, only a portion of the soil is utilized for the growing of paddy rice and coconut, while the rest are still undeveloped open land. The local varieties of rice grown on this soil type are *Binuhangin, Pinursigue* and *Senador*. The yields of these varieties are quite low, ranging from 25 to 30 cavans per hectare.

The organic matter content of this soil type is quite low. The addition of sufficient organic matter and application of fertilizers are, therefore, in order.

POLILLO SERIES

This soil series is newly established in Polillo Island. It occupies the coastal plains in Polillo and Burdeos towns.

This soil series is derived from recent alluvial deposits brought down from the uplands. The relief is nearly level to level. Drainage conditions are good. Organic matter content is fairly good.

Only Polillo sandy clay loam is mapped under this soil series. The typical profile descriptions of Polillo sandy clay loam are given below.

Horizon	Depth (cm.)	Characteristics
Ap	0—35	Light yellowish brown (10YR 6/4) when dry and brown (10YR 5/3) when moist, sandy clay loam; with reddish brown streaks; gritty, slightly sticky and plastic when wet and slightly hard when dry; boundary to next layer is clear and smooth.
B2	35—60	Yellowish brown (10YR 5/4) when moist, silicious sandy loam mixed with particles of white sandy materials; loose and structureless; boundary to lower layer is clear and wavy.
C	60—150	Very pale brown (10YR 7/4) when moist, coarse sand mixed with bigger particles of silicious materials.

Polillo sandy clay loam (924).—This soil type covers an area of about 2,867.1 hectares or about 0.24 per cent of the total area of the province. It is devoted to the growing of paddy rice. The rice varieties grown are Peta, Intan, Raminad, *Pinursigue* and *Inurak*. The rice yield ranges from 25 to 30 cavans per hectare. No fertilizer is being applied. Other crops, like coconut, root crops and banana are also grown on this soil.

QUINGUA SERIES

The soils of Quingua series are secondary soils derived from alluvial deposits washed down from the adjoining uplands. The relief is nearly level to slightly undulating. Drainage conditions are fair to good.

Rice, corn and coconut are the most important crops grown on this soil series. Other crops grown in small scale are cassava, camote, legumes and vegetables.

Two soil types are mapped under this series. The typical profile characteristics of the series as represented by Quingua silt loam are given below.

Horizon	Depth (cm.)	Characteristics
Ap	0—35	Brown (10YR 5/3) to pale brown (10YR 6/3) silt loam; with reddish brown streaks; structureless; friable and loose.
B2	35—110	Brown (10YR 4/3) silty clay loam; loose, friable to slightly compact.
B3	110—150	Dark yellowish brown (10YR 4/4) silt loam to silty clay loam.

Quingua silt loam (5).—This soil type is mapped in Infanta, Puerto Real, General Nakar and Atimonan. It covers an ag-

gregate area of about 7,167.7 hectares or 0.60 per cent of the total area of the province.

At present, this soil is devoted to the growing of paddy rice. The rice varieties grown are Intan, Peta, FB–76, *Pinursigue* and Raminad. The yield ranges from 40 to 50 cavans per hectare. No fertilizer is used. Other crops grown on this soil type are coconut, banana and root crops.

Quingua sandy clay loam (910).—This soil type is mapped in the municipalities of Pagbilao and Padre Burgos. It covers an area of about 2,269.8 hectares or 0.19 per cent of the total area of the province. It has similar profile characteristics as those of the Quingua silt loam, except in the texture of the topsoil which is sandy clay loam.

The crops grown on this soil are lowland rice, coconut, banana, vegetables and root crops. The rice varieties grown are Intan, *Pinursigue,* Peta, and others. The yield of the palay without the use of fertilizers ranges from 40 to 50 cavans per hectare. Coconut yields 3,000 nuts per hectare per year.

SAN MANUEL SERIES

This soil series is a recent alluvial deposit established first in Tarlac Province. The same series is identified and mapped in the municipalities of Sariaya, Sampaloc and Perez, Quezon. The relief is level to nearly level. Drainage conditions are good. This series is one of the best soils of the Philippines.

Only one soil type, San Manuel sandy loam, is mapped in Quezon. The typical profile characteristics of the soil type are given below.

Horizon	Depth (cm.)	Characteristics
Ap	0—35	Grayish brown (10YR 5/2) when moist and dark yellowish brown (10YR 4/4) when dry, sandy loam; moderate medium granular structure; loose and friable.
B2	35—110	Light brownish gray (10YR 6/2) silt loam; with brownish yellow streaks; weak fine granular structure; loose and friable.
C	110—150	Yellowish brown (10YR 5/8) fine sandy loam to medium sand.

San Manuel sandy loam (96).—This soil type covers an area of about 2,150.3 hectares or 0.18 per cent of the total land area of Quezon Province.

The crops grown are lowland rice, coconut, banana, legumes, vegetables, and root crops. The yield of the palay ranges from 30 to 50 cavans per hectare. Coconut yields 20 nuts per tree per quarter.

UMINGAN SERIES

This soil series is first established in the province of Pangasinan. It is of recent alluvial deposit washed down from the surrounding highlands. It is identified in Aurora Sub-province, Quezon. It has a nearly level to undulating relief. External drainage is good while internal drainage is good to excessive. Organic matter content is fair to moderately good.

Under this series, two soil types, Umingan loam and Umingan sandy loam, are mapped in Quezon. The typical profile characteristics of Umingan loam are as follows:

Horizon	Depth (cm.)	Characteristics
Ap	0—25	Brown (10YR 4/3) to dark yellowish brown (10YR 4/4) loam, fine granular structure and friable.
B2	25—90	Reddish brown (5YR 4/4) friable sandy loam to fine sand. Lower layer is water-worn gravels of 10 to 15 centimeters thick.
C	90—150	Brown (10YR 5/3) sand mixed with gravels and stones.

Umingan loam (322).—This soil type covers an area of about 12,662.90 hectares or 1.06 per cent of the total area of Quezon Province. It is mapped in San Luis, Dipaculao and Dingalan, Aurora Sub-province.

The crops grown are lowland rice, coconut, citrus, banana, coffee and root crops. The yield of rice ranges from 30 to 40 cavans per hectare. The rice varieties grown are Intan, Peta and FB–76.

Umingan sandy loam (100).—This soil type is mapped in the municipalities of Maria Aurora, San Luis and Baler, Aurora Sub-province. It covers an area of about 2,986.5 hectares or 0.25 per cent of the total area of the province of Quezon. It has similar profile characteristics as those of Umingan loam, except for the texture of the topsoil which is sandy loam.

The crops grown are lowland rice, coconut, citrus, coffee, root crops, banana and fruit trees. The yield of palay ranges from 30 to 40 cavans per hectare.

Soils of the Uplands, Hills and Mountains

The soils of the uplands, hills and mountains comprise twenty-five soil types. They are Alaminos clay, Alimodian sandy loam, Annam clay loam, Annam silt loam, Boac clay, Bolinao clay loam, Castilla clay, Cervantes sandy loam, Faraon clay, Guadalupe clay loam, Guadalupe loam, Guimbalaon sandy clay, Ibaan loam, Macolod clay loam, Rizal clay, Sariaya sandy loam, Sevilla clay loam, Siain silt loam and Tagkawayan sandy loam. This group has a total area of about 730,984.7 hectares or 61.19 per cent of the total area of Quezon Province.

These soils are developed in place from the weathering of various rocks. Ibaan, Guadalupe and Lipa soils are derived from the weathering of volcanic tuff; Faraon and Bolinao soils from coralline limestone; Bantay and Bauang soils from shale and sandstone, Boac soil from conglomerates; Antipolo, Alaminos, Macolod, Luisiana, Guimbalaon, Sevilla, Annam and Sariaya soils from basalt, andesite and other volcanic rocks; Castilla soil from calcareous tuff, clays, basalts and agglomerates; Siain soil from stratified shale and limestone; and Tagkawayan soil from quartz and silica.

These soils occur either on a plateau, hills or mountains. Some portions of these soils are planted to coconut, corn, rice, root crops, banana or fruit trees; other areas are under grasses. The steep hills and mountains are still under primary and secondary forests with scattered patches of clearings that are planted to either coconut, rice, corn, root crops and/or fruit trees.

ALAMINOS SERIES

Alaminos series is a primary soil developed from the weathered volcanic rocks. It is a deep, red soil similar to Luisiana soil, but differs from the latter in the presence of boulders on the surface. This soil series is first identified in Pangasinan Province. It usually occurs on rolling to hilly relief. External drainage is excessive while internal drainage is good. Only one soil type, Alaminos clay, is mapped under this series in Quezon. The descriptions of the typical profile of Alaminos clay are given below.

Horizon	Depth (cm.)	Characteristics
Ap	0—30	Dark red (2.5YR 3/6) when dry and dark reddish brown (2.5YR 3/4) when moist, clay; friable; boulders are embedded in this horizon.

B2	30—110	Reddish brown (2.5YR 4/4) to dark red (2.5YR 5/6) clay loam; loose and friable with some iron concretions.
C	110—150	Red (2.5YR 4/6) clay loam to clay with weathered volcanic rocks; iron concretions are also present.

Alaminos clay (166).—This soil has an aggregate area of about 38,108.2 hectares or 3.19 per cent of the total area of the province. It is found in the municipality of Mauban, from Bo. Sta. Lucia extending up to the northern portion in the vicinity of Labayat River; in Cabalete Island; and also in the municipality of Tagkawayan.

The uncleared areas are still under primary and secondary forests. Coconut is the principal crop grown in the cultivated portions. Other crops grown are upland rice, corn, banana and root crops like cassava and camote. The yield of the coconut is 2,000 to 2,500 nuts per hectare per year. The upland rice yield ranges from 8 to 15 cavans per hectare and the corn yield is also 8 to 15 cavans of shelled corn.

ALIMODIAN SERIES

Alimodian series is a residual soil developed from the weathered shale and sandstones. It occurs on moderately sloping to hilly and mountainous relief. It has good to excessive external drainage and fair internal drainage.

Only one soil type under this series, Alimodian sandy loam, is mapped in the province. The profile descriptions of this soil type are given below.

Horizon	Depth (cm.)	Characteristics
Ap	0—25	Dark brown (10YR 4/3) when moist and brown (10YR 5/3) when dry, sandy loam; brittle when dry; rounded gravels and pebbles are present; many pore spaces.
B2	25—65	Yellowish brown (10YR 5/4) clay loam; weak, medium, columnar structure; slightly friable when moist and brittle when dry.
C	65—150	Pale brown (10YR 6/3) clay with highly weathered shale and sandstones; weak platy structure; slightly compact.

Alimodian sandy loam (798).—This soil type is mapped in the municipalities of Tagkawayan, Calauag, Quezon and Alabat. The major portion of the agricultural land of Tagkawayan is occupied by the soil type. It has an aggregate area of about

51,726.8 hectares or 4.33 per cent of the total land area of the province. The uncultivated areas are covered by primary and secondary forests.

This soil type is mostly grown to coconut and fruit trees. Other crops grown are upland rice, corn, cassava, camote, and vegetables. The yield of the coconut ranges from 3,000 to 3,500 nuts per hectare per year. The yield of the corn is 8 to 12 cavans of shelled corn per hectare and that of upland rice is 10 to 15 cavans per hectare.

ANNAM SERIES

This soil series is developed from the weathered basalt, andesite and tuffaceous rocks. It occurs on hilly and mountainuous areas with good to excessive external drainage and fair internal drainage. Soils of this series are acidic and also show low phosphorus content.

In Quezon Province, this soil series occupies the hilly and mountainous area of Aurora Sub-province. It has an area of about 79,442.0 hectares or 6.65 per cent of the total land area of Quezon Province. Two soil types are mapped under this series, Annam clay loam and Annam silt loam. The typical profile characteristics of Annam clay loam, representing the series are given below.

Horizon	Depth (cm.)	Characteristics
Ap	0—20	Dark brown (10YR 3/3) when moist and brown (10YR 4/3) when dry, clay loam; with granular structure.
B2	20—75	Dark brown (10YR 4/3) clay loam; loose and friable; gravels are common.
C	75—150	Dark brown (7.5YR 3/2) gravelly clay loam; stones and boulders are embedded.

Annam clay loam (98).—This soil type is mapped in the municipalities of Gen. Nakar, Maria Aurora, Baler, San Luis and Dingalan. It covers an aggregate area of about 67,495.8 hectares or 5.65 per cent of the total land area of the province. This soil type is mostly under primary forest, except the low-lying hills which are planted to coconut and other fruit trees and root crops. In some places the coconut trees are stunted in growth and bear fruits of sub-standard size. The coconut gives a yield of 1,500 to 2,000 nuts per hectare per year.

Annam silt loam (914).—This soil type is mapped in the municipality of the Dipaculao. It has an approximate area of 11,946.2 hectares or about 1.00 per cent of the total area of the province. It has similar characteristics as those of Annam clay loam, except for the texture of the topsoil.

The uncultivated areas are under primary forest, while the cultivated areas are devoted to the growing of rice, coconut, corn, root crops, banana and some fruit trees. The yield of the coconut is rather low, about 1,800 nuts per year only.

ANTIPOLO SERIES

Antipolo series is developed from the weathered basalts and other igneous rocks. It occurs on strongly rolling to hilly and mountainous relief. This soil series differs from the Alaminos series in soil color. But they are similar in the profile. Antipolo series has spherical iron concretions while Alaminos series has iron concretions also. The external drainage is good to excessive and the internal drainage is good.

Antipolo sandy clay is the only soil type under this soil series mapped in the province. The descriptions of the typical profile of this soil series are given below.

Horizon	Depth (cm.)	Characteristics
Ap	0—30	Dark yellowish brown (10YR 3/4) when moist and yellowish brown (10YR 5/4) when dry, sandy clay; coarse granular structure; friable; iron concretions present.
B2	30—85	Dusky red (2.5YR 3/3) clay; medium to fine granular structure; friable with spherical iron concretions. Lower layer is weathered tuffaceous material with fine iron concretions.
C	85—150	Yellow (10YR 7/6) to yellowish brown (2.5YR 5/8) clay; coarse granular structure; many iron concretions.

Antipolo sandy clay (912).—This soil type occupies the upland portion of the municipalities of Sampaloc, Lucban, Infanta, Puerto Real, General Nakar, Casiguran and Dilasag. It covers an aggregate area of about 85,534.4 hectares or 7.16 per cent of the total area of the province. The hilly and mountainous areas are under primary and secondary forests. The low-lying hills are cultivated in patches to rice, corn, coconut, banana, and root crops like camote and cassava.

Coconut is the principal crop. Boulders are exposed on the surface which deter the cultivation of this soil.

The *kaingin* system of farming is practiced by the farmers in the area. Timber cutting is done indiscriminately also in Infanta, General Nakar, Puerto Real, Casiguran and Dilasag. Hence the soil is exposed to erosion. It is suggested that selective logging should be practiced and the *kaingin* system of farming be stopped by all means.

BANTAY SERIES

This soil series is first identified and established in Bantay, Ilocos Sur. It is a primary soil derived from weathered shale. It occurs on strongly rolling to hilly and mountainous relief. The external drainage is good to excessive while the internal drainage is poor. The distinctive characteristics of Bantay series, which make it different from Luisiana soils, are its pale brown to light gray surface soil and the presence of whitish yellow massive shale and gravels in the substratum. The vegetation is mostly primary and secondary forests. Bantay clay loam is the only soil type under this series that was mapped in the province. The typical profile characteristics of Bantay clay loam which represents the series are given below.

Horizon	Depth (cm.)	Characteristics
Ap	0—25	Light gray (10YR 7/2) when dry and pale brown (10YR 6/3) when moist, clay loam; fine granular structure; slightly sticky and friable; boundary to next layer is diffuse.
B2	25—35	Light yellowish brown (10YR 4/4) clay loam; coarse granular structure; boundary to next layer is clear.
B3	35—65	Loose, strongly weathered shale that breaks easily into cubes. Some grayish white lime precipitates are present.
C	65—150	Highly weathered, massive, whitish yellow shale. Gravels are sometimes present.

Bantay clay loam (259).—This soil type is mapped in the municipality of Pagbilao near the Quezon National Agricultural School and extends to the northeastern part of Agdangan. It covers an area of about 14,215.9 hectares or 1.19 per cent of the total land area of the province.

The mountainous areas are under primary and secondary forests, while the hilly portions are utilized for the cultivation of crops. The crops grown are coconut, rice, banana, fruit trees and root crops like cassava and camote.

Coconut is the main crop. The yield ranges from 2,000 to 2,500 nuts per hectare per year.

BAUANG SERIES

This series is a primary soil developed from weathered stratified shales and sandstones. It occurs on strongly rolling to hilly relief. The internal drainage is good and the external drainage is rapid to excessive.

Under this series, Bauang clay loam is the only soil type identified and mapped in the province.

The typical profile characteristics of Bauang clay loam are given below.

Horizon	Depth (cm.)	Characteristics
Ap	0—30	Dark grayish brown (10YR 6/2) when dry, and brown (7.5YR 5/4) or dark brown (7.5YR 4/4) clay loam; coarse granular structure; loose and friable.
B2	30—100	Yellowish brown (10YR 5/4) clay loam. Hexagonal fragments of weathered shales and sandstones which when pulverize become powdery are present.
C	100—150	Yellowish brown (10YR 5/4) mostly weathered stratified shales and sandstones in alternate layers.

Bauang clay loam (647).—This soil type is mapped in the municipalities of Agdangan, Gumaca, Lopez, Plaridel, Pitogo and Macalelon. The aggregate area is about 32,493.5 hectares or 2.72 per cent of the total area of the province.

This soil type is presently devoted to coconut, banana, root crops, fruit trees and coffee. The coconut yields 3,000 nuts per hectare per year.

BOAC SERIES

Boac series is first identified and established in Boac, Marinduque. The soil is formed in place from the weathered conglomerates. The distinctive characteristics of this soil series are the presence of partially weathered conglomerate in the subsoil and numerous partially weathered boulders in the sub-

stratum. It occupies the moderately rolling to strongly rolling and hilly areas. The external drainage is good to excessive while the internal drainage is fair. Only one soil type is mapped under this series, Boac clay. The typical profile characteristics of Boac clay which represents the series are given below.

Horizon	Depth (cm.)	Characteristics
Ap	0—25	Dark brown (10YR 3/3) when dry, very dark grayish brown (10YR 3/2) when moist, clay; medium granular in structure, sticky and plastic when wet and friable when dry; pebbles are present occasionally; good root penetration; boundary to lower layer is wavy and diffuse.
B2	25—70	Dark grayish brown (10YR 4/2) to grayish brown (10YR 5/2) clay loam; sticky and plastic when wet and compact when dry; partially weathered conglomerates are present; boundary to next layer is wavy and diffuse.
C	70—110	Dark brown (10YR 3/3) silty clay loam with numerous gravels; boulders are occasionally present.

Boac clay (917).—This soil type occupies the greater part of the agricultural area of the municipality of Pitogo and a portion of Macalelon. Vegetation consists of primary and secondary forests on the uncultivated portions. Majority of the cultivated areas are devoted to the growing of permanent crops like coconut, fruit trees and banana. The fruit trees are starapple, mango, santol, jackfruit, chico, and the like. These thrive well on this soil. Other crops grown are corn, camote and vegetables.

Coconut is the main crop. The yield ranges from 2,000 to 3,000 nuts per hectare per year. While corn yields from 15 to 20 cavans of shelled corn per hectare.

BOLINAO SERIES

Bolinao series is developed from weathered coralline limestone. It is similar to Faraon series in parent material but differs from it in the color of its surface soil. Faraon has dark gray to black surface soil while Bolinao has dark brown to reddish brown surface soil. Most of the soils of Bolinao series are shallow. In some instances, the shallow solum is immediately underlain by massive limestone rock as observed

in Pagbilao Grande Island and in the municipality of Sampaloc. The relief is rolling to hilly and the drainage is fair. Bolinao clay loam is the only soil type mapped under this series.

The typical profile characteristics of this soil series as represented by Bolinao clay loam, are as follows.

Horizon		Characteristics
Ap	0—25	Brown (10YR 4/4) to reddish brown (2.5YR 4/4) clay loam; sticky and plastic when wet and friable when dry; limestone gravels and pebbles are present. In some places, limestone rocks are exposed on the surface.
B2	25—80	Light reddish brown (2.5YR 6/4) clay; fine granular in structure; limestone gravels and weathered limestone fragments are present. In some instances, this layer is absent.
C	80—150	Upper layer is reddish brown (2.5YR 4/4) weathered limestone rock. Lower layer is hard limestone rocks.

Fig. 24.—Typical landscape of Bolinao clay loam taken at Pagbilao, Quezon.

Bolinao clay loam (108).—This soil type is mapped in the municipalities of Pagbilao, Padre Burgos, Buenavista, Tayabas, Guinayangan, Sampaloc, Atimonan, Lopez, Mauban, Gumaca,

079271——5

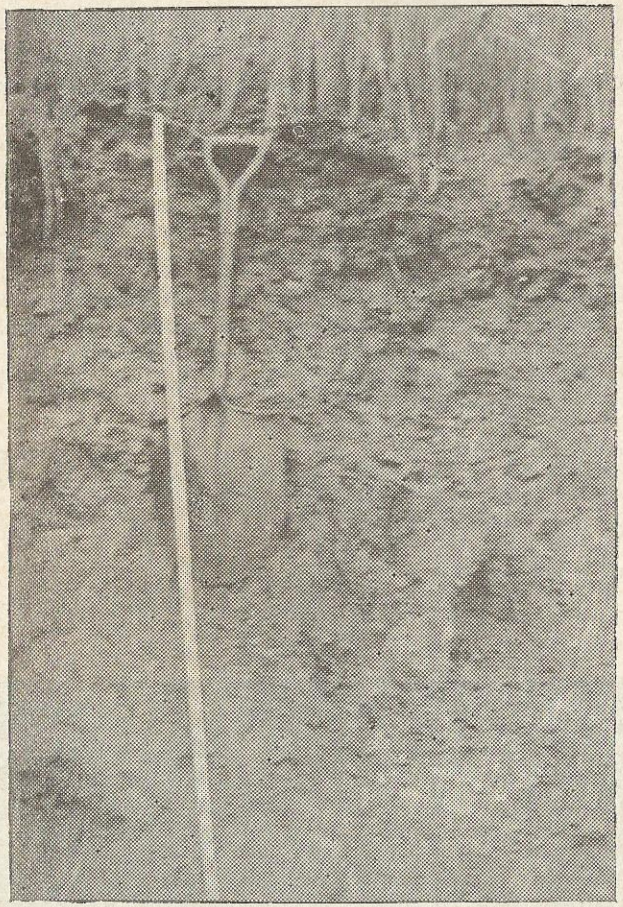

Fig. 25.—Typical profile of Bolinao clay loam.

Macalelon, Unisan, Pitogo, Pagbilao and Alabat Island. It covers an aggregate area of about 37,869.3 hectares or 3.17 per cent of the total area of the province.

At present, Bolinao clay loam is utilized for the growing of coconut, corn, root crops, citrus and other fruit trees and upland rice. The yield of the rice ranges from 8 to 15 cavans per hectare. While coconut yields 1,400 to 2,000 nuts per hectare per year which is lower than those grown in other soils of the province.

CASTILLA SERIES

Castilla series is a residual soil formed and developed from weathered calcareous tuff, basalt and agglomerates. This soil series usually occupies slightly rolling to moderately rolling

relief. Boulders are sometimes present on the surface. The external drainage is good to excessive while internal drainage is poor.

The uncultivated areas are usually under primary and secondary forests with patches of cogonal areas. The cultivated areas are planted to upland rice, coconut, corn, root crops and fruit trees.

Under this series, two soil types are identified in Quezon—Castilla clay and Castilla clay loam. However, Castilla clay loam is not mappable because it occupies small areas in patches. The two soil types are found in the Islands of Polillo, Patnanongan and Jomalig. The natural vegetation of the soil type is composed of shrubs, forest trees and patches of cogon grass. *Kaingin* system of farming is rampant in the area. Upland rice, corn, root crops and coconut are planted on these soils.

The typical profile characteristics of Castilla series as represented by Castilla clay are given below.

Horizon		Characteristics
Ap	0—40	Brown (2.5YR 5/2) to strong brown (7.5YR 5/6) heavy clay; coarse angular blocky in structure; sticky and plastic when wet and slightly brittle when dry; organic matter content is medium; boundary to next layer is diffuse and wavy.
B2	40—100	Brown (7.5YR 5/4) clay; mottled black: coarse granular to fine columnar structure; very sticky and plastic when wet, brittle when dry; boulders are sometimes present; boundary to lower layer is diffuse and wavy.
C	100—150	Yellowish brown (10YR 5/4) to brown (10YR 5/3) clay with splotches of yellowish brown, red and white colors, underlain by strongly weathered parent material.

Castilla clay (421).—This soil type is found in the islands of Polillo, Jomalig and Patnanongan. It covers an area of about 37,033.1 hectares or 3.10 per cent of the total area of the province. The major portion of this soil type is under primary and second-growth forests with some cogonal areas. The principal crops planted on this soil type are coconut, upland rice, banana, and fruit trees. The yield of the upland rice is about 10 cavans per hectare while the coconut yields 2,500 to 3,000 nuts per hectare.

CERVANTES SERIES

Cervantes series is developed from the weathering of a wide variety of igneous rocks. It occurs on strongly rolling to hilly and mountainous relief. The external drainage is good to excessive, while internal drainage is fair to good. The distinguishing characteristics of this soil series which make it different from Annam and Antipolo soils, is the light gray and grayish brown sandy material found in the substratum which appears powdery when dry.

Generally, the vegetation is primary forest. Patches of cleared areas on the low-lying hills are grown to upland rice, corn, coconut, and banana. Only one soil type, Cervantes sandy loam, is mapped under this soil series. The profile descriptions are given below.

Horizon	Depth (cm.)	Characteristics
A1	0—15	Reddish brown (2.5YR 4/4) when moist and very pale brown (10YR 7/4) when dry, sandy loam; very friable and coarse fragmental in structure.
B2	15—120	Red (2.5YR 4/8) clay loam, columnar in structure; friable; with few gravels.
C	120—150	Light gray (10YR 7/1) and grayish brown (10YR 5/2) loose sandy materials; powdery when dry.

Cervantes sandy loam (908).—This soil type is found in Aurora Sub-province, in the vicinity of Calabgan River in Casiguran extending to the northern portion of the municipality of Dipaculao. It covers a total area of about 1,433.6 hectares or 0.12 per cent of the total area of the province.

The greater portion of this soil type is still untouched. Only small patches of clearings are found. Majority of the cleared areas are planted to permanent crops like coconut, banana, and fruit trees. Some small areas are planted to upland rice and corn.

FARAON SERIES

Faraon series, like Bolinao series is developed from coralline limestone. The relief is strongly rolling to hilly and mountainous. The external drainage is good to excessive and the internal drainage is poor to fair. The distinguishing characteristics of this soil series is its black surface soil underlain by a strongly friable and porous coralline limestone. Like the Bolinao series, Faraon series has limestone rocks exposed on the surface.

Fig. 26.—Landscape of Faraon clay taken at Mulanay, Quezon.

Fig. 27.—Typical profile of Faraon clay. Note the numerous roots and the limestone fragments in the profile.

Only Faraon clay is mapped under this soil series. The profile descriptions are as follows:

Horizon	Depth (cm.)	Characteristics
Ap	0—35	Dark gray (10YR 3/1) to almost black (10YR 2/1) clay; medium granular in structure; friable and soft when moist, and brittle when dry; fair in organic matter content; with fine fragments of limestone; limestone rocks are exposed on the surface in some places; boundary to lower layer is abrupt and irregular.
B2	35—70	Very dark gray (10YR 3/1) clay; slightly compact, coarse to medium granular structure; sticky and plastic when wet and very hard when dry; partially weathered limestone fragments are present; boundary to lower horizon is smooth and clear.
C	70—150	Dark gray (10YR 4/1) clay with highly weathered limestone rock fragments; weak coarse granular in structure, underlain by porous, soft and friable light gray limestone rock.

Faraon clay (132).—This soil type is the most extensive upland soil of the province. It covers an area of about 204,159.7 hectares or about 17.09 per cent of the total area of the province. It is mostly found in the Bondoc Peninsula. It is also found in some portions of the municipalities of Calauag, Tagkawayan, Lopez, Gumaca, Gen. Luna, Macalelon and in the islands of Pagbilao Grande and Pagbilao Chica.

The greater portion of this soil type is presently utilized for the grazing of animals. Some patches of forested areas, however, are found in the interior portions of the grazing land. The low-lying hills are planted to coconut and seasonal crops, like rice, corn, and root crops. Fruit trees, such as avocado, santol, guava, starapple and jackfruit are also grown. The yield of the crops grown on this soil type is moderately higher than those grown on Bolinao soils. Upland rice yields from 8 to 15 cavans per hectare; whereas coconut yield ranges from 1,500 to 3,000 nuts per hectare per year.

GUADALUPE SERIES

The Guadalupe series is first established in Rizal Province. This soil series is derived from water-laid volcanic tuff.

Guadalupe series is characterized by a nearly black surface soil with weathered tuffaceous rock lying underneath. It differs

from the Lipa series in the texture and color of its subsoil. Both are developed from volcanic tuff.

The relief of this series ranges from flat to undulating and moderately rolling. External drainage is good to rapid while internal drainage is very poor. In Quezon Province, this series is found in the municipalities of San Antonio, Candelaria and Lucena City. It covers an area of about 17,082.4 hectares or 1.43 per cent of the total area of Quezon Province.

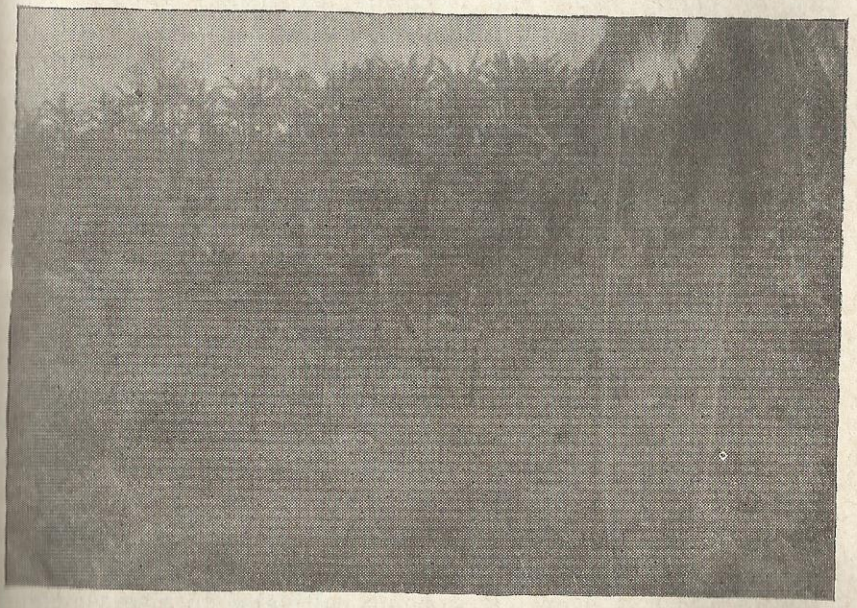

Fig. 28.—Landscape of Guadalupe loam at Buenavista, Candelaria, Quezon. Note the poor growth of the coconuts.

Two soil types are mapped under this series, namely, Guadalupe loam and Guadalupe clay loam. The typical profile characteristics of Guadalupe clay loam which represents the series are given below.

Horizon	Depth (cm.)	Characteristics
Ap	0—30	Very dark grayish brown (10YR 3/2) to very dark gray (10YR 3/1) clay loam; cloddy and hard when dry, sticky and plastic when wet.

B2	30—60	Light brownish gray (10YR 6/2) clay; fine granular in structure; sticky and plastic; spherical tuffaceous concretions are present.
C	60—120	Light grayish brown (10YR 6/2) clay mixed with weathered volcanic tuffaceous materials; with many tuffaceous concretions.

Guadalupe clay loam (30).—This soil type is mapped in Candelaria and Lucena City. It covers an area of about 9,915.3 hectares or 0.83 per cent of the total area of the province. It has almost flat relief. This soil is used mainly for the cultivation of paddy rice. The ricefields are mostly rainfed and only a small portion is irrigated. In areas where water is scarce, upland rice is grown. The rice varieties grown are *Pinursigue, Binuhangin, Senador,* Intan, Peta and FB–76. The yields of these varieties range from 25 to 40 cavans of palay per hectare. Other crops grown are coconut, corn, root crops and fruit trees like mango, starapple, santol and avocado. The yield of coconut is very low, only 800 to 1,500 nuts per hectare per year. The coconut trees in some places are stunted which may be attributed to the poor internal drainage and shallowness of the soil.

Guadalupe loam (616).—This soil type is mapped in the municipalities of Tiaong, San Antonio, Sariaya and Candelaria. It covers an area of about 7,167.7 hectares or 0.60 per cent of the total area of Quezon Province. The relief is moderately sloping.

The profile characteristics of this soil type is similar to those of Guadalupe clay loam except for the texture of the topsoil which is loam. It is being cultivated to rice (lowland and upland), corn and some root crops. Vegetables are also grown in small scale. The yield of palay is quite low. In lowland culture, the yield ranges from 25 to 30 cavans per hectare without the use of fertilizers; while in the upland culture, it ranges from 15 to 16 cavans per hectare.

GUIMBALAON SERIES

The soils of this series are primary soils developed from basalts and andesites. The relief is moderately rolling to hilly. The external drainage is good to excessive while internal drainage is good. The soil is quite acidic with low phosphorus and calcium contents. Guimbalaon sandy clay is the only soil type mapped under this series in Quezon.

The typical profile characteristics are as follows:

Horizon	Depth (cm.)	Characteristics
A1	0—25	Reddish brown (5YR 4/4) when moist and reddish yellow (5YR 6/8) when dry, sandy clay; slightly sticky and plastic when wet and friable when dry; boulders are occasionally present on the surface.
B2	25—70	Yellowish red (5YR 5/6) clay loam; medium granular structure, sticky and plastic when wet and friable when dry; boundary to next layer is smooth and clear.
C	70—150	Yellowish red (5YR 4/8) clay mixed with 3 to 5 mm. fragments of rock; soft and brittle; and hard; boulders are sometimes present.

Guimbalaon sandy clay (916).—This soil type covers an area of about 9,676.4 hectares or 0.81 per cent of the total area of the province. It is mapped in the municipality of Maria Aurora, Aurora Sub-province.

This soil type is mostly under primary and secondary forests. Patches of open lands are planted to coconut, banana, upland rice, root crops and citrus. On undulating portions, paddy rice is grown under irrigation by gravity system or rainfall. The yield of the lowland rice ranges from 20 to 35 cavans per hectare, and the upland rice is from 9 to 12 cavans per hectare. The varieties of rice grown are Intan, Peta, FB–76 and *Inuwak.*

IBAAN SERIES

Ibaan series is developed from weathered volcanic rocks. It occurs usually on undulating to moderately sloping relief. The surface soil is friable and easily tilled. The external drainage is good to rapid while internal drainage is fair to good.

Under this series, two soil types are mapped in the province, namely, Ibaan silty clay loam and Ibaan loam. The typical profile characteristics of the series as represented by Ibaan loam are as follows:

Horizon	Depth (cm.)	Characteristics
Ap	0—30	Dark yellowish brown (10YR 4/4) when dry, very dark brown (10YR 2/2) when moist, loam; coarse granular to blocky structure; friable; boundary to next layer is distinct.

B2	30—90	Very dark grayish brown (10YR 3/2) clay loam to clay; blocky to columnar in structure; with many tuffaceous concretions; underlain by highly weathered tuffaceous materials with numerous concretions.
C2	90—150	Yellowish brown (10YR 5/4) soft, highly weathered tuff, underlain by partially weathered tuffaceous rocks.

Ibaan loam (59).—Ibaan loam covers an aggregate area of about 13,260.2 hectares or 1.11 per cent of the total area of the province. It is mapped in the municipalities of Candelaria, Dolores, Tayabas and Lucena City. The main crop is coconut. The average yield ranges from 2,000 to 3,000 nuts per hectare per year.

Lowland rice is also grown. The varieties are Peta, Intan, *Binuhangin* and Raminad. The yield ranges from 30 to 50 cavans per hectare. Other crops grown are fruit trees like mango, santol, avocado, coffee and citrus. The uncultivated areas are under grasses with few shrubs and bamboos.

Ibaan silty clay loam (909).—This soil type is delineated in the municipalities of Tiaong, Candelaria, Sariaya and Lucena City. It covers a total area of about 6,450.9 hectares or about 0.54 per cent of the total area of the province. It has similar characteristics as those of Ibaan loam, except the texture of the topsoil, which is silty clay loam.

Upland rice and coconut are the main crops. The average yield of rice ranges from 8 to 12 cavans per hectare while coconut gives an average production of 1,500 to 2,000 nuts per hectare. Other crops grown are corn, mango, citrus and banana. Corn yields from 8 to 12 cavans of shelled corn per hectare.

To increase the yield of the crops and maintain the fertility of the soil, soil management practices such as contour tillage, contour planting, crop rotation, green manuring and contour strip cropping should be employed.

LIPA SERIES

Lipa series is developed from volcanic rocks. Unlike the Ibaan series, this series has very deep solum. The relief is usually nearly level to undulating to strongly rolling. External drainage is good to rapid while internal drainage is good. Only one soil type, Lipa loam, is mapped under this series in Quezon.

Fig. 29.—Profile of Lipa loam at Dolores, Quezon.

The typical profile characteristics of Lipa loam, representing the series are given below.

Horizon	Depth (cm.)	Characteristics
Ap	0—35	Dark grayish brown (10YR 4/2) when moist, grayish brown (10YR 5/2) when dry, loam; fine granular structure; very friable and loose.
B2	35—65	Very dark brown (10YR 2/2) loam; with tuffaceous materials and concretions; fine granular, very friable.
C1	65—120	Highly weathered tuff with tuffaceous gravels and concretions.
R	120—150	Pale brown (10YR) 6/3) tuffaceous rocks.

Lipa loam (62).—This soil type comprises most of the agricultural areas of the municipalities of Tiaong, Dolores and Candelaria. It covers an aggregate area of about 7,765.0 hectares or 0.65 per cent of the total area of the province. Coconut is the principal crop grown interplanted with upland rice, corn, banana, mungo and camote. Starapple (caimito), mango, avocado and santol are also grown. Kudzu and calopogonium are grown as cover crops for the coconut; while mungo, beans and peanuts are grown commercially.

In Tiaong, this soil type is the most extensively developed for agriculture. Areas not devoted to coconut are grown to lowland rice. The yield of coconut ranges from 2,000 to 3,000 nuts per hectare per year. Lowland rice varieties such as Peta, Intan and FB–76 give an average yield of 40 to 45 cavans per hectare from unfertilized fields.

Cover cropping with Kudzu or calopogonium is being practiced in the coconut plantations. The coconut gives higher yield in areas where soil management practices such as green manuring and cover cropping are employed. Crop rotation, fertilization and contour tillage are suggested for the maintenance of the fertility of this soil type.

LUISIANA SERIES

Luisiana series is first identified and established in Luisiana, Laguna. It is a primary soil developed from the weathered products of basalts and andesites. It usually occurs on rolling to hilly relief. External drainage is rapid to excessive while internal drainage is fair. Soils of this series are usually deep. Only one soil type, Luisiana sandy clay loam, is mapped under this soil series in Quezon.

The descriptions of the typical profile of this series represented by Luisiana sandy clay loam, are given below.

Horizon	Depth (cm.)	Characteristics
A1	0—30	Yellowish red (5YR 4/6) when dry and dark brown to brown (7.5YR 4/4) when moist, sandy clay loam; prismatic to columnar in structure; soft and friable; boundary to lower layer is smooth and diffuse.
B2	30—50	Dark red (10R 3/6) to dusky red (10R 3/4) clay; with weak red streaks and splotches; columnar in structure; slightly sticky and slightly plastic and friable; boundary to next layer is smooth and diffuse.
B22	50—70	Dark red (10R 3/6) to dusky red (10R 3/4) clay; with weak red streaks and yellow and gray splotches; columnar in structure; slightly friable; boundary to next layer is smooth and diffuse.
B3	70—150	Red (10R 4/8) clay; with yellow and yellowish gray splotches.

Luisiana sandy clay loam (911).—This soil type is found in the municipalities of Lucban, Sampaloc and Tagkawayan in the vicinity of the provincial boundary. It has an aggregate area of about 40,019.6 hectares or 3.35 per cent of the total

area of the province. The portion mapped in Tagkawayan is an extension of what was mapped as Mountain soils, undifferentiated (45) in Camarines Norte.

Coconut is the main crop on this soil. Upland and lowland rice, corn, cassava, camote and banana are planted in patches. The yield of the coconut in Sampaloc area is fairly low, about 1,000 to 1,500 nuts per hectare per year. In Lucban, the yield per hectare per year is 2,000 to 3,000 nuts. While the yield of upland rice is 8 to 12 cavans per hectare.

MACOLOD SERIES

Macolod series is a primary soil derived from weathered igneous rocks. The distinctive characteristics of this series are the presence of boulders on the surface and the dark brown color of the surface soil which make it different from the Luisiana soils. It occurs usually on hilly to mountainous relief. External drainage is good to excessive while internal drainage is fair to good. The vegetation consists of primary and secondary forests. Only one type, Macolod clay loam, is mapped under this soil series in the province.

The profile descriptions of Macolod series are given below.

Horizon	Depth (cm.)	Characteristics
Ap	0—20	Dark yellowish brown (10YR 4/4) when dry and (10YR 3/4) when moist, clay loam with gravels; boundary to next layer is diffuse and wavy; andesite rocks are exposed on the surface in some places.
B2	20—60	Brown (10YR 4/3) clay; medium granular structure; slightly compact; stones of varying sizes are sometimes present; boundary to next layer is diffuse and wavy.
C	60—150	Dark yellowish brown (10YR 4/4) clay mixed with weathered andesite rocks.

Macolod clay loam (143).—This soil type is mapped in the municipalities of Sariaya, Tayabas and Pagbilao and in Lucena City. It covers an aggregate area of about 24,131.2 hectares or about 2.02 per cent of the total area of the province. The principal crops are coconut and lowland rice. The coconuts are grown on areas where there are boulders while the lowland rice are grown on irrigated bench-terraces constructed along the hillsides. The rice varieties grown are Intan, Raminad and Peta. The yield of these rice varieties ranges from 30 to 40 cavans per hectare. The coconut yields about 2,000 to 3,000 nuts per hectare per year.

To maintain the fertility of the soil and minimize soil erosion, special soil conservation practices such as contour tillage, cover cropping, strip cropping and terracing in addition to crop rotation, green manuring and fertilizer application should be employed. Properly designed irrigation and drainage systems should be installed, especially in the rice paddies, so that the supply of water can be controlled.

RIZAL SERIES

Rizal series is a newly established soil series in Quezon Province. It is established in Bo. Rizal, Jomalig Island. This soil series is derived from the weathered andesite rocks. The relief is undulating to gently rolling and hilly with slopes ranging from 3 to 60 per cent. The soil is deep and well-drained. The surface soil is mellow thus easy to work on. It is, however, susceptible to soil erosion due to its relief.

Only one soil type, Rizal clay, is mapped under this series. However, there is another soil type, Rizal clay loam, identified in small patches in Jomalig and Patnanongan Islands that are not mappable.

The profile descriptions of Rizal series as represented by Rizal clay are as follows:

Horizon	Depth (cm.)	Characteristics
Ap1	0—2	Ashes from burned cogon mixed with partially decayed organic matter and clay.
Ap2	2—22	Reddish yellow (5YR 7/6) clay; friable when dry, sticky and plastic when wet; iron concretions, calcareous material and partially decayed organic matter are present.
B2	22—38	Reddish yellow (5YR 6/8) clay; with many red and brown mottles; many iron concretions.
B3	38—95	Reddish yellow (5YR 6/8) light clay; slightly friable; highly weathered rocks are present.
C	95—150	Strongly weathered red rocks. Decomposed rocks are easily crushed between fingers; plastic and sticky when wet.

Rizal clay (963).—Rizal clay covers an aggregate area of about 4,300.6 hectares or about 0.36 per cent of the total area of the province. This soil type is under primary and second growth forests and cogon grass. The cleared areas are utilized for the growing of rice, corn, coconut, root crops and banana. *Kaingin* system of farming is rampant in the hilly forested areas. This practice, if not checked, will eventually destroy the forest cover of the area.

SARIAYA SERIES

Sariaya series is a newly established soil series in Sariaya, Quezon Province. It is developed from accumulated sand, stones and gravels. The distinctive characteristics of this soil are the presence of boulders on the surface and of cobblestones embedded in the profile. The relief is undulating to moderately sloping. External and internal drainage are good. The vegetation consists of secondary forest, grasses and some shrubs. The cultivated areas are planted to coconut and interplanted with banana, citrus, coffee and root crops.

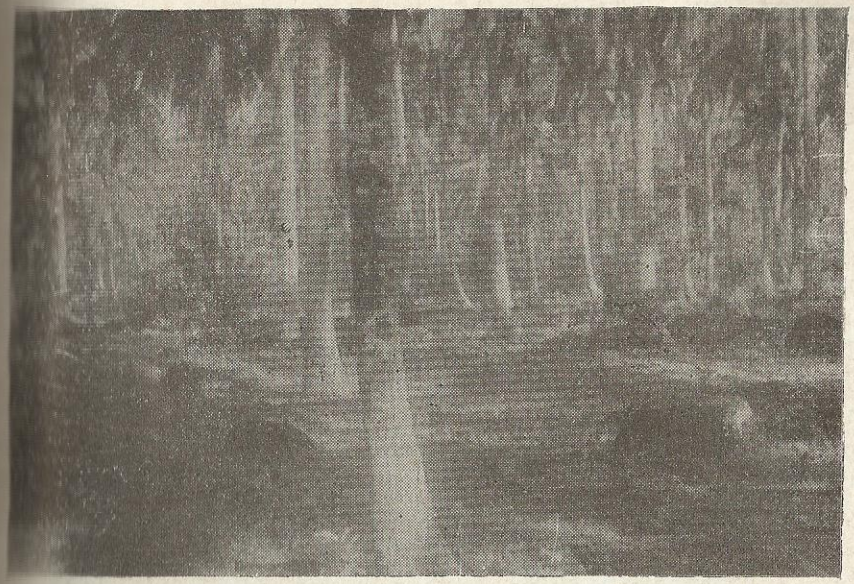

Fig. 30.—Landscape of Sariaya sandy loam at Sampaloc, Sariaya, Quezon. Note the boulders on the surface.

Only one soil type, Sariaya sandy loam, is mapped under this series. The profile descriptions of Sariaya sandy loam representing the series are given below.

Horizon	Depth (cm.)	Characteristics
Ap	0—35	Very dark gray (10YR 3/1) sandy loam; structureless, gritty and slightly compact; few gravels present; easy root penetration; fair in organic matter content. Boulders are present on the surface.

B	35—100	Brown (10YR 4/3) loamy sand to fine sand; structureless; gritty and loose; gravels and cobblestones are present.
C	100—150	Sand mixed with water-worn gravels and stones underlain by water-worn gravels and stones in some places.

Sariaya sandy loam (925).—This soil type is found in Sariaya. It has an area of about 5,256.3 hectares or 0.44 per cent of the total area of the province.

Permanent crops are commonly grown on this soil, however, some root crops are also grown in patches where the surface soil is not covered with boulders. The permanent crops grown are coconut, banana, citrus, coffee, cacao and lanzones. The coconut is the principal crop. Fruit trees are interplanted with coconut. The yield of the coconut ranges from 2,000 to 3,000 nuts per year.

Cover cropping, green manuring, and fertilization are recommended for the maintenance of the fertility of this soil.

SEVILLA SERIES

Sevilla soils are developed from weathered calcareous shale and sandstones. They are deep primary soils. The relief is moderately rolling to hilly and mountainous. External drainage is good to excessive while internal drainage is poor. In Quezon Province, Sevilla soils occupy the upland areas east of Padre Burgos and West of Agdangan. The steep portion is under primary and secondary forests; while the low-lying hills are cultivated to coconut, banana and fruit trees. Only Sevilla clay loam is mapped under this soil series. The descriptions of the typical profile of Sevilla clay loam are given below.

Horizon	Depth (cm.)	Characteristics
Ap	0—45	Very dark brown (10YR 2/2) when moist and very dark grayish brown (10YR 3/2) when dry, clay loam; granular structure; slightly compact; few calcareous gravels and cobblestones are present; root penetration is fair, boundary to lower layer is diffuse and smooth.
B2	45—100	Yellowish brown (10YR 5/4) clay; medium granular structure; sticky and plastic; with many limestone nodules and fragments of shale.
C	100—150	Yellowish brown (10 YR 5/4) clay; sticky and plastic; mixed with limestone nodules and fragments of calcareous shale and sandstone.

Sevilla clay loam (1114).—This soil type has a total area of about 3,344.9 hectares or 0.28 per cent of the total area of the province. Coconut is the main crop. Other crops grown are fruit trees and root crops. The yield of the coconut ranges from 2,000 to 3,000 nuts per hectare per year.

SIAIN SERIES

Siain series is another newly established soil series in Quezon Province. It is identified and established in Siain north of the town proper of Plaridel. This series is developed in place from weathered stratified shales and limestone. This soil series differs from the Bauang soils in the parent material. Siain soils developed from shale and limestone while Bauang soils are mostly from shale. The solum of Siain series is underlain by stratified shale and limestone. The relief is hilly and mountainous. External drainage is good to excessive while internal drainage is good. The native vegetation consists mostly of primary and secondary forests. The cultivated areas are planted to coconut, fruit trees and banana.

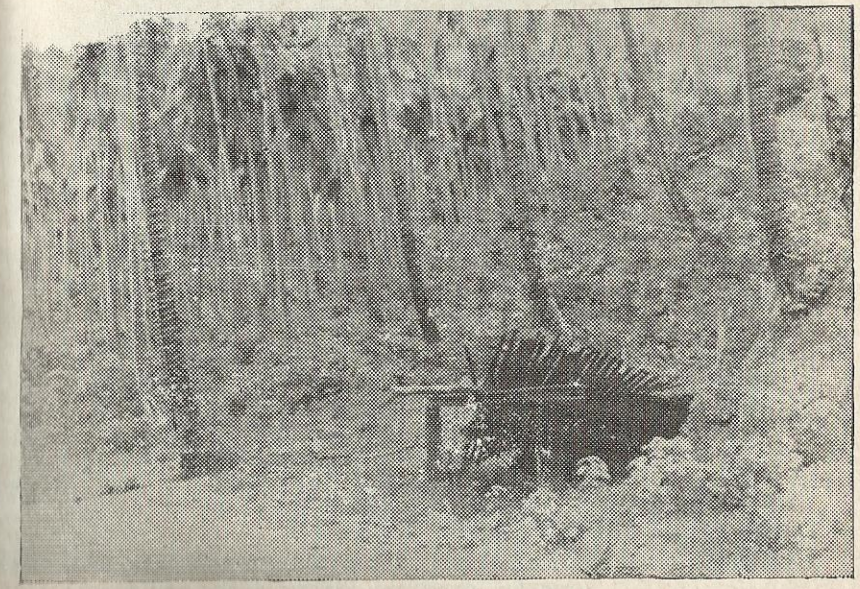

Fig. 31.—Landscape of Siain silt loam.

Under this soil series, only one soil type, Siain silt loam, is mapped in the province. The profile descriptions of Siain silt loam representing the series are given below.

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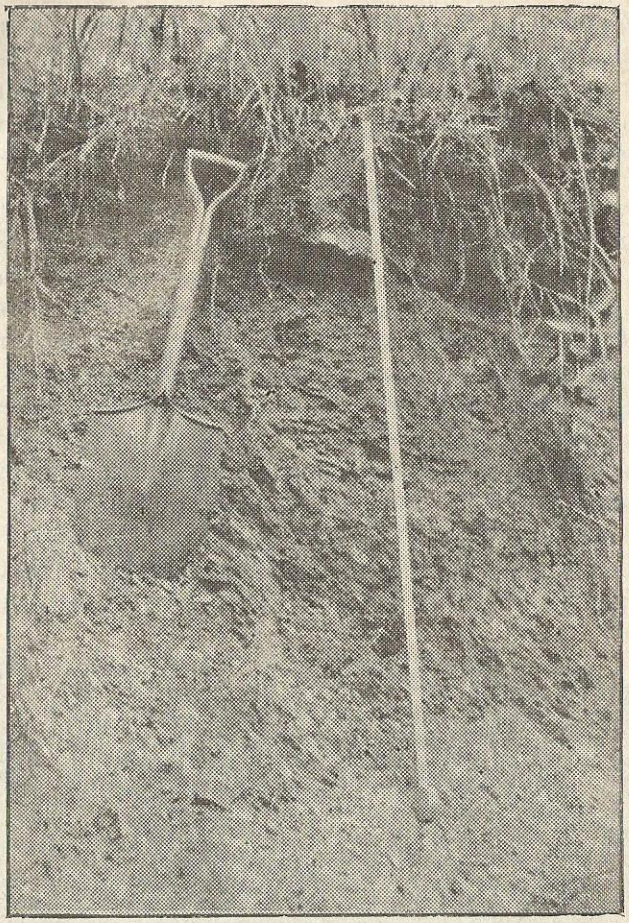

Fig. 32.—Profile of Siain silt loam.

Horizon	Depth (cm.)	Characteristics
Ap	0—30	Grayish brown (10YR 5/2) when dry and dark grayish brown when moist, silt loam; friable and slightly sticky; angular fragments of shale and limestone are present; boundary to next layer is gradual and irregular.
B2	30—70	Yellowish brown (10YR 5/6) clay loam to clay; fine granular structure; slightly sticky and plastic when wet and hard when dry; fragments of shale and limestone are present; boundary to lower layer is gradual.
C	70—150	Light brown (7.5YR 6/4) clay mixed with weathered shale and limestone, underlain by stratified shale and limestone.

Siain silt loam (926).—This soil type is mapped in the municipalities of Plaridel, Atimonan, Unisan, and Gumaca. It has an aggregate area of about 9,317.9 hectares or about 0.78 per cent of the total area of Quezon Province.

The main crop is coconut. The average yield of coconut is rather low, only 1,500 to 2,500 nuts per hectare per year.

TAGKAWAYAN SERIES

Tagkawayan series is another newly established soil series identified in Bo. San Jose, Tagkawayan, Quezon Province. It is a residual soil developed from weathered quartz and siliceous rocks. This soil series has rock outcrops in some places. The relief is hilly and mountainous. External drainage is rapid to excessive while internal drainage is good. The vegetation consists of primary and secondary forests. Patches of cleared areas are devoted to the growing of crops.

Fig. 33.—Landscape of Tagkawayan sandy loam which shows some silica rocks locally called *puting-bato*.

Under this series, only one soil type, the Tagkawayan sandy loam, is mapped in the province. The profile descriptions of of this soil type which represents the series are given below.

Horizon	Depth (cm.)	Characteristics
Ap	0–30	Very pale brown (10YR 7/4) when dry and brown (10YR 6/3) when moist, sandy loam, slightly compact and friable; with fine angular fragments of quartz and siliceous rocks; root penetration is easy; rock outcrops are found in some places.
B2	30—50	Brown (10YR 5/3) fine sand mixed with coarse angular fragments of quartz and siliceous rocks; few reddish brown streaks.
B3	50—70	Brownish yellow (10YR 6/8) sand mixed with very coarse fragments quartz and siliceous rocks; with reddish brown streaks.
C	70—150	Strongly weathered angular (3–6 mm. diameter) quartz and siliceous rocks; many reddish brown streaks.

Tagkawayan sandy loam (927).—This soil type is identified in the municipality of Tagkawayan between the Alimodian and Faraon soils. It occupies an area of about 6,211.9 hectares or 0.52 per cent of the total area of Quezon Province. Commercial timbers still abound in the mountainous portion.

The patches of cleared areas are planted to corn, coconut, banana, upland rice, cassava and camote. Fruit trees are also planted on the hilly areas. Landslide usually occurs here. The quartz and silica rocks are being quarried. These quarried rocks are exported to Iligan City for the manufacture of China wares.

Miscellaneous Land Types

Areas that have no true soil or have little or no natural soil or without agricultural value for the immediate future or they are inaccessible for investigation are classified as miscellaneous land types. These consist of beach sand, swamp or hydrosol, mountains soils, undifferentiated and riverwash.

Beach sand (118).—This land type is an accumulation of sandy materials and marine shells deposited by sea current along the coastal areas of the province. It covers an area of about 3,464.4 hectares or about 0.29 per cent of the total area of the province.

Beach sand is suited for the growing of coconut. The coconut trees on this land type are growing luxuriantly than elsewhere. Other crops like vegetables can also be grown on this land type, provided abundant organic matter is added to the soil.

Hydrosol (1).—The mangrove and nipa swamps along the coasts of the province belong to this miscellaneous land type. It has an aggregate area of about 26,162.1 hectares or 2.19 per cent of the total area of the province. A great portion of these areas is submerged at high tide. Majority of these areas has been converted into fishponds like those found in Pagbilao, Padre Burgos, Lucena, Gumaca, Atimonan and other towns along the coasts. *Bangus* are reared in the fishponds. *Bakauan* trees abound here. These are cut for firewoods and are sold to bakeries. Charcoal making also flourishes in these areas.

Mountain soils, undifferentiated (45).—This miscellaneous land type covers a large portion of Quezon Province. It covers an approximate area of about 372,361.5 hectares or about 31.17 per cent of the total area of the province. It occupies the northern portions of the Sierra Madre Range; southwestern parts of Baler to northern Dingalan; southern Dingalan extending to Infanta and Mauban areas from the vicinity of Labayat River to Mayapis River; and a small portion in Mount Banahaw; in Polillo and Alabat Islands. This land type is heavily forested and rugged which makes it inaccessible during the survey. Presently, these areas have no agricultural value.

Riverwash (152).—This land type is found in the municipalities of San Luis in Aurora Sub-province and in Sariaya and Dolores. It covers an area of approximately 1,433.6 hectares or about 0.12 per cent of the total area of the province.

This land type is once a good agricultural land but because of the meandering river, the original soil and its cover are washed out, leaving in its place the sand, gravels and stone referred to as riverwash.

This miscellaneous land type is devoid of vegetation. Only sporadic growth of *talahib* and other native grasses cover the land. Some areas with thin soil are utilized for the growing of seasonal crops like watermelon, peanuts and beans.

LAND-USE, SOIL MANAGEMENT AND WATER CONTROL

The term land-use refers to the general use of the land such as (1) cropland (2) pasture land (3) forest and (4) wildlife preservation. While soil management refers to the operations done on the farm such as (1) method of tillage, (2) choice and rotation of crops, (3) application of fertilizers

TABLE 4.—*Key to the soils of Quezon and Aurora Subprovince.*

Soil mapping number	Soil mapping unit	Parent material	Relief	Drainage		Present use/vegetation
				External	Internal	
921	Baler silty clay loam	Recent alluvial deposits	Nearly level	Good	Fair	Rice, coconut, citrus, root crops, banana corn, vegetables.
915	Bay loam			Poor	Poor	Rice, coconut, citrus, root crops, corn, vegetables, legumes.
913	Bigaa loam					Rice, coconut, vegetables.
1012	Buglo sand				Good	
572	Bugtey loamy sand		Nearly level to slightly undulating	Good	Excessive	Coconut, citrus, banana, fruit trees.
922	Catanauan clay loam		Nearly level	Poor	Poor	Coconut, root crops, banana, vegetables.
907	Laylay silt loam					Rice, corn, root crops.
923	Piris clay loam		Nearly level to slightly undulating	Good	Excessive	Coconut, citrus, root crops.
924	Polillo sandy clay loam			Fair to good	Fair to good	Rice, coconut, open grassland.
5	Quingua silt loam		Nearly level to level	Good	Good	Rice, coconut, banana, root crops.
910	Quingua sandy clay loam		Nearly level to slightly undulating			
96	San Manuel sandy loam		Nearly level to level			Rice, coconut, banana, root crops, vegetables
100	Umingan sandy loam		Nearly level to undulating			Rice, coconut, banana, legume, vegetables, root crops.
922	Umingan loam					Rice, coconut, banana, citrus, coffee, root-crops.
166	Alaminos clay	Volcanic rocks	Rolling to hilly			Rice, coconut, citrus, coffee, fruit trees, root crops.
728	Alinodian sandy loam	Shale and sandstone	Moderately sloping to hilly and mountinous	Excessive		Coconut, rice, corn, banana, root crops, forests.
						Coconut, rice, fruit trees, corn, root crops vegetables, forests.
28	Annam clay loam	Basalts and andesites	Hilly and mountainous		Fair	Coconut, fruit trees, root crops, forests.
904	Annam silt loam					Coconut, rice, corn, root crops, banana, fruit trees, forests.
902	Antipolo sandy clay	Igneous rocks	Strongly rolling to hilly and mountainous	Good to excessive	Good	Coconut, rice, corn, banana, root crops, forests.
909	Buntay clay loam	Shale			Poor	Coconut, rice, banana, fruit trees, root-crops, forests.
907	Bunung clay loam	Shale and sandstone	Strongly rolling to hilly		Good	Coconut, banana, coffee, fruit trees, root-crops.

917	Bosc clay	Conglomerate	Moderately to strongly rolling and hilly		Fair	Coconut, fruit trees, banana, corn, camote vegetables, forests.
168	Bolinao clay loam	Coralline limestone	Rolling to hilly	Rapid		Coconut, corn, root crops, citrus, fruit trees, upland rice, forests.
921	Castilla clay	Calcareous tuff, basalt and agglomerate	Slightly to moderately rolling	Good to excessive	Poor	Coconut, banana, fruit trees, upland rice forests.
908	Cervantes sandy loam	Igneous rocks	Strongly rolling hilly and mountainous		Fair to good	Coconut, banana, corn, upland rice, fruit trees, forests.
902	Faraon clay	Coralline limestone			Poor to fair	Coconut, rice, corn, root crops, fruit trees, grasses.
30	Guadalupe clay loam	Water-laid volcanic tuff	Nearly level	Good	Poor	Rice, coconut, corn, root crops, fruit trees.
906	Guadalupe loam		Moderately sloping			Rice, vegetables.
906	Guimbalaon sandy clay	Basalt and andesite	Moderately rolling to hilly	Good to excessive	Good	Coconut, banana, rice, root crops, citrus, forests.
30	Ibaan loam	Volcanic tuff	Undulating to moderately sloping	Good to rapid	Fair to good	Coconut, rice, fruit trees, grasses, shrubs, bamboo.
909	Ibaan salty clay loam					Coconut, rice, corn, mongo, citrus, banana.
62	Lipa loam	Volcanic rocks	Nearly level, undulating to hilly		Good	Coconut, rice, corn, banana, mongo, camote, beans, peanut, Kudzu, calopogonium, fruit trees.
911	Luisiana sandy clay loam	Basalt and andesite	Rolling to hilly	Rapid to excessive	Fair	Coconut, rice, corn, cassava, camote, banana.
143	Macolod clay loam	Igneous rocks	Hilly to mountanous	Good to excessive	Good	Coconut, rice, forests.
963	Riza clay	Andesite rocks	Undulating to gently rolling and hilly		Fair	Rice, corn, coconut, root crops, banana, forests.
925	Sariaya sandy loam	Sand, gravel and stones	Undulating to moderately sloping	Good	Good	Coconut, banana, citrus, coffee, root crops cacao, lanzones, grasses, shrubs, forests.
1114	Sevilla clay loam	Calcareous shale and sandstone	Moderately rolling to hilly and mountainous	Good to excessive	Poor	Coconut, banana, fruit trees, root crops, forests.
926	Siain silt loam				Good	Coconut, fruit trees, banana, forests.
927	Tagkawayan sandy loam	Quartz and silica	Hilly to mountainous			Coconut, corn, rice, banana, root crops, forests.
118	Beach sand	—	Undulating	Excellent	Excellent	Coconut, root crops.
1	Hydrosol	—	Flat	Very poor	Very poor	Mangrove, nipa, bakauan, fishponds.
45	Mt. Soils, undifferentiated	—	Mountainous	—	—	Forests.
152	Riverwash	—	Nearly level	—	—	Cogon, talahib.

and soil amendments, and (4) control of runoff and erosion. The primary objective of soil management is to promote favorable condition for the growth of the plant in consonance with the capability for use. Control of water is one of the phases of soil management.

The success or failure of a crop is oftentimes dependent upon water supply. Too little water in the soil means crop failure. Likewise, excessive moisture in the soil will also affect the crop adversely. On the other hand, failure to control runoff will wash away the soil.

To a great extent, runoff control is a big problem in Quezon Province owing to the hilly and mountainous relief of most of the land in the province. Once the land is laid bare, runoff flows down the slope at a high velocity, hence, soil erosion sets in. Measures that would check and reduce the velocity of runoff should be provided. A thick vegetative cover most often reduces erosion losses to the minimum. It is suggested, therefore, that immediate reforestation of denuded areas should be instituted in order to stop the further destruction of such areas. Aside from arresting erosion, water is also conserved by providing adequate vegetative cover to the soil. Reducing the flow of runoff will cause the water to stay longer on the land, hence, allowing a great portion of the water to be absorbed by the soil which can be used later by plants. Runoff should be conducted to safe outlets through grassed waterways so that it will not scour the land thus prevents excessive loss of the soil.

The installation of irrigation and drainage systems is of primary importance in the province for the growing of lowland rice. The occurrence of dry periods during the flowering and milking stages of rice has caused so many crop failures. With the construction of irrigation system that would supply water when needed, crop failures will not only be avoided but increase yield of the crops can be expected. Moreover, after the harvest of the regular crop the land can be utilized again for planting.

The soils of the plains and valleys are planted to crops year after year without replenishments of the nutrients, a practice that depletes the soil of its fertility. Although the soils may be fertile, they may become submarginal in the long run, if they are continuously cropped without instituting proper soil management. During the survey, it is observed that most of the fertilization is haphazardly done. The leguminous crops

planted add very little organic matter to the soil because they are grown not as green manure crops but as source of food. Crop rotation and green manuring, the cheap means of maintaining soil fertility, are practiced by very few farmers only.

The area of arable land in the province is so limited that the farmers have resorted to the cultivation of the hills and mountains. The land is plowed up and down the slope thereby soil erosion is enhanced. Likewise, shifting cultivation or *kaingin* system of farming is rampant in the forested areas. The rolling and hilly areas which are suited only for permanent crops are being cultivated to clean cultured crops like rice, corn and vegetables. No soil conservation measure is employed thus the land is exposed to soil erosion.

The need to change from the antiquated system of farming to the modern way of cultivating the land should be given serious thought. The farmers should be taught to utilize the land according to its capability. Conservation measures such as cover cropping, contour planting, strip cropping, terracing, etc., should be employed on sloping areas. Green manuring, crop rotation, addition of organic matter to the soil, and application of fertilizers and lime, if needed, should be done. The rolling areas should be either utilized for permanent crops, or for pasture in order to keep the land under permanent vegetative cover. Only the gentle slopes may be cropped conveniently, provided conservation measures are applied. The soils on the steeper slopes should not be cultivated but must be planted to permanent crops to prevent or minimize its loss.

PRODUCTIVITY RATINGS OF THE SOILS OF QUEZON PROVINCE

The productivity of a soil is its capability to produce a specific crop or sequence of crops under a specified system of management. Yield predictions are arrived at in two principal ways; namely, (1) through judgments based upon evidence afforded by actual yield data from sample areas of the soil mapping units, and (2) through judgment based on comparisons of the characteristics of soils and basic knowledge of plant requirements. In this report, soil productivity rating is based on the average crop yield of a soil type in relation to national standard index established. This standard index represents the approximate yield of a given crop on good and extensive soil types of the Philippines without the use of fertilizers or soil amendments.

Table 5 indicates the productivity ratings of the soils of Quezon Province for the major crops grown in the province. The productivity ratings were developed mainly from estimates based upon observations and interviews of the farmers supplemented by crop records of the Provincial Agriculturist and census data, thus, their reliability may be considered fair only. The soil productivity rating for a given crop is expressed in terms of a standard index of 100. Hence, a productivity rating of 75 for a certain crop means that a soil is about three-fourths as productive or in terms of production the soil can produce 45 cavans of palay in the case of lowland rice wherein the national standard is 60 cavans of palay per hectare.

The productivity index for any soil type is computed using the following formula:

$$\frac{\text{Expected yield per hectare}}{\text{Standard yield per hectare}} \times 100 = \text{productivity rating}$$

TEXTURAL CLASSES OF THE SOILS OF QUEZON PROVINCE

FIELD DETERMINATION OF SOIL TEXTURAL CLASS

The determination of the soil textural class is made in the field mainly by feeling the soil with the fingers. While this requires skill and experience, accuracy can be had if the field scientist frequently checks his field textural classification against laboratory results.

Hereunder are definitions and descriptions of the basic soil textural classes in terms of field determination.

Sand.—Sand is loose and single-grained. The grains can readily be seen or felt, squeezed in the hand when dry, individual particles will fall apart when the pressure is released. Squeezed when moist the particles will form a cast, but will crumble when touched.

Sandy loam.—Sandy loam contains much sand with enough silt and clay to make it somewhat coherent. The individual sand grains can be readily seen and felt. Squeezed when dry, the soil particles will form a cast which readily falls apart, but if squeezed when moist, a cast can be formed which will bear careful handling without breaking.

Loam.—Loam consists of relatively even mixture of different grades of sand, silt and clay. It is mellow with a somewhat gritty feel, yet fairly smooth and slightly plastic.

TABLE 5.—*Productivity ratings for the Soils of Quezon Province.*

Soil types	Crop productivity index for: Rice — Lowland 100=60 cavans	Rice — Upland 100=20 cavans	Coconut 100=3,750 nuts	Corn 100=17 cavans	Camote 100=8 tons	Cassava 100=15 tons	Banana 100=900 bunches	Abaca 100=15 piculs
Alaminos clay	x	80	111	x	x	x	70	x
Alimodian sandy loam	x	50	100	55	6	70	85	40
Antipas clay loam	x	x	45	x	x	x	x	x
Antipas silt loam	x	x	50	x	45	50	70	x
Antipolo sandy clay	x	105	70	47	45	50	90	x
Bacor silty clay loam	80	x	80	50	x	x	95	x
Bantay clay loam	x	80	100	x	40	50	70	x
Bantog clay loam	x	85	170	48	x	x	90	30
Bay loam	70	x	x	x	55	x	80	x
Beach sand	x	x	100	x	x	x	x	x
Bucal clay	x	x	193	x	x	x	75	x
Bulan clay loam	100	80	80	80	x	x	x	x
Burgos loamy sand	x	x	100	x	x	x	75	50
Casilla clay	x	75	90	x	x	x	75	x
Catanauan clay	75	100	90	x	x	x	85	x
Cervantes sandy loam	x	x	x	x	x	x	80	x
Faraon clay	x	92	120	55	50	50	x	x
Guadalupe clay loam	90	120	x	x	x	x	80	x
Guadalupe loam	65	83	147	50	x	x	x	x
Ilaan loam	x	83	180	55	x	x	80	x
Ilaan silty clay loam	75	105	100	x	x	x	90	x
Layday silt loam	x	x	80	x	x	x	90	x
Lipa loam	70	78	154	55	x	55	75	x
Luisiana sandy clay loam	70	77	67	x	x	x	95	x
Macolod clay loam	70	115	165	x	x	x	80	x
Pins clay loam	100	85	90	x	x	x	85	x
Polillo sandy clay loam	70	80	x	60	x	x	95	x
Rizal clay	x	80	x	x	x	x	95	x
Sariaya sandy loam	x	x	150	x	x	x	90	x
Sevilla clay loam	x	x	115	x	x	x	90	x
Tagkawayan sandy loam	x	x	60	x	x	x	70	x
Umingan sandy loam	70	80	100	50	50	x	70	x
Quingua silt loam	75	88	105	65	x	x	85	x
Quingua sandy clay loam	100	100	60	50	60	95	95	x

x Indicates that the crop is not grown on the soil type or the crop is grown but on a small scale.

Squeezed when dry, the soil particles will form a cast that will bear careful handling, while the cast formed by squeezing the moist soil can be handled quite freely without breaking.

Silt loam.—Silt loam contains a moderate amount of the fine grades of sand and only a small amount of clay, over half of the particles being of the soil separate called "silt". When dry it may appear cloddy but the lumps can be readily broken, and when pulverized it feels soft and floury. When wet, the soil readily runs together and puddles. Either dry or moist, the soil particles will form into a cast which can be freely handled without breaking. When moistened and squeezed between the fingers, it will not "ribbon" but will give a broken appearance.

Clay loam.—Clay loam is a fine-textured soil which usually breaks into clods or lumps that are hard when dry. When the moist soil is pinched between the thumb and fingers, it will form a thin "ribbon" which breaks readily, barely sustaining its own weight. The moist soil is plastic and can be formed into a cast that will bear much handling. When kneaded in the hand it does not crumble readily but tends to form into a heavy compact mass.

Clay.—Clay is a fine-textured soil that usually forms very hard lumps or clods when dry, and is quite plastic and usually sticky when wet. When the moist soil is pinched between the thumb and fingers, it will form into a long, flexible "ribbon". Some fine clays very high in colloids are friable and lack plasticity under all conditions of moisture.

The above definitions are descriptive only, none could be made in these or similar terms that would apply adequately to all soils. The dependable definitions, the standards, are those developed from mechanical analysis.

MECHANICAL ANALYSIS

Accuracy in the determination of the textural classes of the soils delineated during the soil survey is attained through mechanical analysis. Generally, field determination coincides with the results of the mechanical analysis. However, there are instances when field determination and laboratory results differ. Some soils exhibit clayey textures in the fields. They are sticky and plastic when wet, hard or brittle when dry, but when analyzed in the laboratory their clay contents are low. Under these circumstances the field classification prevails

except when their contents are so low in which case the textural class established by the laboratory is adopted.

The soil separates are sand, silt, and clay. Sand includes particles from 2.0 to 0.05 millimeter in diameter; silt from 0.05 to 0.002 millimeter; and clay, particles smaller than 0.002 millimeter in diameter.[1] Particles larger than 2 millimeters such as gravels, pebbles and cobbles, are considered coarse skeletons. Class names such as sand, silt, silt loam, clay loam, sandy loam, etc., are determined by the proportionate amount of the different separates present in the soil. A soil with an analysis of 30 per cent or more of clay fraction is considered a clay soil. Lately, however, this percentage was changed to 40 thus all soils containing 40 per cent or more of clay are classified as clay soils.

The modified Bouyoucos method was employed in the mechanical analysis where the conventional jar, hydrometer and thermometer were used. Analysis was made without removing the organic matter from the soils.

Table 6 shows the average mechanical analysis of the surface soils of the different soil types of Quezon.

LAND CAPABILITY CLASSIFICATION AND CONSERVATION GUIDE FOR THE SOILS OF QUEZON PROVINCE

Land capability classification is a scheme of grouping soil types together for their proper utilization. Utilization, from the standpoint of agricultural as well as economic capabilities, implies any of or a combination of four general purposes, namely: (1) cropland, (2) pasture land, (3) forest land, and (4) land for wildlife or recreation. For cropping purposes the crop or set of crops are usually specified and the corresponding necessary soil management practices together with the supporting soil conservation measures are given.

The three major factors to consider in land capability classification are (1) the soil type, (2) the slope of the land, and (3) the degree of erosion. In the consideration of a given soil type, its physical and chemical properties, both of which consist of inherent and acquired characteristics, are fully evaluated in the field and in the laboratory. Land capability classes are further subdivided into subclasses by taking into account different soil problems. In the Philippines, the three

[1] Previous to 1938, the United States Department of Agriculture used the 0.05 to 0.005 millimeter for the size of silt and smaller than 0.005 millimeter for clay.

TABLE 6.—*Average mechanical analysis of the surface soils of the different soil types of Quezon Province.*

Soil Mapping No.	Soil Type	Sand 2.00-0.05 mm. Per cent	Silt 0.05-0.002 mm. Per cent	Clay below 0.002 mm. Per cent
921	Baler silty clay loam	19.0	52.0	29.0
915	Bay loam	49.8	28.0	22.2
913	Bigaa loam	27.6	45.8	26.6
1082	Bugko sand	98.0	—	—
572	Buguey loamy sand	82.4	10.0	7.6
922	Catanauan clay loam	28.4	32.0	39.6
907	Laylay silt loam	22.0	61.0	16.4
923	Piris clay loam *	—	—	—
924	Polillo sandy clay loam	55.0	24.0	21.0
5	Quingua silt loam	23.8	56.0	20.0
910	Quingua sandy clay loam	45.6	27.4	27.0
96	San Manuel sandy loam	60.0	29.2	8.8
322	Umingan loam	32.8	49.6	17.6
100	Umingan sandy loam	74.2	20.0	5.8
166	Alaminos clay	24.8	19.4	55.8
798	Alimodian sandy loam	67.8	16.0	16.2
98	Annam clay loam	29.4	42.2	28.4
914	Annam silt loam	27.0	54.0	18.0
912	Antipolo sandy clay	50.0	10.0	40.0
259	Bantay clay loam	22.0	42.0	36.0
647	Bauang clay loam	31.4	38.4	30.2
917	Boac clay	20.0	32.5	47.5
108	Bolinao clay loam	36.0	26.0	38.0
421	Castilla clay	20.5	33.0	46.5
908	Cervantes sandy loam	59.0	26.0	14.2
132	Faraon clay	11.6	34.4	54.0
30	Guadalupe clay loam	37.6	25.8	36.6
616	Guadalupe loam	30.4	42.4	27.2
916	Guimbalaon sandy clay	49.8	12.0	38.2
59	Ibaan loam	32.8	44.6	22.6
909	Ibaan silty clay loam	9.0	52.6	28.4
62	Lipa loam	32.4	41.0	26.6
911	Luisiana sandy clay loam	54.0	20.0	26.0
143	Macolod clay loam	29.6	33.2	37.2
963	Rizal clay	12.5	35.0	53.5
925	Sariaya sandy loam	75.2	16.0	8.8
1114	Sevilla clay loam	40.8	20.6	38.6
926	Siain silt loam	20.4	64.0	15.6
927	Tagkawayan sandy loam	72.0	17.6	10.4
118	Beach sand	93.0	—	—

* No laboratory result reported.

major problems on soils are (a) erosion and runoff, (b) wetness and drainage, and (c) root zone and tillage limitations, such as shallowness, stoniness, droughtiness, and salinity. The subclasses are indicated by "e" for erosion and runoff; by "w" for wetness and drainage; and by "s" for root zone and tillage limitations.

The different land capability classes are as follows:

CLASS A—Very good land; can be cultivated safely; requires only simple but good farm management practices.

CLASS B—Good land; can be cultivated safely; requires easily applied conservation practices.

CLASS C—Moderately good land; must be cultivated with caution; requires careful management and intensive conservation practices.

CLASS D—Fairly good land; must be cultivated with extra caution; requires careful management and complex conservation practices. Best suited to pasture or forest.

CLASS L—Level to nearly level land; too stony or very wet for cultivation. Suited to pasture or forest with good soil management.

CLASS M—Steep, very severely to excessively eroded or shallow for cultivation. Suited to pasture or forest with careful management.

CLASS N—Very steep, excessively eroded, shallow, rough, or dry for cultivation. Suited to pasture with very careful management and definite restrictions. Best suited to forest with very careful management.

CLASS X—Level land, wet most of the time, cannot be economically drained. Suited for farm ponds or for recreation.

CLASS Y—Very hilly, mountainous, barren and rugged. Should be reserved for recreation and wildlife.

LAND CAPABILITY CLASS A

Very good land. Can be cultivated safely. Requires only simple but good farm management practices.

Baler silty clay loam
Quingua silt loam
Quingua sandy clay loam

Class A is level to nearly level land. The soil is deep, fertile or well supplied with plant nutrient elements, well drained, and easy to cultivate.

Erosion is not much of a problem. The land is rarely flooded.

This class is suited for intensive cultivation and all crops common in the area can be grown. Since soils under this class have good permeability, if lowland rice is to be grown, puddling the soil is usually necessary to minimize seepage.

Good farm management practices are required specially the judicious application of agricultural lime and fertilizers and the observance of crop rotation which should include a legume or soil-improving crop in the sequence for sustained production. In consonance with lime and fertilizer application, greater benefits can be derived thereof if green manuring or the plowing under of young green plants, preferably leguminous crops, and the application of farm manure or compost are observed regularly.

LAND CAPABILITY CLASS B, SUBCLASS Be

Nearly level to gently sloping, slightly to moderately eroded. Erosion is the main problem. Observe erosion control measures and easily applied conservation practices.

TABLE 7.—*Land capability classification of the different soil types and miscellaneous land types of Quezon Province.*

Soil Mapping Number	Soil type / miscellaneous land type	Possible soil unit[1] (Slope-erosion class)	Land Capability Class / Subclass
921	Baler silty clay loam	a-0	A
5	Quingua silt loam		
910	Quingua sandy clay		
923	Piris clay loam	b-1	Be
1082	Bugko sand	a-0	Bs
907	Laylay silt loam		
924	Polillo sandy clay loam		
96	San Manuel sandy loam		
100	Umingan sandy loam		
322	Umingan loam		
915	Bay loam	a-0	Bw
913	Bigaa loam		
922	Catanauan clay loam		
30	Guadalupe clay loam		
925	Sariaya sandy loam	c-1	Cs
118	Beach sand	a-0	Ds
572	Buguey loamy sand		
166	Alaminos clay	b-1	Be
798	Alimodian sandy loam		
98	Annam clay loam		
914	Annam silt loam		
912	Antipolo sandy clay		
259	Bantay clay loam	c-1	Ce
647	Bauang clay loam		
917	Boac clay		
108	Bolinao clay loam		
421	Castilla clay	c-2	
908	Cervantes sandy loam	d-1	De
132	Faraon clay		
616	Guadalupe loam		
916	Guimbalaon sandy clay		
59	Ibaan loam	d-2	
909	Ibaan silty clay loam		
62	Lipa loam		
911	Luisiana sandy clay loam		
143	Macolod clay loam	e-0	M
963	Rizal clay		
925	Sariaya sandy loam	e-1	
1114	Sevilla clay loam	f-0	N
926	Siain silt loam	g-0	
927	Tagkawayan sandy loam		
1	Hydrosol	—	X
152	Riverwash	—	Y

[1] The slope-erosion units are possible conditions that may exist in each soil type. Any other unit with a slope or an erosion greater than the ones specified in the table will accordingly be classified under a lower capability class.

Bolinao clay loam
Guadalupe clay loam
Ibaan loam
Ibaan silty clay loam
Lipa loam
Piris clay loam
Rizal clay
Sariaya sandy loam

Subclass Be is nearly level to gently sloping land and is slightly to moderately eroded. It is deep with rather heavy subsoil.

The slope, which in any place is not more than 8 per cent, makes the soil susceptible to moderate erosion.

Crops adapted to the area grown on soils of this subclass respond to good management. However, erosion control measures such as contour plowing, terracing, and strip cropping should be practiced. Excess water on the area and runoff from the adjoining uplands must be channeled into grassed waterways or diversion ditches.

In addition to erosion control measures the proper kind and quantity of fertilizer and lime should be applied. Crop rotation should be observed wherein a legume is included in the sequence at least once in every three or four years for soil building purposes. For all legumes, the soil should be well supplied with lime and a phosphate-carrying fertilizer. If the soil does not contain the right kind of bacteria it should be inoculated accordingly. The use of farm manure or compost is recommended.

LAND CAPABILITY CLASS B, SUBCLASS BS

Nearly level. Low fertility, shallowness, droughtiness, slight alkalinity or salinity is/are the problem/s. Adopt special soil management practices and observe easily applied conservation practices.

Bugko sand
Laylay silt loam
Polillo sandy clay loam
San Manuel sandy loam
Umingan sandy loam
Umingan loam

Subclass Bs is nearly level land with sandy loam or light textured subsoils.

This subclass is potentially good land but the soil is inherently low in fertility and its porous subsoil allows water to percolate rapidly thus making it somewhat droughty. Moreover, fertility loss through leaching is relatively high.

Fruit trees, vegetables, and other truck and special crops are best adapted to this land.

Special soil management practices and the observance of easily applied conservation practices are necessary. To enhance and maintain productivity the plant nutrient and organic matter contents of the soil should be always at their highest possible level. This means using a system of crop rotation

which must include a legume at least once in every three or four years, the addition of farm manure or compost, and the application of mineral fertilizers. Increasing the organic matter content of the soil increases its waterholding capacity and improves its tilth and fertility. Supplemental irrigation may be needed during the dry season for best growth of all crops.

Land Capability Class B, Subclass Bw

Nearly level, occurs in depressions. Occasional overflow is the problem. Requires protection from overflow. Observe easily applied conservation practices.

Bay loam
Bigaa loam
Catanauan clay loam
Guadalupe clay loam

Subclass Bw land is nearly level and occurs in depressions near large streams or on low bottom lands. Included under this subclass are wet lands that can be easily drained and those with a high water table. The soil is deep; the subsoil is heavy.

Poor external and internal drainage require some means to drain the excess water. Furthermore, the area is subjected to occasional overflow.

Lowland rice is especially suited to this land. When properly drained, corn, sugar cane, legumes, and other row crops common in the area may be grown.

Protection from occasional overflow of nearby streams may be needed. Diversion ditches should be constructed for runoff coming from adjoining uplands. When drained and cultivated, lime and the right kind and quantity of fertilizer should be applied. The planting of soil-improving crops and the use of farm manure and compost must be observed.

Land Capability Class C, Subclass Ce

Moderately sloping, moderately to severely eroded. Erosion and fertility are the main problems. Observe erosion control measures, careful management and intensive conservation practices.

Alaminos clay
Alimodian sandy loam
Annam clay loam
Annam silt loam
Antipolo sandy clay
Bauang clay loam
Rizal clay loam
Sariaya sandy loam
Sevilla clay loam
Boac clay
Bolinao clay loam
Cervantes sandy loam
Faraon clay
Lipa loam
Luisiana sandy clay loam
Macolod clay loam
Siain silt loam
Tagkawayan sandy loam

Subclass Ce land is moderately sloping and is moderately to severely eroded. Its effective depth may extend to 90 centimeters or more.

The slope which ranges from 8 to 15 per cent accelerates erosion. In turn erosion depletes fertility.

Primarily, for this subclass, a good cropping system should be planned. The crops grown and tillage methods affect soil condition, and consequently runoff and soil erosion. Different combinations of erosion-prevention and water-control practices should be chosen with the crops to be grown. In general, crops common in the area as well as fruit trees could be cultivated. Close-growing crops with a legume in the rotation should be supported by practices that control runoff and minimize erosion the most important of which are contour tillage, strip cropping, cover cropping, grassed waterways, and terracing. In addition, lime and fertilizer according to needs, should be applied; compost and farm manure should be incorporated into the soil; and green manuring must be observed regularly.

Land Capability Class C, Subclass Cs

Moderately sloping, slightly eroded. Low fertility, rapid permeability, and/or moderate salt content is/are the problem/s. Adopt special soil management practices and observe intensive conservation practices.

Sariaya sandy loam

Subclass Cs land is moderately sloping and slightly eroded. The surface soil is deep; the subsoil is highly permeable. The soil is sandy and droughty.

The retention of moisture in the soil on these well drained sloping land, the improvement and subsequent maintenance of its fertility, and/or keeping the salt content of the soil at the desirable level are the main problems.

Truck crops, orchard, and some root crops are suitable for this land. Clean culture crops may also be planted provided the proper conservation measures are observed.

Green manuring and the incorporation of animal manure and compost into the soil are essential to improve its fertility and increase its water-holding capacity. Contour cultivation, strip cropping and crop rotation are the minimum soil conservation measures required. Lime, if required, the proper kind and and amount of fertilizer should be applied to maintain or improve fertility.

Land Capability Class D, Subclass De

Strongly sloping, severely to very severely eroded. Erosion and fertility are the main problems and the number of years for cultivation limited. Observe erosion control measures; very careful soil management specially good crop rotation, and complex conservation practices if land is to be cultivated. Best suited for permanent crops.

Alaminos clay	Faraon clay
Annam clay loam	Ibaan loam
Annam silt loam	Ibaan silty clay loam
Antipolo sandy clay	Lipa loam
Bantay clay	Luisiana sandy clay loam
Bauang clay loam	Macolod clay loam
Boac clay	Sariaya sandy loam
Bolinao clay loam	Sevilla clay loam
Castilla clay	Siain silt loam
Cervantes sandy loam	Tagkawayan sandy loam

Subclass De is strongly sloping and is severely to very severely eroded land. The topsoil is generally thin; the subsoil is usually heavy and slowly permeable.

The slope, which ranges from 15 to 25 per cent, and the heavy and slowly permeable subsoil induce moderate to excessive runoff. Consequently, the danger of soil erosion is increased. The topsoil being thin, accelerated erosion on this land will be very critical both on the standpoint of effective soil depth and fertility. The lack of soil depth for good root penetration and water intake and storage are added problems to cope with.

To farm this land safely, very careful and good soil management practices should be observed. Subclass De land has definite restrictions and the choice of use is reduced. Planting of row crops is not advisable. When close growing crops are planted, a well planned rotation should be followed. Planting should be along the contour, and before full growth is attained by the plants, mulching is necessary. On the higher slopes a system of properly laid out terraces should be constructed with suitable outlets installed in the absence of natural outlets. Terrace outlets must have vegetative cover, preferably grass, at all times. If grass is not well established, reseeding and fertilizing should be done. All hazards induced by tillage and runoff should be properly appraised and supporting conservation practices instituted accordingly.

When used for orchards contour planting should be observed and a good stand of leguminous cover crop should be maintained. Deep-rooted legumes improve subsoil structure. They keep the subsoil porous for water, roots, and air to get through readily.

Where erosion on a moderately deep soil is not severe, gullies should be smoothened and then seeded to grass or legumes. The soil should be limed and fertilized to give the grass or legume a good start; the legume seeds will need inoculation.

It is best suited to pasture or forest.

Land Capability Class D, Subclass Ds

Nearly level to gently sloping, slightly eroded. Very low fertility, very rapid permeability and low moisture holding capacity, strongly alkaline or high salt content, formation of dunes is/are the problem/s. Adopt special soil management practices and observe complex conservation practices if land is to be cultivated.

Beach sand

Buguey loamy sand

Subclass Ds is nearly level to gently sloping land and is slightly eroded. The surface soil is shallow with sandy to loamy texture; the subsoil is highly permeable.

Relatively, subclass Ds land may be less sloping than subclass Cs land, but for root zone and tillage limitations, the former has more acute problems than the latter. Thus, Ds land is comparatively of lower fertility, or has a more rapid permeability and lower moisture holding capacity, or has a higher salt content than Cs land. Moreover, the formation of dunes through wind action is more likely to happen on land under subclass Ds.

If planted to clean culture crops, soils under this subclass require intensive conservation measures. This subclass may be devoted to vegetables or to truck farming and to root crops provided water supply is adequate and additional measures are taken to increase the water holding capacity of the soil. Increasing the organic matter content of the soil by the application of compost and farm manure and the observance of green manuring are necessary. Other vegetative soil conservation measures to be instituted in conjunction with clean culture cultivation are contour and buffer strip cropping, cover cropping and mulching. Where sand dunes are likely to form vegetative and mechanical means to stabilize the shifting sand must be adopted.

It is not likely that soils under this subclass will need any lime but should it be deemed necessary, lime may be added only after the soil is analyzed. Commercial fertilizers needed would be more of nitrogenous fertilizer for leafy vegetables and ammonium phosphate or complete fertilizers, as soil analysis may show, for the fruiting vegetables.

Land Capability Class M

Steep, very severely to excessively eroded, or shallow for cultivation. Suited to pasture or forest with careful management.

Alaminos clay
Annam clay loam
Annam silt loam
Antipolo sandy clay
Bantay clay
Bauang clay loam
Boac clay
Bolinao clay loam
Cervantes sandy loam
Guimbalaon sandy clay loam
Faraon clay
Luisiana sandy clay loam
Macolod clay loam
Sevilla clay loam
Siain silt loam
Tagkawayan sandy loam

Class M is steep and is very severely to excessively eroded, or shallow land. Stone and gravels may be present.

The slope which ranges from 25 to 40 per cent, and the generally shallow soil make this land unfit for seasonal cultivation. Where climatic conditions are favorable orchards of citrus, coffee, etc., may be developed provided the trees are planted along the contour and a good cover crop is raised to prevent soil erosion.

Land under this capability class is best suited to pasture or forest. When devoted to pasture careful management should be observed. To grow legumes or grass for grazing the soil should be well prepared. Lime and fertilizers, as needed should be applied to give the young legumes or grass a good start. Newly developed pastures should not be grazed heavily; the use of those already established should be controlled and rotated. Stock ponds should be constructed wherever possible. Diversion terraces around the heads of active gullies should be installed. Gullies that are about to develop should be smoothened and sodded.

For forest purposes, trees should be protected from fires; *kaingin* cultivation must be prevented; bare spaces should be planted to trees like *ipil-ipil*.

Land Capability Class N

Very steep, excessively eroded, shallow, rough or dry for cultivation Suited to pasture with very careful management and definite restrictions. Best suited to forest with very careful management and restrictions.

Alimodian sandy loam
Annam silt loam
Antipolo sandy clay
Bauang clay loam
Bantay clay loam
Cervantes sandy loam
Sevilla clay loam
Siain silt loam
Tagkawayan sandy loam
Mountain soils, undifferentiated

Class N is very steep and is excessively eroded land. The soil is very shallow and dry; the land is rugged and broken by many large gullies.

The slope, which is 40 per cent or over, and excessive erosion make this land not suitable for cultivation.

Land under this capability class can be utilized for pasture provided very careful management is observed and definite restrictions imposed. Where grasses grow, grazing must be controlled or restricted to a few heads of animals per hectare and grazing areas rotated regularly. The pasture will need liberal application of fertilizers and lime; reseeding is necessary.

This land is best suited to forest. However, very careful management and restrictions must be observed. The establishment of permanent vegetation, like *ipil-ipil,* is recommended especially in gullied places. *Kaingin* farming must be stopped by all means.

Land Capability Class X

Level land, wet most of the time and cannot be economically drained. Can be used for farm ponds or for recreation.

Hydrosol

Class X is level or slightly depressed land and because of its location and elevation, sea water or fresh water finds passage into the area. In some places the water may flow or drain back to its source with the receding tide while in others the water stagnates. Lands along the shore or very near the sea and at the mouths of rivers and creeks which are accessible to sea water are usually covered by mangroves or nipa palms. Inland areas occupied by fresh water, on the other hand, are covered by grasses. In general, land covered by sea or fresh water part or most of the time is known as a hydrosol area.

This land is suitable for salt beds, fishponds, farm ponds, or recreation, as the case may be.

In the construction of fishponds or salt beds the trees and palms are cut except a strip along the shore line wide enough to protect the site from the scouring action of waves. For fishponds the site should be dug no less than a meter deep. Afterwards, the water should be fertilized to produce a good growth of algae, the food for most fish.

Land Capability Class Y

Very hilly or mountainous, barren and rugged. Should be reserved for recreation and wildlife.

Riverwash

Class Y is extremely arid or very steep, rough and stony land with thin or no soil cover at all. It includes such areas as rocky foot-hills, rough mountainous lands; large areas dotted with rock outcrops or strewn with boulders; and extremely eroded places with exposed substrata.

Land under this capability class is recommended for wildlife and recreation. By all means, existing forests should be preserved; as much as possible, where non-existent, permanent forest vegetation should be established.

II. SOIL EROSION SURVEY

SOIL EROSION DEFINED

Soil erosion is defined as the process of soil detachment and transportation by either wind or water. There are two kinds of erosion; namely, normal or geologic and accelerated erosion.

Normal or geologic erosion.—Normal or geologic erosion takes place in a natural or undisturbed condition under the canopy of forest, grass, ground litter, and in underground network of binding roots. Geologic erosion is a slow process; the removal of the soil by either water or wind is balanced by the formation of soil from the parent material underneath. This kind of erosion is beneficial in the sense that there is a constant renewal of the fertility of the soil.

Accelerated erosion.—Accelerated erosion is the process brought about by man's activities on the land, thereby disturbing the equilibrium between soil building and soil removal. This kind of erosion is destructive as it removes soil particles very much faster than the formation of soils from the material underneath. The loss of the surface soil which contains most of the fertility means also the decline in crop yields. Soil erosion in the Philippines is caused mainly by water. The different kinds of accelerated soil erosion are: sheet, rill, gully, and stream bank erosion.

Sheet erosion.—This is the washing away in a more or less uniform depth, of the upper part of the soil in the croplands. It occurs when farmers cultivate their sloping lands without employing any means of controlling the flow of the surface water or runoff. At the beginning, this kind of erosion is slow and is not noticeable, but it is treacherously destructive.

Rill erosion.—This kind of erosion is the washing off of the soil by the formation of tiny incisions of a few inches depth and width which run down the slopes of an unprotected cultivated land. This is attributed to the method of planning and arranging the furrows along the slope of the land. Such rills may be erased by ordinary plowing. This type of erosion marks the beginning of the formation of more serious kinds of erosion.

Gully erosion.—This erosion occurs on paths of concentrated flow down a slope and is the cutting of deep narrow strips

or gullies on the face thereof. Gullies occur both on alluvial plains as well as on uplands. On a plain where drainage outlets are not protected, the edges of the plain are gradually eroded which consequently form into deep vertical cuts. These gullies, if not checked, gradually destroy the plain. On uplands, gullying occurs mostly on slopes where runoff continually drain. This happens when farmers plow their fields up and down the slopes. Some gullies are small, but others are so big that farm animals cannot cross. Gullies grow bigger each year.

Stream bank erosion.—This kind occurs along the banks of streams and rivers. It is very destructive particularly on such lands where the substrata are of coarse or medium-textured soils. The flowing water undermines the lower part of the river or stream bank particularly along its outer curve thus causing the upper part to fall by its own weight.

FACTORS AFFECTING SOIL EROSION

Soil erosion occurs when water runs over the surface of a sloping land. This water running over the surface is called runoff. The rate of soil erosion will depend upon the speed of surface runoff. The volume of runoff as well as its speed depend upon the soil, slope, vegetation, and intensity of rainfall in the area.

SOIL

The soil possesses certain physical characteristics which influence its erodibility. Under similar conditions of climate, relief, and vegetative cover, there are marked differences in the erodibility of different soils. In some cases sandy loam soils are more susceptible to erosion than clay loam soils.

Porosity and permeability are important factors in the formation of runoff. The higher the absorbing quality of the soil or infiltration of water into the soil the less runoff will be formed. Different soil types differ in porosity and permeability. Also soils rich in organic matter are porous and will absorb more water readily than those poor in it.

SLOPE

Slope has a great influence on erosion. Runoff flows faster on a steeper slope than on one with a lesser grade. Taking other erosion factors equal, soil loss is greatest where runoff

is fastest. Furthermore, on farm lands with the same grades of slopes, one with a longer slope will erode more than one with a shorter slope. This is so because as runoff acquires momentum its cutting power as well as the soil carrying capacity is increased considerably. A slope unprotected by vegetation or some mechanical devices to decrease the velocity of runoff suffers heavily during a heavy rainfall.

VEGETATION

The density of the vegetative cover of an area contributes a great deal to its resistance to erosion. In the heavily wooded portions of our forests the rate of soil loss is balanced by the formation of soil underneath. On the cultivated farms the crops offer very little protection for the soil. Crops that can cover the ground well will give some protection for the soil but clean tilled row crops are conducive to erosion. Land slopes exposed or bare of vegetative cover suffer heavy soil losses.

In the open areas where cogon predominates very little erosion takes place. The thick growth of cogon is quite adequate protection for the land. Even on steep slopes the grass cover if preserved and improved will give good protection.

INTENSITY OF RAINFALL

Rainfall intensity is a factor in erosion. A region with rainfall distributed throughout the year will have less soil erosion than another area where the same amount of rain occurs but within a period of six months. In the latter area the intensity of rainfall is much bigger and hence the amount of runoff is correspondingly greater. In the former case, the intensity of rainfall is less giving more time for the water to infiltrate into the soil, hence, less runoff.

How much of the rain that falls run off the surface is shown by investigation conducted by the United States Department of Agriculture. At the Yazoo River Watershed, 27 inches of rain caused a disastrous flood, where 62 per cent of the rain water immediately ran off cultivated fields and carried soil at the rate of 34 tons per acre. Runoff from plots on barren abandoned fields was 54 per cent of the total rainfall. Surface runoff during the most intense rains

increased from 75 to 95 per cent of the total precipitation. On undisturbed oak forest only 0.5 per cent of the 27 inches of rain ran off the experimental plots while soil removed was only 75 pounds per acre.

FACTORS PROMOTING SOIL EROSION

System of farming lands.—In the province, especially in the upland section, most of the farms are rolling and hilly as coastal plains are few and narrow. These are planted mostly to upland rice, corn, and cassava which are erosion promoting crops. No means of protection is employed in farming these sloping lands. Erosion is aggravated by the common farm practice of plowing up and down the hill and laying the furrows along the slopes.

Crop rotation in the province is seldom practiced. Rice and corn are planted from year to year. Sometimes the field is fallowed after the rice crop. A good rotation of crops which includes a soil building legume helps conserve the soil.

The pasture lands are over-grazed. As a result, hillsides have very scant grass cover and erosion is very much in evidence.

Kaingin or Shifting cultivation.—This is another factor contributing to the destruction of the soil and forest. Very often *kaingin* clearings are more on steep slopes. The trees and other vegetation are burned, leaving the area cleared and entirely bare. When it rains runoff rushes downhill and generates quite a tremendous cutting power that detaches and carries a great deal of surface soil. Rills and sometimes gullies often result after one heavy rain.

SOIL EROSION SURVEY METHODS

The primary purpose of the soil erosion survey is to determine the degree of erosion in the different soils of the province, that is, the extent to which removal of the surface or subsoil has progressed as well as the amount of gullying with special reference to its effect on the cultivation of the land.

The present depths of the different soil types under cultivation in the province were compared to the depths of the virgin soils or soils with normal profiles. The depths of different soils under normal profiles were established after

various determinations over a wide area by boring with the soil auger, studying road cuts, pits, open wells, and stream banks.

Variations in the depths of soil as caused by erosion together with the presence of gullies are considered in mapping the different erosion classes. The depth and frequency of occurrence of gullies are noted as these affect the cultivation of the land. The classification of the different degrees of soil erosion used in this survey are as follows:

Erosion Class	Degree of Erosion	Description
0	No apparent erosion; no gullies.	No apparent erosion; no gullies.
1	Slight erosion	Less than 1/4 of the original surface soil eroded; occasional crossable gullies present.
2	Moderate erosion	From 1/4 to 3/4 of original surface soil eroded.
3	Severe erosion	From 3/4 of original surface soil to 1/4 of subsoil eroded.
4	Very severe erosion	All of the surface soil to 3/4 of subsoil eroded.
5	Excessive erosion	All of the surface soil and over 3/4 of subsoil eroded.
W	Normal erosion	Balance between soil erosion and soil formation is maintained.
Q	Erosion, undifferentiated	Erosion conditions change as often as floods occur.

The extent as well as the degree of soil erosion will increase each year unless control measures are instituted and practiced.

SOIL EROSION IN THE DIFFERENT AREAS

The soils of Quezon Province have undergone erosion (normal or geologic and accelerated) during one time or another. The survey on soil erosion of the province was conducted for the purpose of determining the degree and extent to which each soil type had been subjected. However, due to various attendant factors responsible for erosion as discussed in the preceding section; the report cannot present erosion losses spot by spot, or field but rather in a generalized manner. A given soil type

in one particular place may have lost more soil than one of the same type located elsewhere; or two different but adjacent soil types may have the same degree of erosion losses, or a certain soil type confined in one area could be expected to have different degree of erosion within its boundaries.

The degrees of erosion by which the different soil types in the province have undergone are given in the succeeding table.

EFFECTS OF SOIL EROSION

Soil erosion has an exhausting influence on agriculture. Previously, most of us have had so little concern about its adverse effects; it was only recently that we became aware of the fact that erosion if left uncontrolled will eventually deplete our agricultural lands of their productivity thereby affecting the nation's economic stability and prosperity.

PHYSICAL EFFECTS

Where erosion exists, the first to suffer is the land which is gradually robbed of its surface soil or furrow slice. This means that not only the inherent fertility of the soil is lost but costly commercial fertilizers added are wasted as well. Much more, if the furrow slice shall be comprised less of the surface soil and more of the subsoil which is usually less fertile, there will be greater difficulty in maintaining a satisfactory physical condition of the soil. Moreover, eroded soil materials, such as sand and gravel, have at times covered entire fields of newly cultivated crops causing so much loss in seeding and interference in subsequent cultivation. The objectives of any scheme of soil management, however good, is therefore seriously interfered with. One appreciable effect of soil erosion is the silting up of reservoirs which reduces their storage capacity and adding greatly to the expense of their upkeep. Gullying and stream bank cutting of agricultural lands seriously impair the productive capacity of the farm and the farmer's income suffers an appreciable loss. Likewise, highways near or parallel to stream or river courses suffer from stream bank cutting and those along the hills and mountains suffer from landslides thereby the means of transportation is seriously impeded.

ECONOMIC AND CULTURAL EFFECTS

The adverse effects of accelerated or man-made soil erosion are much too obvious that they need not be over emphasized.

TABLE 8.—*Erosion classification of the different soil and miscellaneous land types of Quezon Province and Aurora Subprovince.*

0-No apparent erosion	1-Slight erosion	2-Moderate erosion	3-Severe erosion	W-Normal erosion
000 Bulan silty clay loam	166 Alaminos clay	108 Bolinao clay loam	108 Bolinao clay loam	912 Antipolo sandy clay
115 Bay loam	798 Alimodian clay loam	641 Batang clay loam		
119 Biga loam	98 Annam clay loam	716 Bosc clay		914 Annam silt loam
1000 Bugallon sand	914 Annam silt loam	1114 Sevilla clay loam		259 Bantay clay loam
172 Bugey loamy sand	912 Antipolo sandy loam	927 Tagkawayan sandy loam		908 Cervantes sandy loam
241 Carmona clay loam	258 Bantay clay loam			911 Luisiana sandy clay loam
36 Gen. Luna clay loam	421 Castilla clay			118 Beach sand
305 Lucay silt loam	908 Cervantes sandy loam			1 Hydrosol
329 Pao clay loam	132 Faraon clay			45 Mountain soils, undifferentiated.
364 Pulilan clay loam	616 Guadalupe loam			
5 Quingua silt loam	916 Guimbalaon sandy clay			
370 Quingua sandy clay loam	59 Ibaan loam			
96 San Manuel sandy loam	909 Ibaan silty clay loam			
399 Umingan sandy loam	62 Lipa loam			
422 Umingan loam	143 Macolod clay loam			
	963 Rizal clay			
	925 Sariaya sandy loam			
	926 Silang silt loam			

Fig. 34.—A severely eroded Bolinao clay loam at Bo. Palale, Tayabas, Quezon with numerous exposed rocks as a result of the unwise use of the land.

Fig. 35.—The *kaingin* system of farming is still practiced in the province. This enhances soil erosion and promotes flood.

Unfortunately, however, most people take the existence of soil for granted, in the manner that almost everyone always indifferently regards the existence of the air we breathe. Whereas our supply of the latter has never been doubted, the certainty of our enjoying the bounty of the former cannot last forever unless we recognize the imminent dangers of soil erosion.

Soil conditions have much to do to shape the pattern of a nation's existence. While we begin by trying to analyze their effects from an agricultural point of view, we ultimately arrive at their economic and social effects as well. This is also because agricultural, economic and social conditions are closely interrelated so much so that it is quite difficult to separate them too sharply. Erodibility being one of the many soil conditions, should ever be borne in mind as much as fertility.

We know that food, shelter, and clothing, man's basic needs, all emanate from the soil. Soil lost to us if taken in terms of the economic value of production of these basic needs surely would amount to enormous figures. The high cost of living may then be partially understood.

We know that while soil loss mounts, there is no sign that population also declines. The tendency is when population increases, people tend to overwork the soil. Overworking the soil inevitably results in the decline of productivity. Soil erosion then commences and if unchecked, the people simply abandon the affected area and move to other places. This may happen once or more than once within a generation. What has started as an agricultural problem also becomes an economic and social problem.

We know that industry, especially the manufacture of consumer goods, is dependent on the supply of various raw materials. By and large, these raw materials are produced from the soil. Industry, therefore, directly and indirectly is affected by soil erosion. In turn when factories shut down or curtail operations, men lose their jobs and another social problem is added.

Soil erosion, therefore, is not the individual farmer's problem alone. While it affects his capacity to provide for his family's wants and meet his social obligations, erosion eventually becomes a community's a province's and finally a nation's agricultural, economic, and social concern.

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METHODS OF EROSION CONTROL

There are two general ways of erosion control in croplands; namely, (1) vegetative measures, and (2) mechanical means. Vegetative measures are simpler and easier to apply, while mechanical means usually require engineering aids, tools, and machinery. The former is usually employed on land that are nearly level to gently rolling, while the latter is adapted to rolling and undulating land. Sometimes both means are employed simultaneously, or one in support of the other depending upon attendant circumstances.

VEGETATIVE MEASURES

Control of erosion by vegetative means deals with the use of plants following the normal farm operations and use of ordinary implements and machinery.

Cover cropping.—Vegetative cover is the first protection against runoff and erosion. Cover crops are usually planted after the harvest of row tilled or seasonal crops. There are also permanent cover crops which are mostly planted in orchards. When planting cover crops mulches of dead stems, leaves, or straw are necessary since cover crops offer protection only after they have attained considerable growth.

Strip cropping.—This vegetative method of erosion control is the alternate cultivation of clean tilled crops on one strip and dense close growing crops on the next strip. These alternate strips break up a relatively large sloping field into small narrow bands lying across the slope. They serve to check the momentum of runoff and to filter out the soil particles. The subsequent loss of the speed of runoff allow rain water to seep into the soil rather than readily flow down the slope. Soil and water are thus conserved.

Buffer strip cropping.—Buffer strips are established bands usually on the contour, two or three meters wide, planted to perennial grass or other erosion-resisting vegetation. They are arranged in regular alternation with relatively wider strips of row tilled crops. Buffer strips are adapted to land with slopes up to eight per cent. When the slope is long, a combination of vegetative and some mechanical means may be necessary. Grasses such as Guinea Grass, Napier, Brown-top, Bermuda Grass, and *Ipil-ipil* (periodically trimmed to about a foot high) are recommended.

Grassed waterways.—Waterways in soils work are either natural or man-made depressions on sloping areas which serve as passageways for water that goes through a farm from adjacent land or accumulating on it due to rain. They are important in any scheme of soil and water conservation. Naturally located depressions serve the purpose best. Man-made canals strategically laid are also necessary for more efficient discharge of runoff. The establishment of a dense vegetative cover over all waterways is imperative. Grasses readily adaptable to the area should be used, but whenever practicable those species which form a dense turf are preferable. Inasmuch as waterways are supposed to carry heavy flows during certain periods they should be designed to handle maximum runoff from the heaviest rainfall occurring in the locality once in about eight to ten years. Grassed waterways are essential wherever excess runoff accumulate such as in strip cropped fields.

MECHANICAL MEASURES

On steep slopes vegetative measures offer inadequate protection for the soil. Mechanical means of erosion control are therefore essential in conjunction with the vegetative phase.

Contour tillage.—Contour tillage is plowing and planting on the contour. This is an erosion control measure which is most effective on two to eight per cent slopes and less than 100 meters long. Ridges formed by the tillage implements retard the downhill flow of water. These ridges serve adequately when rainfall are intense or heavy. Contouring is not enough protection especially when slopes are not uniform and above eight per cent, when the fields are already eroded, or when subsoils are clayey and compact. In these cases excess runoff may break through the ridges thus necessitating the adoption of other mechanical conservation measures like terracing.

Terracing.—Terraces are mechanical measures of soil conservation and are differentiated into three types; namely, (1) absorptive, (2) bench, and (3) drainage.

Absorptive terrace or ridge type is designed for moisture conservation. It is adapted to gentler slopes and absorptive soils.

Bench terrace is constructed on the contour. It has a steep drop and adapted to steeper slopes.

Drainage terrace or broad channel type is designed to conduct water from a field at low velocity.

As used in this text, terrace may denote a ridge type or a combination of ridge and channel type.

Terraces are built across a slope. They are either level or graded depending upon the purpose for which they are made. Graded terraces lead runoff from the field at nonerosive velocities. Level terraces impound most of the water giving it time to soak into the soil. Where the average annual rainfall is less than 30 inches, level terraces are recommended. Dimensions of terraces are also of utmost importance. They should be large enough to avoid overtopping. Usually the runoff which may be expected from the heaviest rain occurring on an average of once in 10 years is used as a basis. Their shape is generally based on the farming equipment used.

Terrace construction requires technical skill, financing, and special implements and machinery. Aside from these considerations, one must realize that all slopes and all soils cannot be successfully or economically terraced. Sandy, stony, and shallow soils, fields dotted by humps or mounds, or slopes that change planes and steepness every 30 meters are impractical to build terraces on.

Diversion ditches.—Diversion ditches or diversion terraces are built to intercept the runoff from drainage areas. They are usually larger than field terraces. They are designed to protect cultivated fields from hillside runoff by providing for a passageway of the water away from the fields to other nearby areas where it is spread or dispersed. Where adjacent slopes generate runoff towards a terraced area, diversion ditches carry the water away from the terrace system, or if towards a gully diverting the water assist in controlling its further enlargement.

OTHER ASPECTS OF EROSION CONTROL

Whereas erosion depletes the soil of its inherent fertility, low fertility also brings about soil erosion. Infertile soils invariably mean poor vegetation, thus more surface soil is exposed to direct rain and wind action. Therefore, soils of low fertility when tilled are highly erodible. In this case proper and adequate fertilization can minimize erosion.

The regular application of farm manures and the practice of green manuring increase the soil's organic matter content.

Organic matter, aside from enhancing soil fertility, also improves tilth and maintain if not improve soil structure. Stable and favorable soil structure means higher porosity and better permeability. When soils are porous and permeable plant root penetration is improved. All of these favorable physical conditions when attained promote the soil's water absorbing and water holding capacities or in other words surface runoff is minimized.

Crop rotation should essentially be a part of every farm program. A well planned scheme of crop rotation, aside from providing a practical means of utilizing green manures and fertilizers, counteracting possible development of toxic substances, and improving crop quality and increasing yields, also minimize or help control erosion. This farm practice keeps the soil in suitable physical condition, helps maintain the supply of organic matter and nitrogen in the soil, provides vegetative cover, and changes the location of the feeding ranges of roots.

The physical effects of liming such as the promotion of soil granulation of fine textured soils and the modification and improvement of the structure of coarse textured soils thus making them lighter to work subsequently contribute much to erosion control.

An efficient system of soil management in support to vegetative and mechanical measures is necessary to combat soil erosion. The different practices followed or adopted should form a farm program that as a unit could fit the kind of soil within a farm so that the end attained is the combined beneficial effects of the many interacting processes involved. Each farmer, therefore, should first appraise the erosion hazards of his farm, then plan a cropping system and supporting conservation practices to reduce or offset the erosion hazards.

GLOSSARY OF COMMON ECONOMIC PLANTS FOUND IN QUEZON PROVINCE

Common name	Scientific name	Family
Abaca	*Musa textilis* Nee	Musaceæ
Acasia (Rain tree)	*Samanea saman* (Jacq.) Merr.	Leguminosae
Achuete	*Bixa orellana* Linn.	Bixaceæ
Adelfa	*Nerium indicum* Mill.	Apocynaceæ
Agas	*Rhynchospora corymbosa* (Linn.) Britt.	Cyperaceæ
Agoho	*Casuarina equisitifolia* Linn.	Casuarinaceæ
Akle	*Albizzia acle* (Blco.) Merr.	Leguminosæ
Alibangbang	*Bauhinia malabarica* Roxb.	Leguminosæ
Almon	*Shorea eximia* (Miq.) Scheff.	Dipterocarpaceæ
Alugbati	*Basella rubra* Linn.	Basellaceæ
Ampalaya	*Momordica charantia* Linn.	Cucurbitaceæ
Amugis	*Koordersiodendron pinnatum* (Blco.) Merr.	Anacardiaceæ
Anahaw	*Livistona rotundifolia* (Lam.) var. *luzonensis* Becc.	Palmæ
Agingai	*Rottboellia exaltata* Linn. f.	Gramineæ
Anonang	*Cordia dichotoma* Forst. f.	Borraginaceæ
Anonas	*Anona reticulata* Linn.	Anonaceæ
Antipolo	*Artocarpus blancoi* (Elm.) Merr.	Moraceæ
Api-api	*Avicennia officinalis* Linn.	Verbenaceæ
Apitong	*Dipterocarpus grandiflora* (Blco.)	Dipterocarpaceæ
Aroma	*Acasia farnesiana* (Linn.) Willd.	Leguminosæ
Arrow root	*Maranta arundinaceae* Linn.	Marantaceæ
Atis	*Anona squamosa* Linn.	Anonaceæ
Avocado	*Persia americana* Mill.	Laureaceæ
Azucena	*Polianthes tuberosa* Linn.	Amaryllidaceæ
Bakawan-babae	*Rhizophora mucronata*	Rhizophoraceæ
Balabalangutan	*Cyperus haspan* Linn.	Cyperaceæ
Balete	*Ficus benjamina* Linn.	Moraceæ
Balingbing	*Averrhoa carambola* Linn.	Oxalidaceæ
Bamboo	*Bambusa spinosa* Roxb.	Gramineæ
Banana (Bungulan)	*Musa sapientum* Linn. var. *saveolens*	Musaceæ
Banana (Saba)	*Musa sapientum* Linn. var. *compressa*	Musaceæ
Banaba	*Lagerstroemia speciosa* Linn. Pers.	Lythraceæ
Bandera espanola	*Canna flaccida* Salisb.	Cannaceæ
Bangkal	*Nauclea orientalis* Linn.	Rubiaceæ
Banuyo	*Albizzia acle* (Blco.) Merr.	Leguminosæ

Batad (Sorghum)	*Andropogon sorghum* (Linn.) Brot.	Gramineæ
Begonia	*Bigonia spp.*	Begoniaceæ
Beet	*Beta vulgaris* Linn.	Chenopodiaceæ
Bermuda grass	*Cynodon dactylon* (Linn.) Pers.	Gramineæ
Betel nut	*Areca catechu* Linn.	Palmæ
Biga	*Alocasia macrorrhiza* (Linn.) Schott	Araceæ
Bignai	*Antidesma bunius* (Linn.) Sprcng.	Euphorbiaceæ
Binayuyo	*Antidesma ghaesembilla* Gaertn.	Euphorbiaceæ
Boho	*Schizostachyum lumampao* (Blco.) Merr.	Gramineæ
Bougainvilla	*Bougainvillaea spectabilis* Willd.	Nyctaginaceæ
Breadfruit	*Artocarpus communis* Forst.	Moraceæ
Bulang	*Panicum colonum*	Gramineæ
Buri	*Corypha elata* Roxb.	Palmæ
Buyo	*Piper betle* Linn.	Piperaceæ
Cabbage	*Brassica oleracea* var. *capitata* Linn.	Cruciferæ
Cacao	*Theobroma cacao* Linn.	Sterculiaceæ
Cadena de amor	*Corulum leptopus* (Hook & Arn) Stuntz.	Chenopodiaceæ
Cahel	*Citrus aurantium* Linn.	Rutaceæ
Caimito	*Chrysophyllum cainito* Linn.	Sapotaceæ
Calopogonium	*Calopogonium muconoides* Desv.	Leguminosæ
Camote	*Ipomoea batatas* Linn.	Convolvulaceae
Campanilla	*Allamanda cathartica* Linn.	Apocynaceæ
Cadios	*Cajanus cajan* (Linn.) Millsp.	Leguminosæ
Carrot	*Daucus carota* Linn.	Umbelliferæ
Cashew	*Anacardium occidentale* Linn.	Anacardiaceæ
Cassava	*Manihot esculenta* Grantz.	Euphorbiaceæ
Cauliflower	*Brassica oleracea* Linn. var. *acephala* D. C.	Cruciferæ
Celery	*Apium graveolens* Linn.	Umbelliferæ
Champaca	*Michelia champaca* Linn.	Magnoliaceæ
Chayote	*Sechium edule* Sw.	Cucurbitaceæ
Chicharo	*Pisum sativum* Linn.	Leguminosæ
Chichirica	*Catharanthus roseus* (Linn.) Don.	Apocynaceæ
Chico	*Achras zapota* Linn.	Sapotaceæ
Coconut	*Cocos nucifera* Linn.	Palmæ
Cock's comb	*Celosia cristata* Linn.	Amaranthaceæ
Coffee arabica	*Coffea arabica* Linn.	Rubiaceæ
Coffee	*Coffea spp.* Linn.	Rubiaceæ
Cogon	*Imperata cylindrica* (Linn.) Beauv.	Gramineæ
Corn	*Zea mays* Linn	Gramineæ
Cosmos	*Cosmos sulphureus* Cav.	Compositæ
Cotton	*Gossypium spp.*	Malvaceæ
Cowpea	*Vigna sinensis* (Linn.) Savi.	Leguminosæ

Dahlia	*Dahlia variabilis Desf.*	Compositæ
Dama de noche	*Cestrum nocturnum* Linn.	Solanaceæ
Dao	*Dracontomelum dao* (*Blco.*) Merr. and Rolfe	Anacardiaceæ
Dayap	*Citrus aurantifolia* (Christm.) Swingle	Rutaceæ
Derris	*Derris eliptica* (Roxb.) Benth.	Leguminosæ
Dita	*Alstonia scholaris* Linn. R. Br.	Apocynaceæ
Duhat	*Eugenia cumini* (Linn.) Druce	Myrtaceæ
Dungon-late	*Heritiera littoralis* Dryand	Sterculiaceæ
Eggplant	*Solanum melongena* Linn.	Solanaceæ
Ferns (lagolo)	*Achrostichum aureum* Linn.	Polypodiaceæ
Fire tree	*Delonix regia* (Boj.) Raf.	Leguminosæ
Gabi	*Colocasia esculenta* (Linn.) Schott & Endl.	Araceæ
Garlic	*Allium sativum* Linn.	Liliaceæ
Gatas-gatas	*Euphorbia pilulifera* Linn.	Euphorbiaceæ
Ginger	*Zingiber officinale* Rosc.	Zingiberaceæ
Gisok	*Shorea astylosa* Foxw.	Dipterocarpaceæ
Gladiolus	*Gladiolus segetum* ker.	Iridaceæ
Gorong-gorong	*Crotolaria saltiara* Andr.	Leguminosæ
Granada	*Punica granatum* Linn.	Punicaceæ
Guava	*Psidium guajava* Linn.	Myrtaceæ
Guayabano	*Anona muricata* Linn.	Anonaceæ
Guijo	*Shorea guiso* (Blco.) Blm.	Dipterocarpaceæ
Gumamela	*Hibiscus rosa sinensis* Linn.	Malvaceæ
Ipil	*Intsia bijuga* (Colebr.) O Ktze.	Leguminosæ
Ipil-ipil	*Leucaena glauca* (Linn.) Benth	Leguminosæ
Jackfruit	*Artocarpus heterophyllus* Lam.	Moraceæ
Kakauati	*Gliricidia sepium* (Jacq.) Steud.	Leguminosæ
Kalabasa	*Cucurbita maxima* Duchesne	Cucurbitaceæ
Kalachuchi	*Plumiera acuminata* Ait.	Apocynaceæ
Kaldis (Kadios)	*Cajanus cajan* (Linn.) Millsp.	Leguminosæ
Kalamansi	*Citrus microcarpa* Bunge	Rutaceæ
Kalumpang	*Sterculia cuneata* R. Br.	Sterculiaceæ
Kamachile	*Pithecolobium dulce* (Roxb.) Benth.	Leguminosæ
Kamagong (Mabolo)	*Diospyros discolor* Willd.	Ebenaceæ
Kamansi	*Artocarpus communis* Forst.	Moraceæ
Kamia	*Hedychium coronarium* Koen.	Zingiberaceæ
Kamias	*Averrhoa bilimbi* Linn.	Oxalidaceæ
Kangkong	*Ipomoea aquatica* Forsk.	Convolvulaceae
Kaong	*Arenga pinnata* (Wurmb.) Merr.	Palmæ
Kapok	*Ceiba pentandra* (Linn.) Gaertn.	Bombacaceæ
Katmon	*Dillenia philippinensis* Rolfe	Dilleniaceæ

Katuray	*Sesbania grandiflora* (Linn.) Pers.	Leguminosæ
Kinchai	*Apium graveolens* Linn.	Umbelliferæ
Kondol	*Benincasa hispida* (Thumb.) Cogn.	Cucurbitaceæ
Kudzu	*Pueraria javanica* Benth.	Leguminosæ
Lanzones	*Lansium domesticum* Correa	Meliaceæ
Lauan (white)	*Pentacme contorta* (Vid.) Merr. & Rolfe.	Dipterocarpaceæ
Lemon	*Citrus limon* Burn. f.	Rutaceæ
Lettuce	*Lactuca sativa* Linn.	Compositæ
Linga	*Sesamum orientale* Linn.	Pedaliaceæ
Lotus	*Nelumbium nelumbo* (Linn.) Druce	Nymphæaceæ
Lumbang	*Aleurites moluccana* Willd.	Euphorbiaceæ
Luya-luya	*Panicum repens* Linn.	Gramineæ
Macopa	*Syzygium samarangense* (Blume.) Mern & Perry	Myrtaceæ
Madre cacao	*Gliricidia sepium* (Jacq.) Steud	Leguminosæ
Maguey	*Agave cantala* Roxb.	Amaryllidaceæ
Makahiya	*Mimosa pudica* Linn.	Leguminosæ
Malunggay	*Moringa oleifera* Lam.	Moringaceæ
Mandarin	*Citrus nobilis* Lour.	Rutaceæ
Mani-manian	*Desmodium capitatum* (Burm. f.) D. C.	Leguminosæ
Manggachapui	*Hopea acuminata* Merr.	Dipterocarpaceæ
Mango	*Mangifera indica* Linn.	Anacardiaceæ
Marang	*Artocarpus odoratissima* Blco.	Moraceæ
Melon	*Cucumis melo* Linn.	Cucurbitaceæ
Millet	*Panicum miliaceum Linn.*	Gramineæ
Molave	*Vitex parviflora* Juss.	Verbenaceæ
Morning glory	*Ipomoea murpurea* (Linn.) Roth.	Convolvulaceæ
Mungo	*Phaseolus aureus* Roxb.	Leguminosæ
Mustard	*Brassica integrifolia* (West) O. E. Schulz	Cruciferæ
Nangka	*Artocarpus heterophyllus* Lam.	Moraceæ
Nipa	*Nypa fruticans* Wurmb.	Palmæ
Okra	*Abelmoschus esculentus* (Linn.) Moench.	Malvaceæ
Onion	*Allium cepa* Linn.	Liliaceæ
Orange (cahel)	*Citrus aurantium* Linn.	Rutaceæ
Pagat-pat	*Sonneratia caseolaris* (Linn.) Engl.	Sonneratiaceæ
Pako	*Athyrium esculentum* Copel.	Polypodiaceæ
Pakol	*Musa errans* (Blco.) var. *botoan* Teo.	Musaceæ
Palosapis	*Anisoptera thurifera* (Blco.) Blm.	Dipterocarpaceæ
Pandan	*Pandanus copelandii* Merr.	Pandanaceæ
Papaya	*Carica papaya* Linn.	Caricaceæ
Patani	*Phaseolus lunatus* Linn.	Leguminosæ

Patola	*Luffa cylindrica* (Linn.) M. Roem.	Cucurbitaceæ
Peanut	*Arachis hypogaea* Linn.	Leguminosæ
Pepino	*Cucumis sativas* Linn.	Cucurbitaceæ
Pepper (Black)	*Piper nigrum* Linn.	Piperaceæ
Pepper (Long)	*Capsicum annuum* Linn. var. *longum* Sendt.	Solanaceæ
Pepper (Sili)	*Capsicum frutescens* Linn.	Solanaceæ
Pepper (Round)	*Capsicum annuum* Linn. var. *grossum* Sendt.	Solanaceæ
Pili-nut	*Canarium luzonicum* (Elm.) A. Gray	Burseraceæ
Pineapple	*Ananas comosus* (Linn.) Merr.	Bromeliaceæ
Pine tree	*Pinus insularis* Endl.	Euphorbiaceæ
Pitcher plant	*Nepenthes alata* Blanco	Nepenthaceae
Poinsettia	*Euphorbia pulcherrima* Willd.	Euphorbiaceæ
Pummelo	*Citrus maxima* (Burm.) Merr.	Rutaceæ
Radish	*Raphanus sativus* Linn.	Cruciferæ
Rambutan	*Nephelium lappaceum* Linn.	Sapindaceæ
Rattan	*Calamus ornatus* Blm.	Palmæ
Red Lauan	*Shorea negrosensis* Foxw.	Dipterocarpaceæ
Rice	*Oryza sativa* Linn.	Gramineæ
Rimas	*Artocarpus communis* Forst.	Moraceæ
Rosal	*Gardenia augusta* (Linn.) Merr.	Rubiaceæ
Sabotan	*Pandanus sabotan* Blco.	Pandanaceæ
Sago	*Metroxylon sagu* Rottb.	Palmæ
Saluyot	*Corchorus olitorius* Linn.	Tilliaceæ
Sambong	*Blumea balsamitera* (Linn.) DC.	Compositae
Sampaguita	*Jasminum sambac* (Linn.) Ait.	Oleaceæ
San Francisco	*Codiaeum variegatum* (Linn.) Blm.	Euphorbiaceæ
Santol	*Sandoricum koetjape* (Burm. f.) Merr.	Meliaceæ
Sincamas	*Pachyrrhizus erosus* (Linn.) Urb.	Leguminosæ
Sineguelas	*Spondias purpurea* Linn.	Anacardiaceæ
Soybean	*Glycine max* (Linn.) Merr.	Leguminosæ
String bean (Sitao)	*Vigna sesquipedalis* Frum.	Leguminosæ
Sugar cane	*Saccharum officinarum* Linn.	Gramineæ
Sun Flower	*Helianthus annuus* Linn.	Compositæ
Talahib	*Saccharum spontaneum* Linn.	Gramineæ
Talisay	*Terminalia catappa* Linn.	Combretaceæ
Tamarind	*Tamarindus indica* Linn.	Leguminosæ
Tambis	*Eugenia aquea* Burm. f.	Myrtaceæ
Tambo	*Phragmites vulgaris* (Lam.) Trin.	Gramineæ
Tangile	*Shorea polysperma* (Blco.) Merr.	Dipterocarpaceæ
Tanglad	*Andropogon citratus* DC.	Gramineæ
Tephrosia	*Tephrosia dichotoma* Desv.	Leguminosæ

Tuhog-dalag	*Cyperus compressus* Linn.	Cyperaceæ
Tiger orchid	*Phalaenopsis schilleriana* Deich b. f.	Orchidaceæ
Tiesa (Canistel)	*Lucuma nervosa* A. DC.	Sapotaceæ
Tindalo	*Pahudia rhomboidea* (Blco.) Praim	Leguminosæ
Tobacco	*Nicotiana tabacum* Linn.	Solanaceæ
Tomato	*Lycopersicum esculentum* Mill.	Solanaceæ
Tugui	*Dioscorea esculenta* (Lour.) Burkill	Dioscoreaceæ
Ubi	*Dioscorea alata* Linn.	Dioscoreaceæ
Upo	*Lagenaria leucantha* (Duch.)	Cucurbitaceæ
Waterhyacinth	*Eichornia crassipes* (Mart.) Solms.	Pontederiaceæ
Water lettuce	*Pistia stratiotes* Linn.	Araceæ
Watermelon	*Citrullus vulgaris* Schrad.	Cucurbitaceæ
Yakal	*Shorea gisok* Forxw.	Dipterocarpaceæ
Yam	*Dioscorea esculenta* (Lour.) Burkill	Dioscoreaceæ
Zacate	*Leersia hexandra* Sw.	Gramineæ
Zinnia	*Zinnia multiflora* Linn.	Compositæ

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