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

Soil Report 42

SOIL SURVEY OF SAMAR PROVINCES PHILIPPINES

Reconnaissance Soil Survey and Soil Erosion Survey

BY

ATANACIO SIMON
Chief of Party

NARCISO M. NATIVIDAD, ROBERTO M. AMABA and TIMOTEO P. DEMEN
Members

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SOIL SURVEY OF SAMAR PROVINCES [1]

CONTENTS

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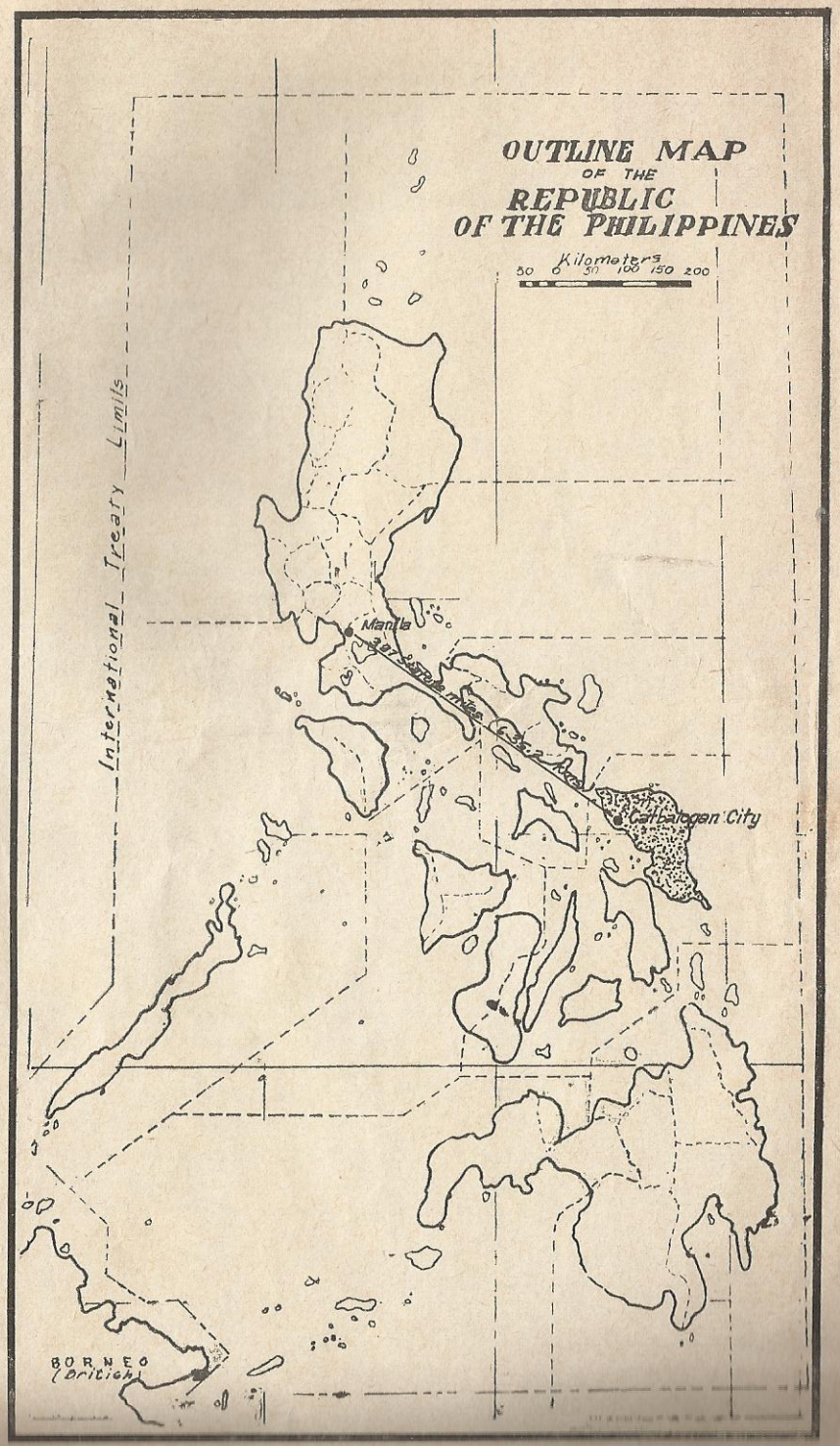

Fig. 1. Outline map of the Republic of the Philippines showing the location Samar Provinces

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DEPARTMENT OF AGRICULTURE AND NATURAL RESOURCES

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Secretary of Agriculture and Natural Resources

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ILLUSTRATIONS

INTRODUCTION

Today, most of the infertile lands—submarginal and severely eroded lands—are the results of man's careless use of the soil. He has, in his haste to provide for his increasing needs, neglected its protection and conservation. For centuries the land has been abused. Realizing his mistakes, man had decided to mend his ways. He changed his attitude towards his land. He has found a way of protecting and conserving the soil. Practices that allow intensive use of the soil to produce at high level while at the same time conserving it are employed now. Sets or combinations of these practices are formulated for a certain land condition, as for instance a sloping slightly eroded land with deep soil, or a piece of land under similar conditions as the former but with shallower soil.

But before these practices can be applied effectively, a good working knowledge of the soil obtaining in a certain land is necessary. For this matter, a soil survey—the basic field study of the soil—has to be undertaken. The data gathered in this study will serve as bases for the formulation of farm and soil management practices suitable for the particular land under study. Furthermore, the agricultural potential of the area can be properly evaluated aside from other benefits that maybe obtained from the said study.

Since the soil resources of Samar are being faced with similar problems existing in other places of the Philippines, a soil investigation, therefore, is a necessity. Hence, a soil classification and erosion survey were conducted in August to December 1952, inclusive, by Messrs. Atanacio Simon, Roberto Amaba and Narciso Natividad; and from March to December 1953, inclusive, by Messrs. A. Simon, N. Natividad and Timoteo P. Demen of the then Bureau of Soil Conservation (now Bureau of Soils) under the directorship of the late Dr. Marcos M. Alicante and during the incumbency of Hon. Juan de G. Rodriguez as Secretary of Agriculture and Natural Resources.

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SUMMARY

Soil classification survey was conducted simultaneously with the soil erosion survey of Samar in 1952 and in 1953.

Samar Provinces consist of the mainland and a number of small islands surrounding the mainland. They lie between 10° 59′ and 12′ 40° north latitude and 124° and 125° 50′ longitude. They are bounded on the northeast by San Bernardino Strait, on the west by Samar Sea, on the southwest by Leyte Gulf, and on the north and east by the Pacific Ocean. Samar Provinces consist of Eastern, Western and Northern Samar. Catbalogan City is the capital of Western Samar, while Catarman and Borongan are the capitals of Northern Samar and Eastern Samar, respectively.

Samar Provinces have generally rugged terrain with restricted plains and valleys. The coastal plains are narrow and discontinuous; the river valleys are low-lying and are often interrupted by hills. The greater portion is rolling, hilly and mountainous. The interior of the mainland consists of highly dissected hills and mountain peaks. Low-lying hills are found in some places such as those found between the coastal plains of Palapag and the river valley of Gamay; between Catubig Valley and Mt. Boboyaon; and, the watersheds of Dolores and Jibatang Rivers.

The rivers found in Samar are relatively long and fairly deep. Most of them are navigable by bancas and the bigger rivers are navigable by launches and boats up to 35 kilometers inland. Transport of agricultural products from the interior towns and barrios are made through these rivers. Most of these rivers can be harnessed for irrigation system and a few for generating power for electricity.

Samar Provinces have adequate water resources. However, in 1953 only four municipalities and two cities have waterworks. Most of the people, especially in the interior barrios, get their water from open dug wells, rivers, springs and creeks, and in some instances, collect rain water for domestic use.

The greater portion of the rolling, hilly and mountainous areas are covered with forest during the time of the survey.

Patches of cogonal and second-growth forest areas are interspersed with cultivated areas in the rolling and hilly lands. The plains and valleys are grown to various crops. Grasses and shrubs are found in the cultivated plains and valleys. Nipa palms and mangroves together with other water-loving plants are found in the swamps.

The development of Samar dates back two centuries after the Spanish discovery of the Philippines. The achievements of the Spaniards were the conversion of the natives to Christianity, and building of churches and fortresses. During the American regime, mass education and building of roads, schools, hospitals and other public works were achieved. Agricultural, industrial, commercial and politico-socio-economic progress were also attained.

The population of Samar in 1918 was 379,575 and in 1939 it was 546,306. In 1948, it rose to 759,212 people, while in 1960 it has reached to 867,994 people.

In 1952, Samar, including Calbayog City, has 12 public high schools, 1,016 elementary schools, 22 privately operated high schools and 10 private colleges. In the school year 1964–'65, the enrollments are as follows: (a) Private—13,095 pupils for elementary, 8,914 students for high school, 2,454 students for collegiate, and 251 students for vocational; and (b) Public—153,283 pupils for elementary and 1,819 students for high school.

In 1953, the transportation facilities are almost inadequate. Almost all the roads are poorly maintained and are often damaged by heavy rains and typhoons. In fiscal year 1964–'65, the existing roads in Samar are as follows: (a) 14.06 kilometers, national road; (b) 577.36 kilometers, provincial road; (c) 37.66 kilometers, city highway; and (d) 181.96 kilometers, municipal roads.

The greater volume of the agricultural products are transported by water vessels. Floating stores are common in Dolores and Oras Rivers. In 1953, only big progressive towns have public markets. Export products are transported directly to Manila and other nearby ports by inter-island vessels. Iron ores from the Samar Mining Company at General MacArthur town are exported to Japan via big Japanese ships.

Farming is the principal industry of the people. Fishing is the next important industry followed by lumbering. Mining

is gaining in importance. The Samar Mining Company in General MacArthur has an employment of about 1,000 laborers in 1953. Mat weaving from *ticog* grass is a lucrative home industry in Samar, especially in the town of Basey. Small scale cheese making from carabao's milk, exists in the towns of Gandara and Villareal.

The second and fourth types of climate prevail in Samar. The second type occurs in Northern Samar, while the fourth type prevails in Eastern and Western Samar.

In 1960, 367,615 hectares of land out of the total area of 1,342,863 hectares, are utilized as farm lands. The ten leading crops are coconut, abaca, rice, camote, corn, banana, gabi, cassava, *galiang* and sugar cane. Coconut (in the form of copra), abaca and banana are the export crops. The rest are raised for local consumption. The total value of the export crops in 1960 is ₱36,927,191.

In 1953, most of the agricultural practices are antiquated. Crude methods are employed in land preparation. No soil conservation measure or practice is employed.

Water control in Samar involves the retention of water in the soil, runoff, irrigation and drainage.

The productivity ratings of the soils, the classification of the soils into land capability classes, and the classification of the different areas into erosion classes, are included in this report.

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

I. RECONNAISSANCE SOIL SURVEY

DESCRIPTION OF THE AREA

Location and extent.—Samar, before its division into Northern, Eastern and Western Samar Provinces, is the third largest island in the Philippine Archipelago. It has an aggregate area of 1,342,863 hectares. It is irregularly shaped and is composed of the mainland and of more than a hundred small islands that dotted practically all directions around the mainland. The approximate locations of these small islands are as follows: Laoang and Batag Islands in the northeastern side; Balicuatro, San Antonio, and Capul Islands in the northwestern side; Buad and Daram Islands in the central western part; and Calicoan and Homonhon Islands in the southeastern tip of the mainland. Samar is approximately located between 10° 59′ and 12° 40′ north latitude, and 124° 00′ and 125° 50′ east longitude. It lies southeast of the Bicol Peninsula and is separated from this region by the San Bernardino Strait; and is northeast of Leyte with the narrow San Juanico Strait lying between the two islands. West of the mainland of Samar is the fish-laden Samar Sea; in the south, the Leyte Gulf; and in the north and east, the Pacific Ocean.

At its longest stretch, from Guiuan to Allen, it measures approximately 253 kilometers; and 90 kilometers at its widest span, from Catbalogan, in the western side, to San Policarpio, in the northeastern point.

Catbalogan City, the commercial center and capital of Western Samar, is 397 statute miles (635.2 Km.) from Manila. Catarman and Borongan Municipalities are the capitals of Northern and Eastern Samar, respectively.

Geology.—Some of the soils found in Samar are geologically young. The youngest among them are the alluvial and marine fans found in the northern side of Samar extending from Bobon to Palapag; in the west central side, bordering the Gandara and Jibatang Rivers, together with the narrow coastal area fringing the coast of Sta. Margarita and Calbayog City; in the southwestern part of the island at Basey Area; in Eastern Samar, bordering the upper courses and lower approaches of

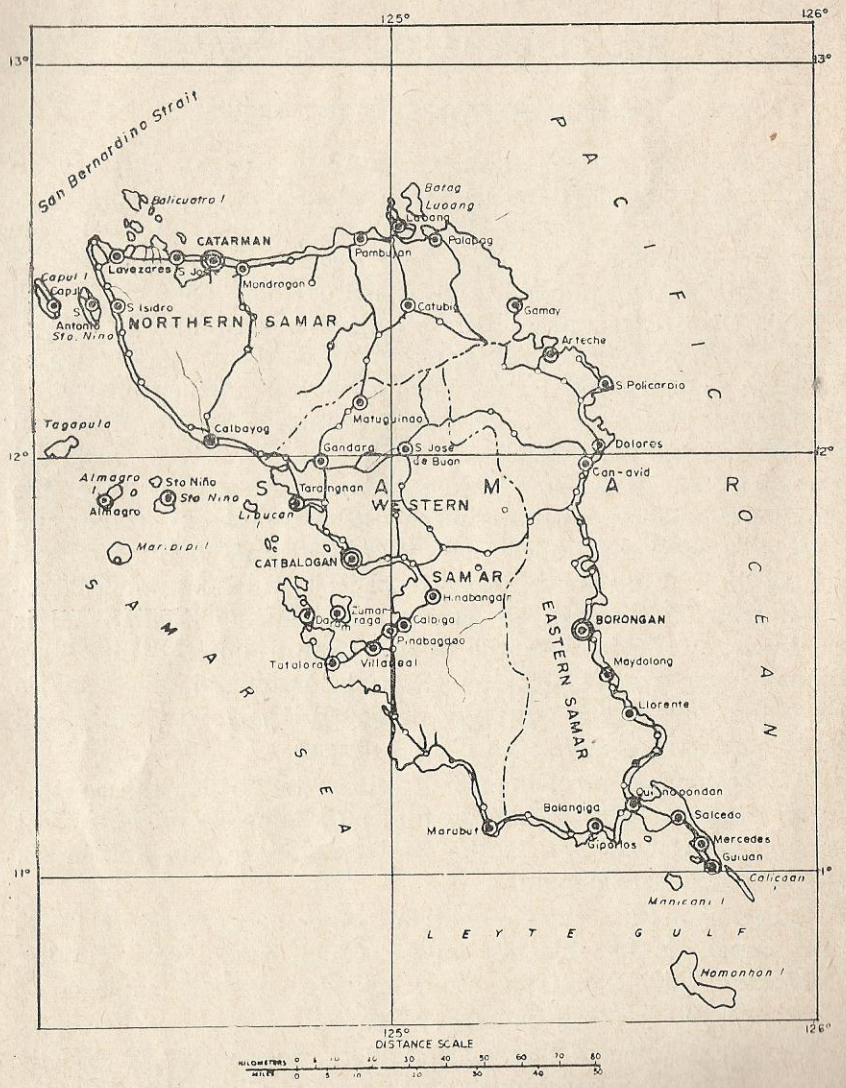

Fig. 2. Map of the Samar Provinces showing the political subdivisions.

Gamay, Oras, Dolores, Ulat, Tubig, Sulat, Borongan, Llorente, Hernani and Pambujan Rivers; and in all the plains in the southern side of Samar, bordering the Quinpundan, Giporlos, Balangiga and Lauaan Rivers. The next older group are the volcanic soils that are found at the northwestern part of Samar from San Jose to Allen and extending southward to Tinambacan, along the western side of Jibatang River; and in the south-

eastern part of Eastern Samar, from Salcedo to General MacArthur and extending westward to Lauaan. This group of soil embraces the central portion of the mainland.

The oldest group of soils occupy the greater portions of Samar. They embrace all the areas not covered by the previously stated two groups of soils. The oldest soils are derived from shales, sandstones and coralline limestone.

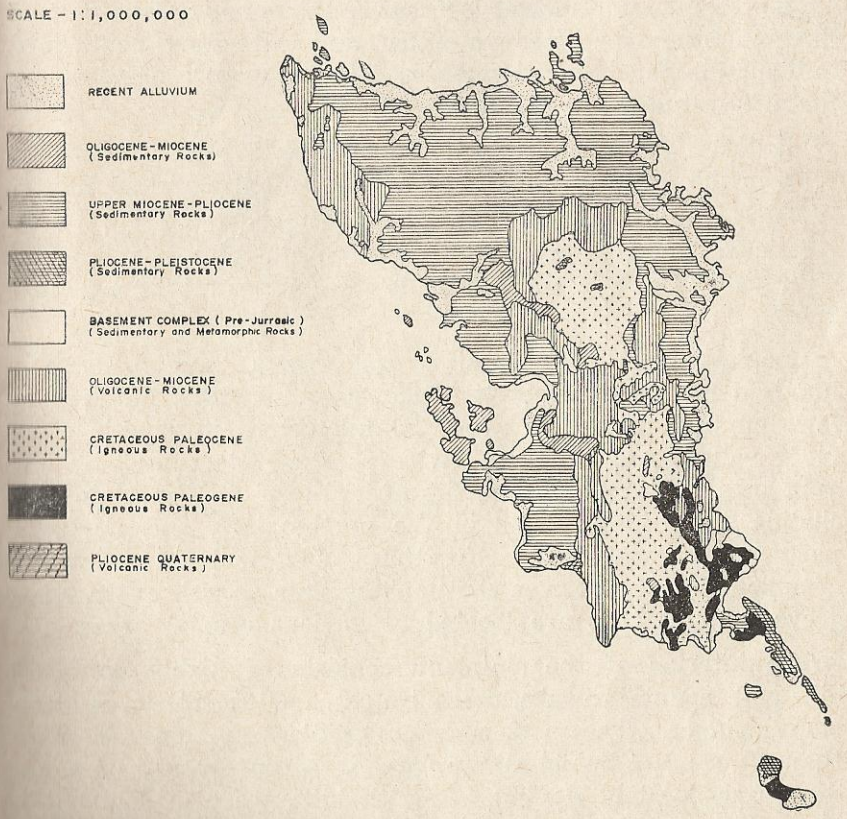

Fig. 3. Geological map of the Samar Provinces.

Recent diastrophic activities played important role in the soil formation in Samar. The presence of marine shell deposits on the beaches, from Sta. Margarita to Calbayog is an evidence of recent uplift. The marine shells underlying the surface soil of Pulupandan soils which are found in the area are further testimonies of such activities.

The coralline limestone rocks found on the rolling areas, hills, and mountains, from Matarinao Bay southward to Calicoan Island, from Hernani to Borongan; and from San Sebastian through Hinabangan and Loquilocon to San Jose de Buan and embracing the eastern part of Matuguinao terminating in the interior of the Catubig River at Pinifisakan Falls, are mute evidences of uplift during mountain formation in Samar.

At present there is no active volcano in Samar. However, volcanic activities have taken place sometime ago as evidenced by the basalts and andesites found in the northwestern part of Samar—from San Jose to Allen and extending southward to Tinambacan. Other evidences are the andesites underlying the substratum of Luisiana series.

Marine, colluvial and alluvial deposits have played important roles in the formation of the relatively limited plains in Samar.

Relief and drainage.—Samar has a rugged topography with restricted and narrow discontinuous coastal plains, and broad river valleys and flats along the lower courses of the principal rivers.

Coastal plains vary in sizes and shapes, ranging from a hundred meters to about ten kilometers in width and from a few hundred meters to about 50 kilometers in length. The river valleys are low-lying and are often interrupted by low hills. This interruption is characteristic of all the plains including the widest plains in the northeastern and northern parts of the mainland. Oftentimes, narrow belts or ranges of small hills dissect even the smallest plain as well as the mangrove swamps that are located at various coastal areas.

The interior of the mainland consists of highly dissected hills and mountain peaks, presenting a complex pattern of steep sloped ridges. The most common gradient of slopes is more than 20 per cent but in many places it is 100 per cent or more, though moderately sloping. Smooth hills are also found. In general, the roughest mountain and the most inaccessible terrain in the interior are found in the southern half of the mainland and in the northwest corner—west of the Calbayog–Catarman Road. The areas with somewhat less rugged topography are those at Mt. Boboyaon—a plateau between the coastal plains of Palapag and of the river of Gamay; the low mountain ranges between Catubig Valley and Mt. Boboyaon; the watershed of the Dolores River which is generally rolling and interrupted by

a few hills; and the watershed of Jibatang River, a low hilly belt east of Calbayog-Catarman Road.

In the vicinities where limestones are exposed, sinkholes, caves and underground streams are found such as the Sohoton Cave in Matuguinao, the unnamed cave in the interior of Bo. Mauo in Allen, and the underground stream in Bo. Casandig at Wright. The exposed part of the underground river serves as the main source of water supply of the inhabitants of the locality.

Generally, the rivers found in Samar are relatively long and fairly deep—seldom more than 8 feet deep. In the upper courses of most of these rivers, waterfalls and rapids are found; while in the downstream, broad and open valleys that develop into river flats near the river mouths are very common. Most of these rivers are navigable by bancas. The larger rivers are navigable from 20 to 35 kilometers inland by launches and boats with six-foot draft, thus, transportation by water compensates the inadequacy of roads in Samar.

The largest and most navigable river in Samar is the Catubig River. This river passes through the towns of Las Navas, Catubig and Laoang. Its widest span, about 500 meters, is near its mouth. This portion of the river provides a good harbor for interisland vessels calling at the island-town of Laoang—a busy port. Launches and boats, of six-foot draft, can easily navigate this river to as far as 35 kilometers inland. This river if properly harnessed could possibly provide power for generating electricity aside from the water it would provide for irrigation. The irrigation water that can be provided by this river to the vast area of rice fields along its course will, no doubt, boosts the rice production in this area thereby making this largest valley of Samar worthy to be called "The Rice Granary of Samar."

Twelve principal rivers and several other minor ones facilitate the natural drainage of the mainland of Samar.

The plains in Samar are practically devoid of adequate drainage in spite of the presence of numerous rivers and their tributaries. The undulating, rolling, and hilly areas that are left bare by the *kaingineros* have excessive runoff which results to severe soil erosion, especially during heavy rains.

The principal rivers in Eastern Samar are Oras, Dolores, Ulat, Tubig, Bihid and Llorente. These rivers rise up from the interior mountain ranges of the mainland such as those in the

districts of Gamay and Hipapad; in Mt. Capotoan and Mt. Canyaba in Matuguinao; in Mt. Yaua in San Jose de Buan; in Mt. Pacgem and Mt. Capoti-an in Concord District; in the mountain ranges in the interior of Wright and in Mt. Catalutuan in Hinabangan; in the mountain ranges in the interior of Llorente; and in Mt. Amangsarahacan in Giporlos. All these rivers drain off to the Pacific Ocean.

The Catarman, Pambujan, Catubig, and Palapag Rivers of Northern Samar have their watersheds in the interior of Sta.

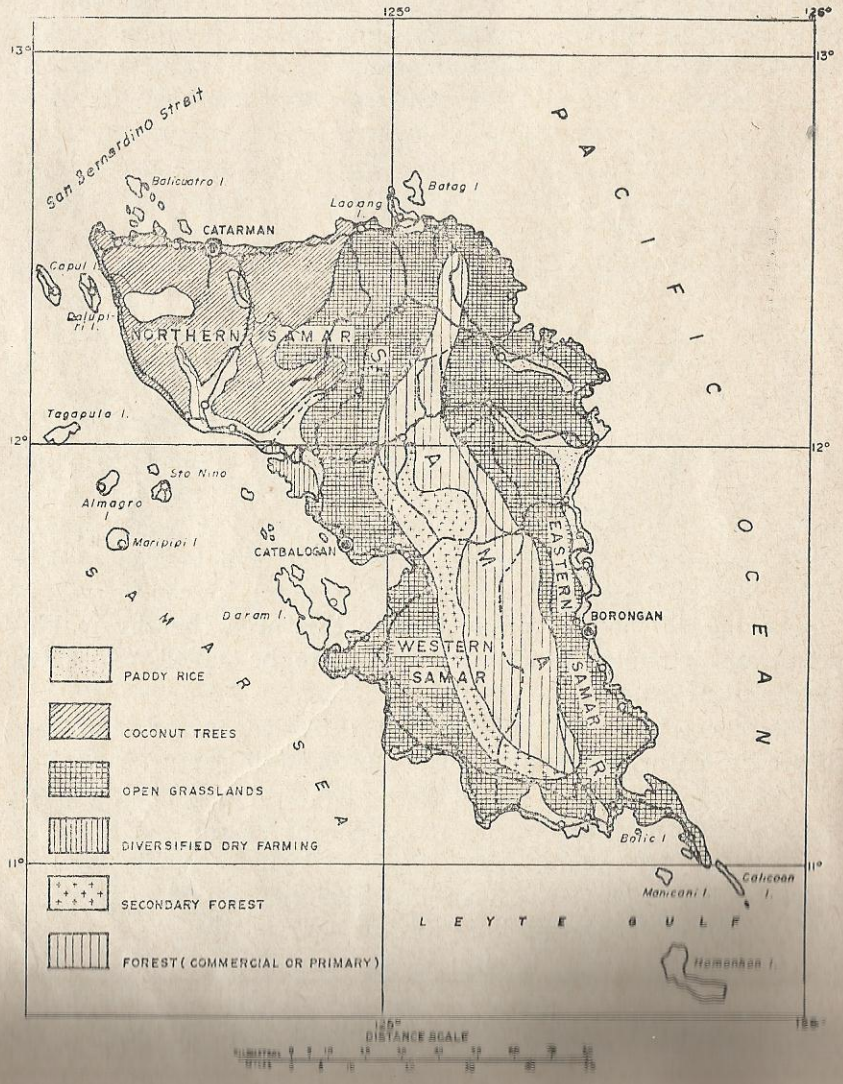

Fig. 4. Vegetation map of the Samar Provinces.

Margarita, Calbayog City and Mondragon; in the interior of Matuguinao and Pambujan; in Mt. Sarawag—the interior of Catubig and Las Navas; and in the interior of Gamay and Palapag Districts. These rivers drain off the northern part of the mainland to the Pacific Ocean in a northward direction.

There are only two important rivers in Western Samar that are of considerable size and navigable—the Jibatang and Gandara Rivers. These two rivers are comparatively short with lesser number of tributaries. They drain the west central portion of Samar and empty into the Samar Sea.

The southern part of the mainland is drained by numerous small rivers that are of minor importance.

Water supply.—Although there are numerous rivers, streams and springs, besides the fairly distributed rainfall through the year in Samar, scarcity of water is felt sometimes in some places of Samar during dry periods. During the survey in 1953, only four municipalities and one city—Basey, Oras, Tarangnan, Wright, and Catbalogan City have waterworks. Pump-wells are found but very inadequate to meet the domestic needs of the people. People in most barrios and even in *poblaciones* obtain their water from rivers, open dug wells, creeks and springs. Some collect rain water and store them in tanks for domestic use. The people in upland barrios depend mainly on rivers, springs, creeks and from rain for the water they use in their homes and for drinking.

Vegetation.—During the soil survey in 1953, majority of the mainland of Samar is still covered with dense forest, especially the steep hills and mountain peaks in the interior. Patches of cogon grass and secondary forest interspersed with cultivated areas are found in the low-lying hills. In the valleys and plains, cultivated crops like rice, coconuts, root crops, abaca, fruit trees, corn, and shrubs and grasses are found while nipa palms and mangroves occupy the numerous swamps. *Talahib, tambo, cogon, and tan-ag* trees are commonly found along the banks of creeks and rivers. In some places species of bamboo are found growing.

Vacant ricefields, and even those that are planted are commonly covered with grasses and weeds, such as *culape, aguingay, talahib, tikiw, bayokibok, ticog,* and other species of grasses.

Organization and population of the area.—Before the Spanish time, Samar had been known by several names like Zamal,

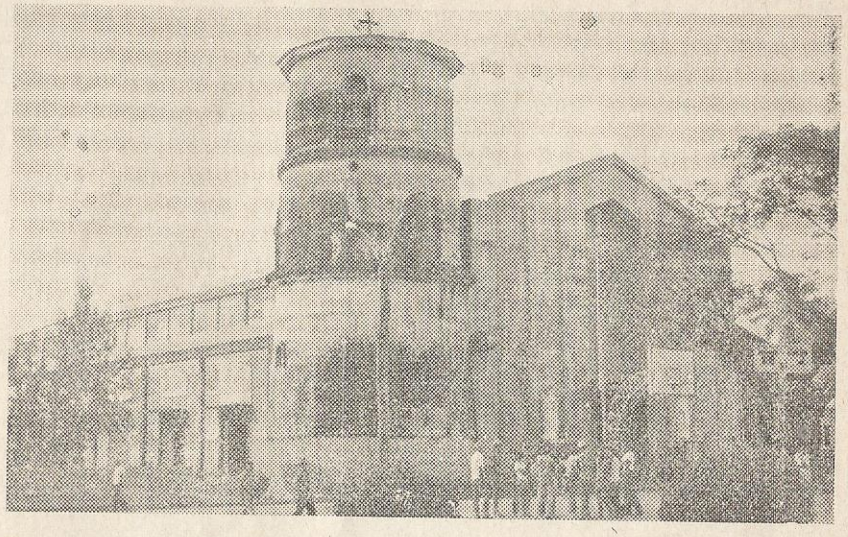

Fig. 5. A Roman Catholic Church at Borongan, Eastern Samar.

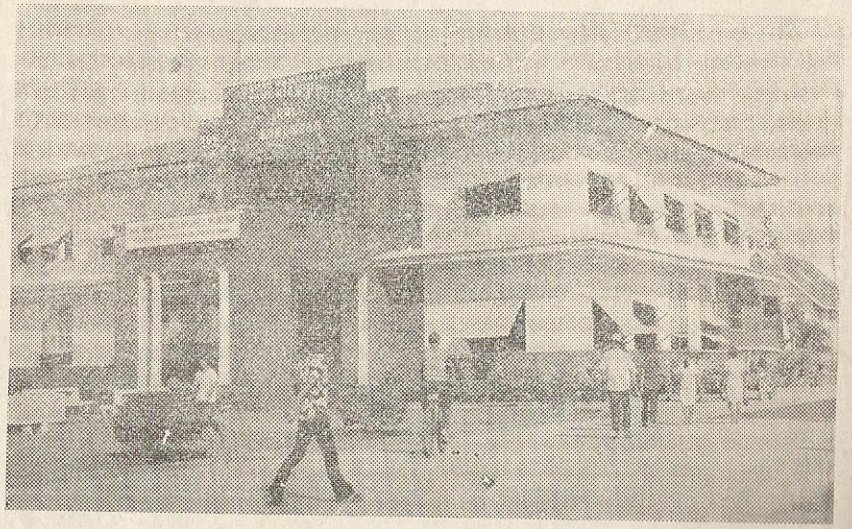

Fig. 6. The Municipal Hall of Borongan, Eastern Samar.

Ibabao or Zimbabao, Achan, and Tandaya. The present name of Samar had originated at the time when the Spaniards landed in Homonhon. As related, the Spaniards upon landing met a native with a wound from whom they asked what was the name of the place. The native, mistaking his wound for what the Spaniards were asking answered *Samad*, a Visayan (Waray)

term for wound. The Spanish navigators missed the word, and then called the place Samar.

In 1735, Samar and Leyte were combined as one province and were under the jurisdiction of Cebu. Carigara, a town in the island of Leyte was the capital. In 1768, Samar was separated from Leyte and Catbalogan became the capital since then. Lately, it was divided into three provinces, namely: Northern, Eastern and Western Samar.

The Spaniards were responsible for the conversion of the natives to Christianity and the building of stone churches, convents, and fortresses.

On June 1, 1649, the Sumoroy Rebellion broke out in Palapag. It was a protest to the Spanish Government against forced labor, collection of tributes, and cruelties of the *guardia civil.* This rebellion had incited other uprisings in the Visayan Islands which caused much harassment to the Spaniards. However, they were suppressed by superior arms.

In the latter part of 1898, all the Spaniards in Samar evacuated to Iloilo. In January 1899, a Provincial Revolutionary Government was organized by General Vicente Lukban, a revolutionist from Luzon. Gen. Lukban took command both of Leyte and Samar. Samar was one of the last two provinces of the Philippines to surrender to the United States Army upon the capture of General Lukban on February 27, 1902.

A *Pulahan* Movement had also occurred in Samar which had started in 1894. The members were called *Pulahanes* because of their red trousers and red bands on their hats. The leaders of the movement were Papa Pablo, Enrique Dagohob, and Antonio Anogar. The *Pulahanes* had caused much disturbances but they were ultimately subdued by the Philippine Constabulary in 1905.

During the American Regime mass education of the people was achieved. Public schools, puericulture centers, hospitals, and radio stations were established. Roads, bridges, artesian wells, causeways, wharves, and other public works were built. Agricultural, industrial, commercial, and politico-socio-economic progress were attained.

Samar was occupied by the Japanese Forces in June 1942. Guerilla activities took place immediately after occupation. Lts. Savellano and Gubatan took the lead in the movement. Capt. Pedro V. Merritt joined them later and assumed com-

mand of the units, the 93rd Infantry Division, USAFFE. Simultaneously, ex-governor Arteche, then elected representative for the second congressional district, organized the Philippine Guerilla Forces. Majors Valley and Albia followed suit by organizing their own units.

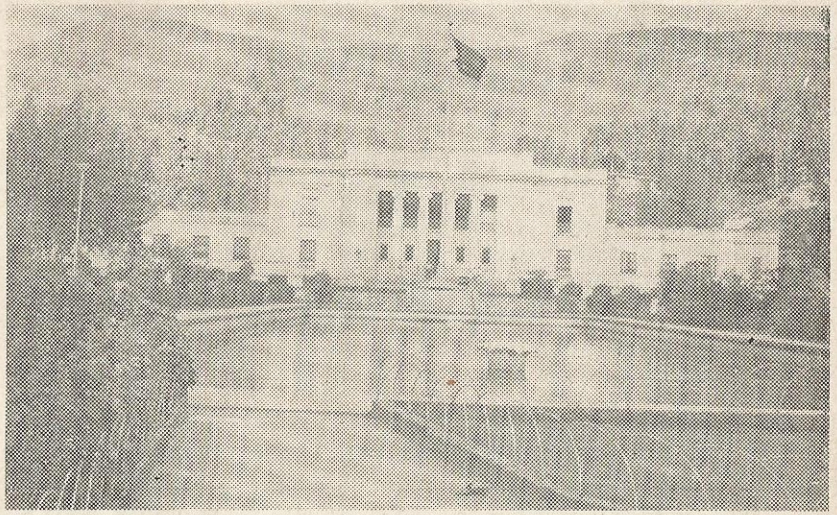

Fig. 7. The Provincial Capitol of Western Samar located at Catbalogan City.

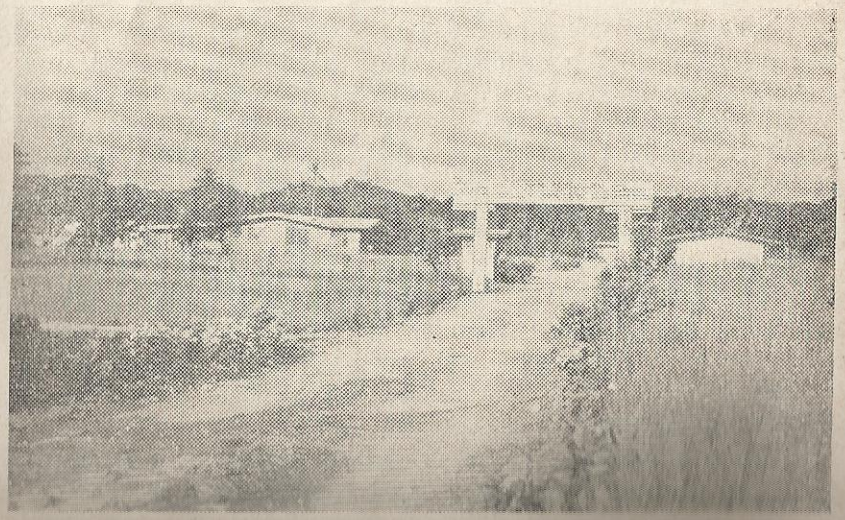

Fig. 8. Maydolong National Agricultural School, Eastern Samar is one of the institutions devoted to teaching agriculture.

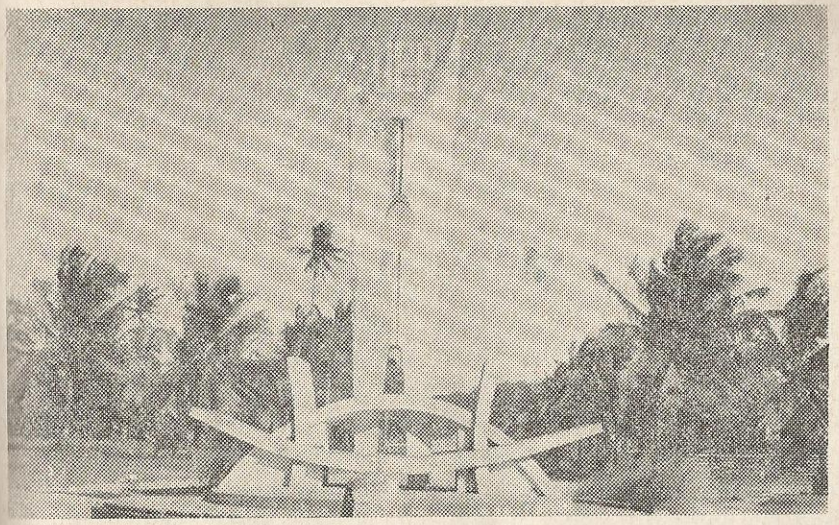

Fig. 9. Agriculture and non-agriculture courses are offered at the University of Eastern Philippines, Catarman, Northern Samar.

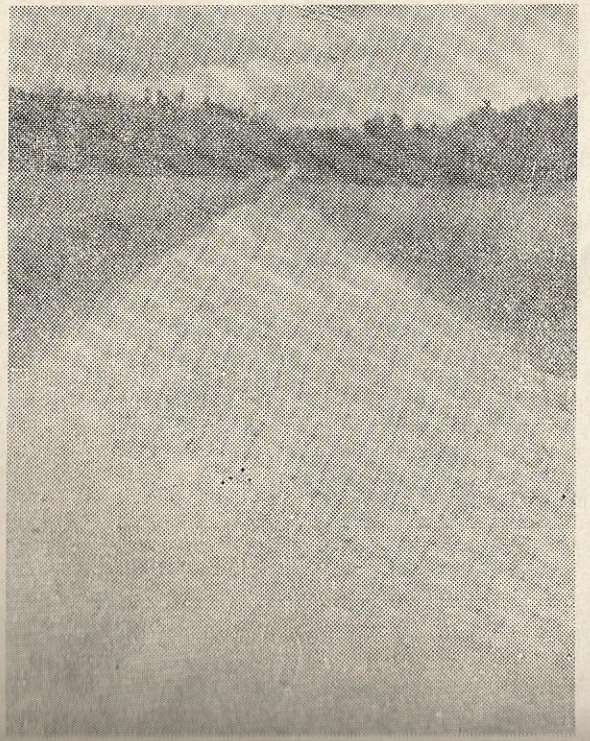

Fig. 10. A portion of the provincial road (Macadam) in Northern Samar.

The Allied Intelligence Bureau unit from Australia, led by Major Smith, which landed in Samar in December 1943, had helped much in paving the way for the final landing of the American Liberation Forces in Leyte in 1944. When Major Smith was assigned elsewhere, Lt. Col. Juan Causing took command of the entire guerilla forces of Samar until liberation time.

The American Liberation Forces landed in Catbalogan in December 1944 unopposed. From then on the unprecedented progress in Samar took place. Old roads and bridges were repaired and new ones were constructed. Among the new bridges built are those spanning across Can-avid, Gandara, Catarman, Pambujan, Taft and Borongan Rivers. Later, Samar became a first class A province. It has 59 municipalities including municipal districts and two chartered cities, Calbayog and Catbalogan.

In 1918, the population of Samar was 379,575 people, then it rose to 546,306 in 1939 and continued increasing to 757,212 in 1948. In 1948, Samar was 7th place in Philippine population, however, it became 10th place in 1960 with 867,994 people.

In 1952, Samar including Calbayog City, has 12 public high schools and 1,016 elementary schools with an enrollment of 130,588 children, manned by 3,096 public school teachers; and 22 private schools and 10 private colleges that offer secondary and collegiate courses (Table 1).

TABLE 1. —*Schools in Samar and Calbayog City as of August 1952.* [1]

Name of School	Samar	Calbayog City	Total
Public High Schools	11	1	12
Public Elementary Schools	928	88	1,016
Public School Teachers	2,853	243	3,096
Public School Pupils	120,099	10,489	130,588
Private High Schools	22	0	22
Private Colleges and High Schools combined	8	2	10

[1] Data supplied by the Office of the Division Superintendent, Catbalogan, Samar.

In the school year 1963–'64, the enrollment in Samar and Calbayog City as recorded in the Yearbook of Philippine Statistics of 1966, published by the Bureau of the Census and Statistics are as follows:

School Level	Private	Public
Primary	13,392	122,812
Intermediate	513	30,471
Secondary	8,914	1,819
Collegiate	2,454	.....
Special Vocational	251	.....
Total	25,524	155,102

Transportation and market.—The complicated terrain in Samar has hampered the establishment of an easy and safe means of land transportation. The existing roads are mostly narrow, rough, bumpy and frequently zigzag along their courses. Road maintenance in Samar is expensive because frequent heavy downpours and typhoons often destroy the roads and the bridges, and the culverts are often washed out. In places, where road-cuts are steep, landslides often occur. Good roads are found only in the big towns and along the coast on sandy beaches.

Catarman, the capital of Northern Samar, is linked to Catbalogan City, the capital of Western Samar, by the national road that traverses through Gandara, Sta. Margarita, Calbayog and Oquendo. At Catarman the road branches in two directions, westward branch goes to Barrio Rawis of Laoang.

The national road from Catbalogan that goes southward, branches at Wright. The one that goes eastward connects all the towns along the eastern and southeastern coast. The road that branches southward links all the towns along the southwestern coast. Leyte is connected to Samar by means of a ferry boat that crosses the San Juanico Strait from Sitio La Paz in Samar to Bo. Ubon in Leyte. A bridge that will connect Samar to Leyte is now under construction. This will bolster the present means of transportation between the two islands.

In 1953, about two-thirds of the entire coastline of Samar were traversed by roads. However, most of these roads are not passable immediately after heavy rains and typhoons. Some towns and barrios are linked to the main highway by feeder roads. Some feeder roads were under construction and many were still in the blue print stage. A road that would connect the Catubig–Las Navas valley, the "Rice granary of

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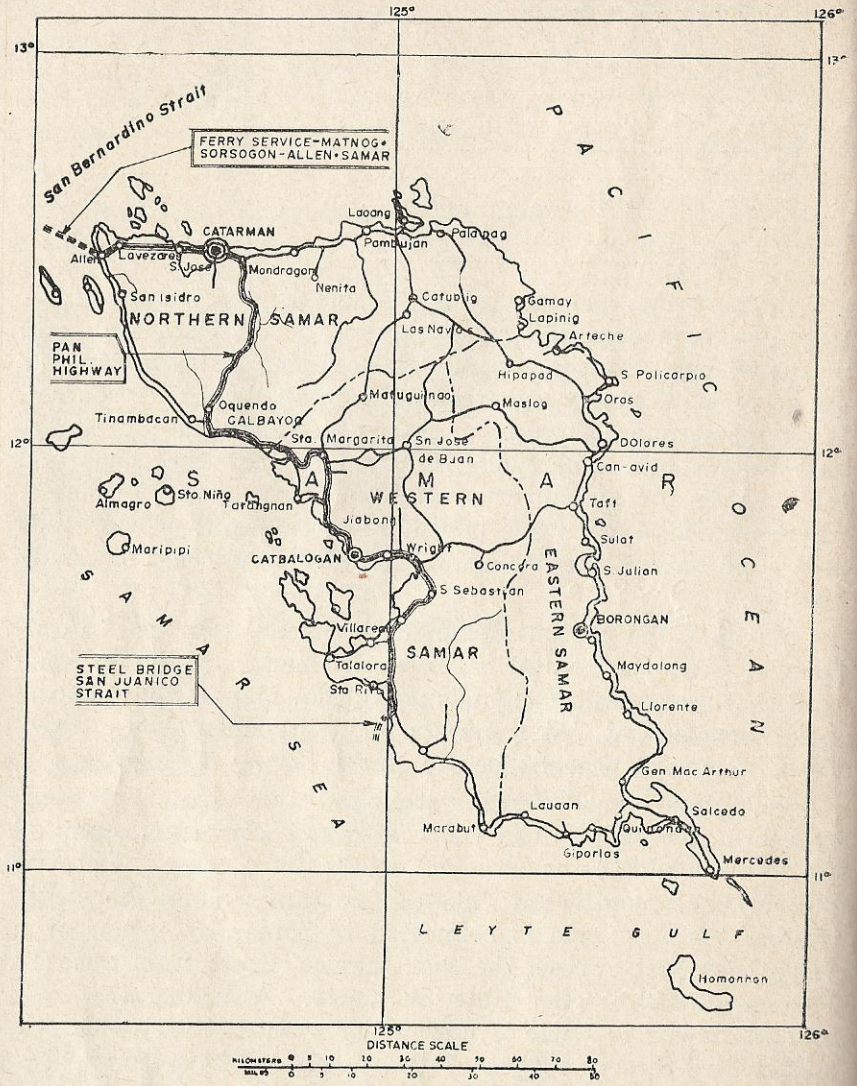

Fig. 11. Road map of the Samar Provinces.

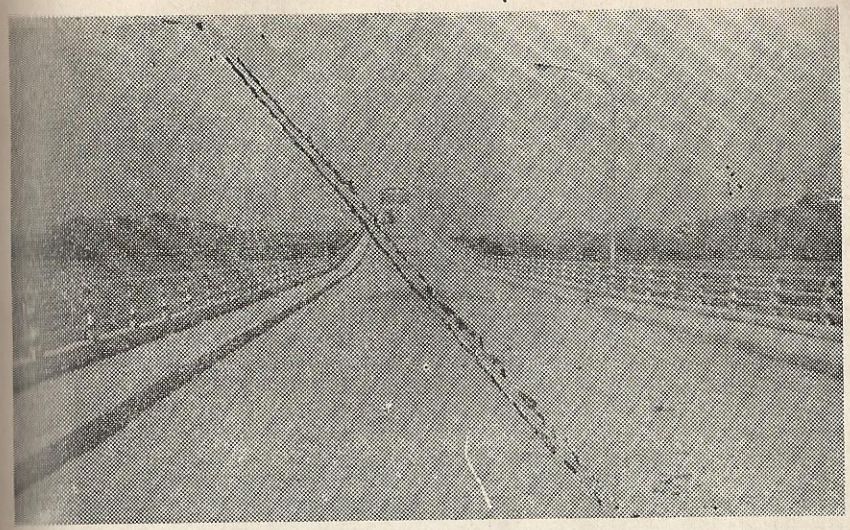

Fig. 12. The San Juanico Steel Bridge that connects Samar Provinces to Leyte del Norte Province has a span of 2.16 kilometers. It is the longest steel bridge in the Far East.

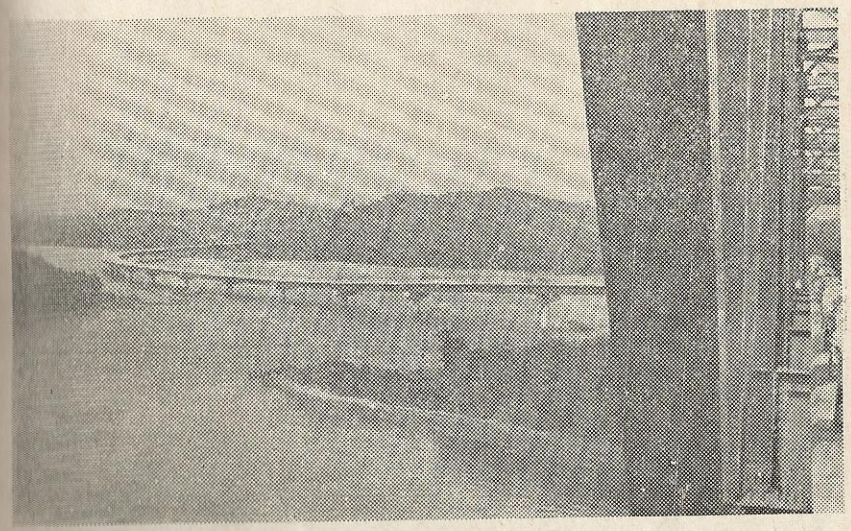

Fig. 13. The same steel bridge as viewed from afar.

Samar," to Catbalogan was under construction during the time of the survey. This road will traverse Matuginao and Gandara. The construction of another road that connects the "Rice granary" of Samar to the town of Oras has been started also.

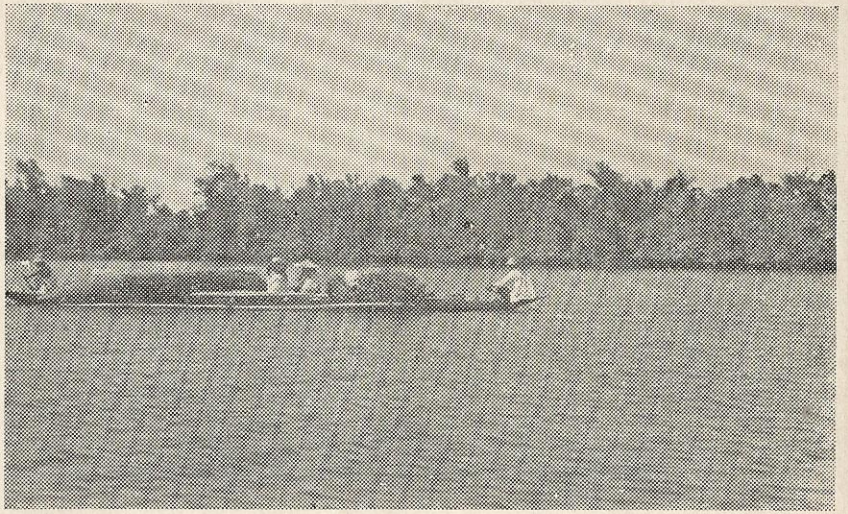

Fig. 14. Boats, motorized and non-motorized, are the chief means of transportation in Catubig River, Northern Samar.

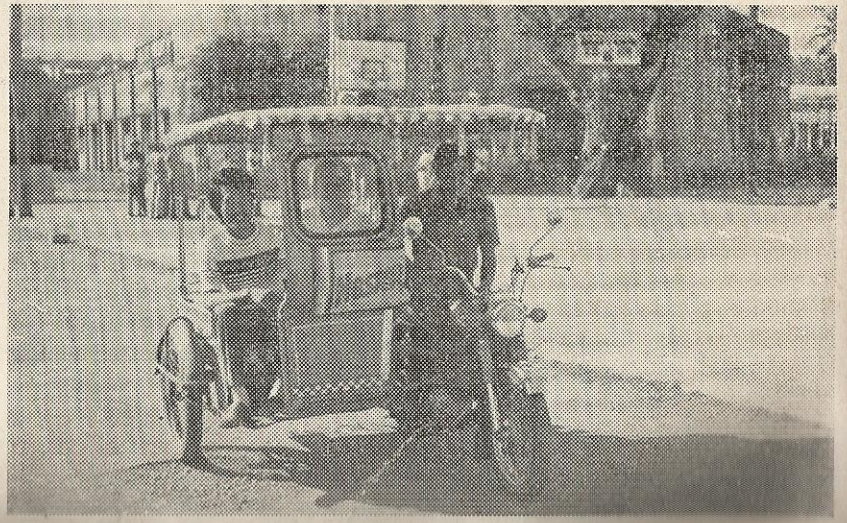

Fig. 15. Tricycles are now locally used as means of transportation in Samar Provinces.

The existing highway kilometerages in Samar in the fiscal year 1964–'65 as recorded in the Yearbook of Philippine Statistics of 1966, are as follows:

System	Kilometerage
1. National Highway	14.06
2. Provincial Highway	577.36
3. City Highway	31.66
4. Municipal Highway	181.96
Total	805.04

The greater volume of the products of the different localities in Samar are not transported by land but rather by means of water transportation. This is due to the accessibility of the localities by the big bodies of water surrounding Samar, and the inadequacy of good roads. Products from the interior towns and barrios are transported by bancas, animals and men. In some areas where there are big rivers, the motor boats and launches are the means of transportation used in the distribution of commodities. Floating stores are common in the Dolores and Oras Rivers. In 1953, only the big and progressive towns have public markets.

Fig. 16. A heavily loaded jeep serves as the means of transportation for farm products and farmers alike in Basey, Western Samar.

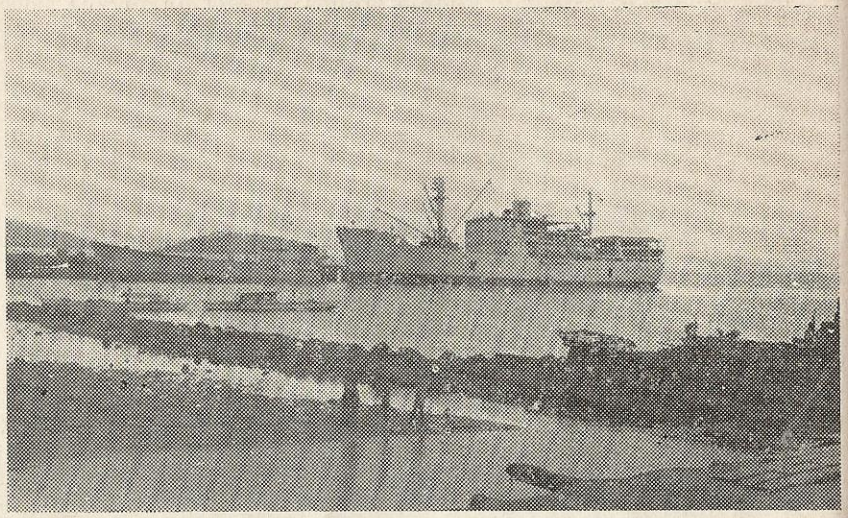

Fig. 17. Local interisland boats dock in the Catbalogan wharf and transport local products to Manila and other cities.

Copra, dried fish, abaca, palay, bananas and other products are accumulated in the regular ports of call, like Allen, Calbayog City, Catbalogan City, Guiuan, Laoang, and San Jose. These ports, together with those having berthing facilities like Borongan, Mauo, Oras, Pagsanhan of Tarangnan, Sta. Rita, Talalora, and Zumarraga, send their accumulated products through inter-island boats direct to Manila and other cities. These inter-island vessels call regularly at the regular ports and occasionally at the other ports.

Industries.—Samar depends mainly on agricultural pursuits. The majority of the people are engaged in farming. As of 1953, the total area under cultivation in Samar was 267,284.00 hectares.[1] In 1960, the farm area in Samar was 367,615.7 hectares which consisted of 95,626 farms.

Rice production (upland and lowland) is the most important industry of the people. It gave a total income of ₱19,626,229.00 in 1960. The relatively wide lowlands in the Northern and Eastern Samar are the heaviest producers of this staple crop.

Fishing is a very lucrative industry in Samar. Maqueda Bay has the best fishing grounds in the Philippines, notwithstanding the claims of Estancia in Iloilo and Malampaya Sound

[1] Figures supplied by the Bureau of Forestry, Catbalogan, Samar, 1952.

in Palawan. Big quantities of frozen, dried, or salted fish are exported to Manila and other provinces.

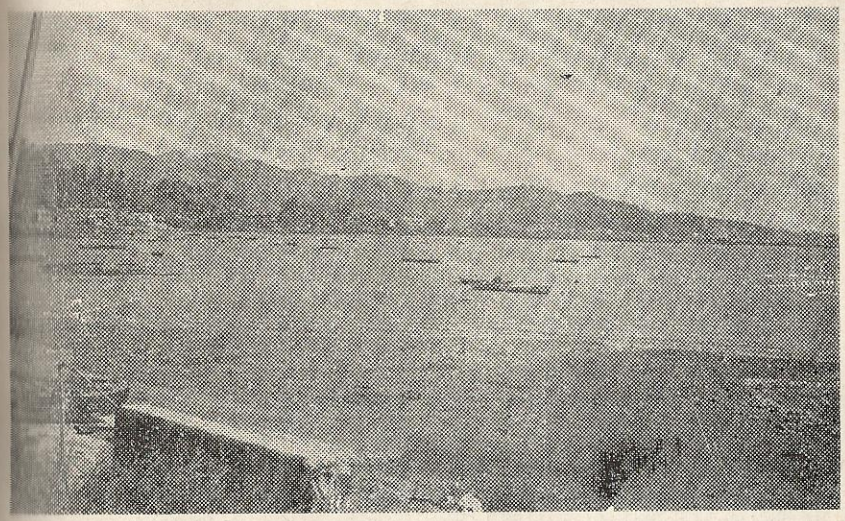

Fig. 18. A fishing village at Catbalogan, Western Samar.

In 1961, the reported quantity of fish sold by large establishments was 2,535,000 kilos valued at ₱2,094,000. In the same year, it was reported that there were 1,447 people working in large fishing establishments.

A fish canning factory is found in Guinsurongan, Catbalogan, Samar in 1953.

Milkfish (*bangus*) culture is gaining impetus in Samar. The Yearbook of Philippine Statistics, published by the Bureau of the Census and Statistics in 1966, has reported that in 1964, the total area of fishpond in operation in Samar was 4,117.85 hectares with a total production of 411,780 kilograms of *bangus*. An area of 26,549.75 hectares of swamp lands still awaits for development. With the presence of vast areas of swamp lands on the one hand, and the growing interest of local capitalists on the other hand will undeniably place the industry on a good footing. The two big problems of the local capitalists as regards the development of fishponds are the frequent visitations of destructive typhoons and the high cost of labor for clearing the areas.

Lumbering is an industry in Samar that awaits big capitalists. Majority of the interior areas of the island is still covered

with dense primary forests. At the time of the survey, there are nine sawmills operating in the province. For the year 1950–'51 the production of these sawmills totaled 2,507,511 board feet and in 1951–'52 the production rose up to 3,225,511 board feet. (See Table 2). The forest products are logs, rattan, tan bark, almaciga, nipa shingles, charcoal, and firewood. The quantity of logs shipped from Samar in 1961 was 521,000 board feet valued at ₱73,000.00. In the same year, the recorded value of other forest products gathered in Samar was ₱1,000.00.

TABLE 2.—*Production in board feet of the different sawmills operating in Samar (1950–'52).*[1]

Name of Sawmills	Location	Production in Board Feet	
		1950–'51	1951–'52
1. San Ramon Sawmill Ltd.	Allen, Samar	804,060	1,450,555
2. Escobar Lbr. and Const. Works	Mauo, Allen, Samar	53,869	7,430
3. Vet. Bros. & Co.	San Ramon, Allen	204,408	10,728
4. West Pacific Lumber Co.	Dolores, Samar	556,488	554,232
5. West Pacific Lumber Co.	Oras, Samar	208,264	171,492
6. East Samar Lumber Mill	Dolores, Samar	188,027	233,535
7. Karapdapan Sawmill Co.	Salcedo, Samar	317,949	270,074
8. Taft Sawmill	Taft, Samar	146,196	109,867
9. Surigao Sawmill	Borongan, Samar	27,960	26,978
10. Eureka Sawmill	Tacloban City	No data	390,620
TOTAL		2,507,221	3,225,511

[1] Data supplied by the Office of the Provincial Forester, Catbalogan, Samar.

Mining is gaining importance in Samar. The Samar Mining Company (SAMICO), owned and operated by Elizalde and Company, is engaged in the mining of iron ore deposit in General MacArthur. The Alicante Mining Company has also a mining claim for manganese in Jiabong. Many mineral deposits await to be tapped.

In 1953, the Samar Mining Company employs about 1,000 laborers and has a monthly output of 30,000 to 40,000 tons of iron ores. The ores are directly exported to Japan. Big Japanese ships anchor at General MacArthur to load the ores.

One of the highly appreciated home industries in Samar is the weaving of fancy mat. This industry was formerly monopolized by the townfolk of Basey but now it is also popular in Tinambacan, Sta. Rita, Gandara, and Sulat. The mats are woven from a species of weed growing wild and luxuriantly in poorly drained bottom lands. This weed is called *ticog* in the local dialect. Dried *ticog* are dyed with commercial dyes in different colors before they are woven into

mats. Mats with intricately beautiful designs or with portraits are made by a few talented men and women on contract basis. The less fancy ones can be made by ordinary weavers. In places where *ticog* does not abound freely, the mat weavers resort to its cultivation. Fancy-mat-weaving is one of the home industries in Samar that needs to be popularized and encouraged by the government.

Small scale cheese making from carabao's milk exists in the towns of Gandara and Villareal.

CLIMATE

The biological activities of plants and animals, in any place, are very much affected by the prevailing climatic conditions. Therefore, the study of climate is a necessity in planning farm activities. A knowledge of the climatic conditions of a place would be very helpful in adjusting the planting calendar to avoid periods of adverse weather at which occurrences of pests and diseases are prevalent.

In the Philippines, there are four types of climate. These types of climate are determined by the amount and distribution of rainfall. Two of these types of climate, the second and fourth types prevail in Samar. The second type is characterized by pronounced maximum rain period and no dry season; while the fourth type has no maximum rain period and no dry season. The former prevails in Northern and Eastern Samar and the latter prevails in Western Samar. The annual and average monthly rainfall and the number of rainy days recorded in the four weather stations in Samar are shown in Tables 3 and 4. Catbalogan Station represent the areas under the fourth type of climate while those in Borongan, Catarman and Oras represent the areas under the second type. In Borongan the least rainfall period are experienced in July, August and September; and in Oras, in June to September. Catbalogan experienced least rainfall in March, April and May; while Catarman has less rainfall in the months of April, May, June, July, August and September. The wettest months of the year in the entire Samar are from October to December.

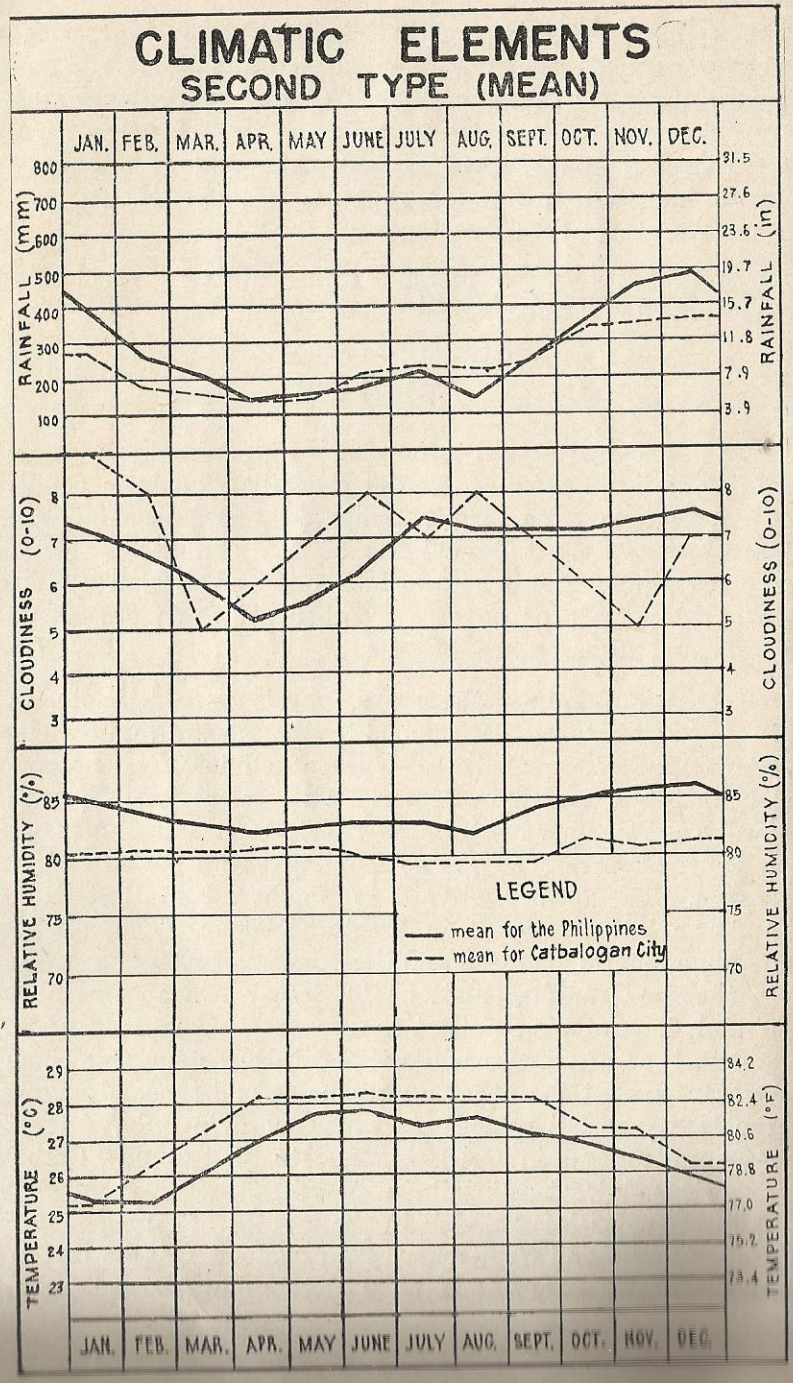

Fig. 19. Graph of the second type of climate of the Philippines and of Catbalogan City.

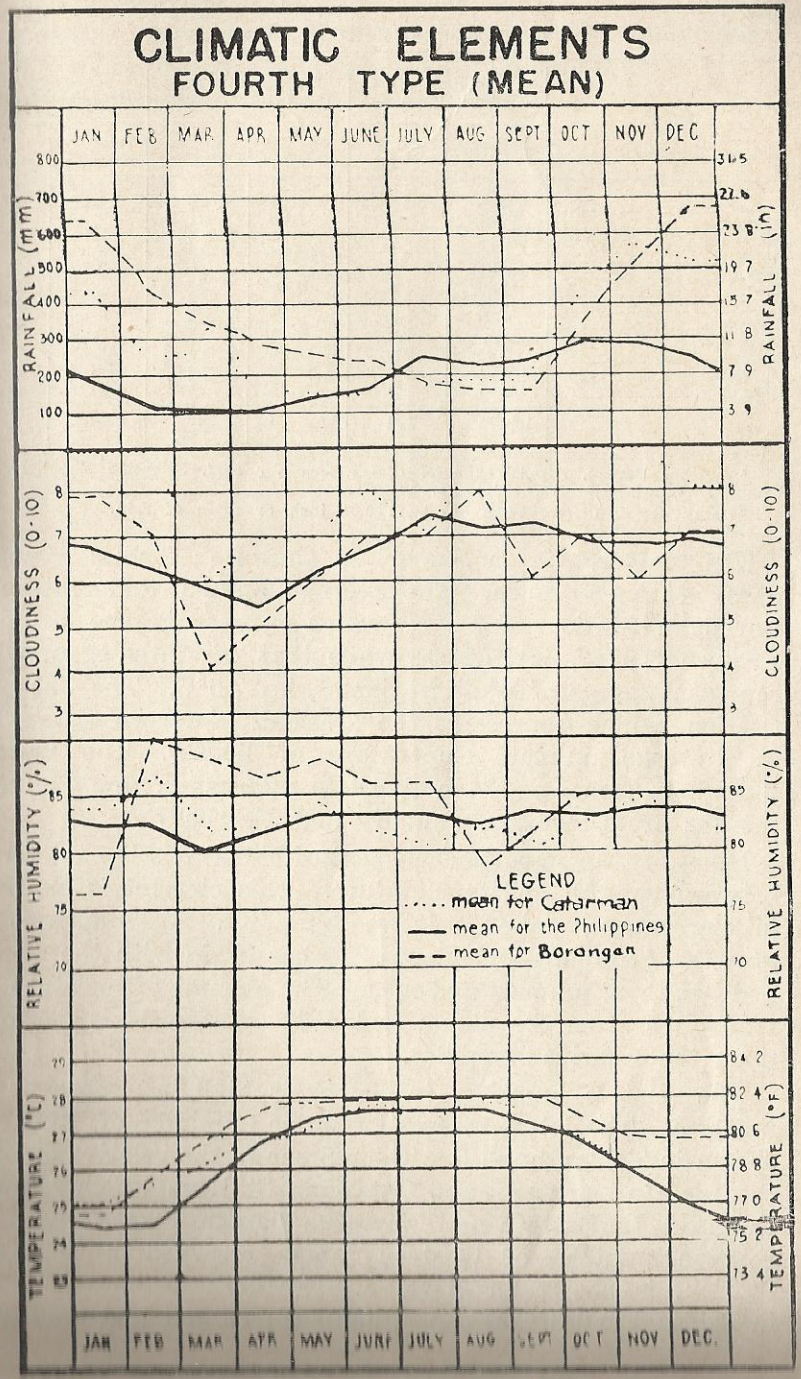

Fig. 20. Graph of the fourth type of climate of the Philippines and of Borongan, Eastern Samar and Catarman, Northern Samar.

TABLE 3.—*Annual and monthly average rainfall and rainy days in three Weather Stations of Samar under the second type of climate.*[1]

Month	Catarman Station (Normal (12-years)		Borongan Station (Normal (52-years)		Oras Station (Normal (13-years)	
	Amount (*inches*)	Rainy Days[2]	Amount (*inches*)	Rainy Days[2]	Amount (*inches*)	Rainy Days[2]
January	16.49	23	24.64	26	14.60	12
February	9.18	17	17.20	21	7.80	9
March	10.21	17	14.15	22	9.91	10
April	6.32	16	10.64	19	8.15	8
May	5.37	16	10.82	19	8.12	8
June	5.66	16	9.01	17	7.18	7
July	6.91	17	7.54	17	7.21	9
August	7.20	17	6.17	14	5.86	7
September	7.44	15	7.13	15	7.68	8
October	17.60	21	13.39	21	12.53	10
November	23.01	24	21.38	23	19.40	15
December	20.31	25	25.74	26	21.92	16
	135.70	224	167.81	240	130.36	119

[1] Weather Bureau, *Annual Climatological Review for 1961*, Scientific Paper No. 501, (Manila: Weather Bureau, 1961) pp. 175–179.

[2] Rainy day is defined as a day with 0.01 inch or more of rain.

The temperature in Samar, as shown in Tables 4 and 5, does not vary much. The average annual temperature in Borongan Station, Table 5, which represents the areas of Eastern Samar, is 27.1°C; while that of Catbalogan, which represents areas of Western Samar, is 27.5°C. The Catarman Station, which represents the areas of Northern Samar has an average annual temperature of 26.8°C. The warmest period in Samar is from April to November, and the cooler months are December, January and February.

Humidity, an important element of climate, is the interaction between rainfall and temperature. This element is expressed in percentage, called relative humidity. It influences the growth of animals and plants. It has to do with the comfort and health of animals and men. The amount of moisture that transpires from the plants and body of animals is dependent upon the relative humidity.

The relative humidity in Samar is high but more or less uniform. The latest recorded relative humidity of Samar are shown in Tables 4 and 5. Table 5 shows the relative humidity recorded in Borongan and Catarman Stations which represent the areas in Eastern and Northern Samar, respectively. The relative humidity of Western Samar, recorded in Catbalogan Station, is shown in Table 4. Northern Samar, as shown in Tables 4 and 5, is damper than Eastern and Western Samar.

In passing, it maybe well to mention that it is usually warm and dry along the coastal areas, and cold and humid in the interior highlands.

TABLE 4.—*Annual and monthly average rainfall, mean temperature, mean relative humidity and cloudiness in Catbalogan Weather Station under the fourth type of climate.*[1]

Month	Rainfall Normal (39 years)		Mean Relative Humidity (%)	Mean Cloudiness (0–10)	Mean Temperature °C
	Amount (inches)	Rainy days[2]			
January	11.07	19	81	9	25.2
February	7.25	15	82	8	26.6
March	6.26	16	81	5	27.1
April	5.35	14	82	6	28.2
May	6.50	15	82	7	28.5
June	7.92	17	80	8	28.7
July	9.76	18	78	7	28.3
August	8.42	16	78	8	28.3
September	10.09	18	78	7	28.2
October	12.54	21	83	6	27.2
November	14.32	21	81	5	27.1
December	14.78	21	83	7	26.6
	114.26	211	81	7	27.5

[1] Weather Bureau, *Annual Climatological Review for 1961*, Scientific Paper No. 501. (Manila: Weather Bureau, 1961) pp. 178–179.

[2] Rainy day is defined as a day with 0.01 inch or more. (Scale of cloudiness: 0–3 clear; 4–7 partly cloudy; 8–10 cloudy).

TABLE 5.—*Annual and monthly mean temperature, mean relative humidity and mean cloudiness in two Weather Stations of Samar under the second type of climate.*[1]

Month	Borongan Station			Catarman Station		
	Mean Temperature °C	Relative Humidity (%)	Cloudiness (0–10)	Mean Temperature °C	Relative Humidity (%)	Cloudiness (0–10)
January	24.8	84	9	25.0	77	8
February	25.9	87	9	25.7	90	7
March	26.7	82	6	26.1	88	4
April	27·7	82	7	26.9	83	5
May	27.9	84	7	27.6	86	6
June	27.9	82	8	27.9	81	7
July	27.9	80	7	27.5	81	7
August	28.0	82	9	27.3	78	8
September	28.1	80	7	27.5	81	6
October	27.2	82	7	26.7	83	7
November	26.9	84	7	26.3	85	6
December	26.6	82	8	26.1	85	7
Annual	27.1	83	8	26.8	83	7

[1] Weather Bureau, *Annual Climatological Review for 1961* (Manila: Weather Bureau, 1961) pp. 175–179.

(Scale of Cloudiness: 0–3 clear; 4–7 partly cloudy; 8–10 cloudy).

Surface winds in Samar, being an island, are greatly influenced by local factors. A clear trend shows that northeasterly winds prevail during the period from November to June; and the southwesterly during the months of July, August and September. The August winds are characterized by variable blowing from all quadrants and sudden squalls usually occur. The squalls make travel by sea on bancas and small boats dangerous.

Samar lies well within the typhoon belt, thus storms are frequent in this region. Many of the typhoons that occur in the Philippines either pass or originate east of Samar. Usually, it is during the months of August, October, November and December when typhoons pass through or near Samar.

AGRICULTURE

Samar is one of the places in the Philippines that is rugged and mountainous. Due to its rugged terrain most of the towns are located along the coast. Though Samar is rugged and irregular in its topographic features, agriculture is the principal occupation of the people. Almost all the people own a parcel of land which is cultivated to economic crops.

In the 1960 Census of Agriculture, it was reported that the farm area in Samar had reached 367,615.7 hectares, classified as follows:

Use	Area (ha.)	Per cent
Arable land:		
Planted to temporary crops	129,343.4	35.36
Lying idle	55,688.2	15.15
Planted to permanent crops	146,843.0	39.94
Permanent pastures	1,398.0	0.38
Forest land	32,244.7	8.50
Other lands	2,098.4	0.57
TOTAL	367,615.7	100.00

While in 1948 census, it was reported that there were only 257,003.96 hectares of land under agricultural development.

It can be noted that from 1948 to 1960 there was an increase in the total farm area in Samar of about 110,611.74 hectares or 30.08 per cent.

The agricultural progress of Samar is somewhat slow. This can be attributed to a number of factors such as lack of technical know-how on scientific farming of the farmers, lack

of work animals, farm implements, capital, and lack of good means of transportation and communications. The frequent occurrence of typhoon also contributes to the slow progress in the agricultural pursuits. The crops are destroyed by typhoons almost every year.

Fig. 21. A coconut plantation in Bayho, Northern Samar.

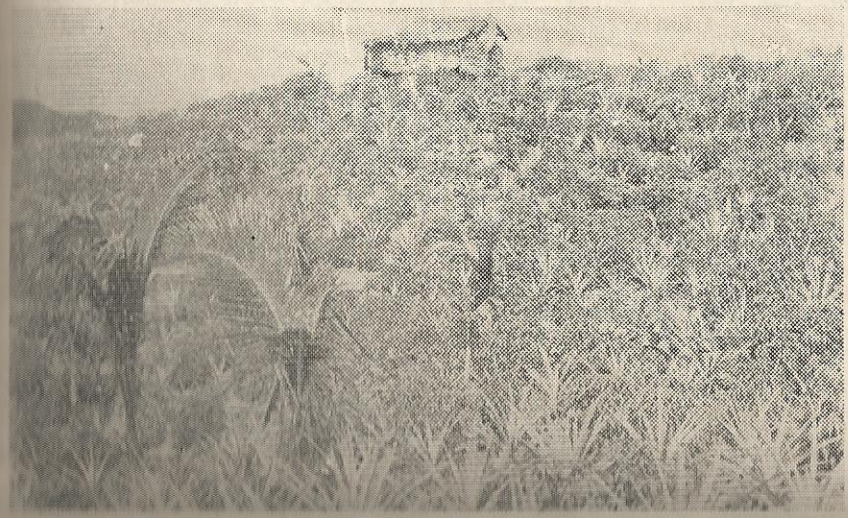

Fig. 22. Farmers now practice intercropping in Samar. The crops grown are coconut, pineapple and cassava.

CROPS

The ten leading economic crops in Samar, with their corresponding area planted, production and value, as listed in the census of 1960, are as follows:

Crop	Area Planted (Ha.)	Production		Value
Coconut	143,211.9	455,321,807	nuts	₱30,523.345
Palay	102,133.2	2,344,590	cav.*	19,624,229
Abaca	13,257.2	8,028,280	kgm.	4,306,154
Camote	15,005.7	60,443,888	kgm.	4,021,154
Corn	16,486.6	307,244	cav.*	2,303,049
Banana	10,658.8	34,631,127	kgm.	2,097,692
Gabi	4,271.6	14,476,114	kgm.	1,922,721
Cassava	5,353.2	24,297,816	kgm.	1,316,966
Galiang	1,003.6	5,683,635	kgm.	486,678
Sugar cane	195.6	6,517	m. tons	153,264

* A cavan of palay weighs 44 kilos and of corn 57 kilos.

Coconut (in the form of copra), abaca and banana are the commercial or export crops raised in Samar. Other crops are raised for local consumption only.

Coconut.—Coconut is second in importance, next to rice, in Samar. The Samareño farmers are mostly dependent on coconut for cash money. Coconut is widely distributed throughout Samar. It covers an area of about 143,211.9 hectares or 38.96 per cent of the total land area cultivated in 1960. This area is planted to 19,620,229 trees of which 11,909,878 are bearing. Out of the bearing trees 82,788 are being tapped for tuba. The recorded production of the bearing trees in 1960 was 455,321,807 nuts valued at ₱30,523,345.00.

This crop thrives well on any type of soil and on varied range of topography. However, plantations along the sea coasts give higher yields than those in the inland plantations. Care and management of coconut plantations are not given much attention. Most of the plantations are left to the invasion of shrubs and thick growths of tall grasses.

Majority of the nuts produced are made into copra. The copra produced are mostly of poor quality because of the very crude way of processing.

In almost all the coconut plantations, whether big or small, some trees are tapped for *tuba*. *Tuba* is the sap of the coconut

inflorescences, which is a common drink of the inhabitants after it has been fermented.

An inflorescence that is about to open is tapped with a *sanggut*, a sharp knife especially made and designed for the purpose. The sap or *tuba* is collected by means of a bamboo tube opened at one end and closed at the other, attached to the inflorescence and tied to a nearby petiole. Handful of powdered tan bark is place inside each bamboo tube to color and neutralize the the sweet taste of the sap. *Tuba* collected without the tan bark is not liked by the people. They claimed that without the tan bark they are liable to have diarrhea. The bamboo tubes with the collected sap are gathered early in the morning and late in the afternoon. The *tuba* is ready for drinking immediately after it is brought down from the tree. However, the professional *tuba* drinker prefers *tuba* that is aged for a day or a week. The *tuba* gatherer is locally called *mananguite;* while the coconut tree being tapped is *sanggutan.*

A great setback to the coconut industry in Samar is the frequent occurrence of typhoon in the area. Almost every year, Samar is visited by typhoons. During typhoons all the coconuts sustain broken and tattered fronds if not totally destroyed. It takes several months or at least a year for a coconut tree to recover and resume fruiting. The frequent occurrence of typhoon affects greatly the standard of living and economy of the coconut farmers. Most of them cannot send their children to schools of higher learning. It is suggested then that the old and destroyed coconut trees should be replaced by other crops that would not be very much affected by typhoon. Pineapple and pili trees seem to be suited to Samar condition.

Rice.—Rice is grown over a wide range of topography in Samar. The cultivation of lowland rice is not confined on flat plains and valleys but also on undulating areas. The upland culture of rice is carried on the undulating to mountainous portions.

There are so many lowland rice varieties grown in Samar. They are locally called *Karamit, Baranay, Sinan Miguel, Kaidol, Magai-ing, Bulao, Lumo-an, Macag-Ong, Kabal-og, Ramelon, Senador, Bundoc na puti, Bundoc na pula, Karimon, Pilit, Elonelon, Sanggaleya, Kaintay, Kapedi, Ras-eg, Kabago, Kinatuday,*

Timancia, Bacsalan, Octoberian, Romero, Kaganggang, Libonglana, Kirayan, Kadahon, Mudbud, Kaputol, Magrawog, Hangadlangit, Binagacay, Magcub-a, Tapul, Kinarabao, Guinobanen, Pinotiokan, Tuturan, Mudbud na itom, Basog, Hinibabao, Menes, Magsanaya, Apostol, Karamet, Wagwag, Bin-og, Pinili, Lubang, Aliguid, and *Kamas-ay.*

Except Wagwag, Elon-elon and Raminad, which are late maturing, all the rice varieties grown in Samar are early and medium-late maturing.

The normal rate of production of lowland rice in Eastern Samar ranges from 25 to 40 cavans per hectare. In Northern Samar, the average production ranges from 25 to 60 cavans a hectare, while that in Western Samar and in the southern part of the island the average production ranges from 25 to 50 cavans. In San Antonio Island, the range of production per hectare is from 15 to 20 cavans only.

The ten leading places in Samar in the production of rice are Catubig, Gandara, Calbayog City, Catarman, Pambujan, Basey, Laoang, Dolores, Villareal, and Oras.

In areas under the second type of climate, lowland rice is planted during the months of October, November and December and harvested in March to May. While in areas under the fourth type of climate (Northern and Eastern Samar), it is planted during the months of May, June and July and harvested in October to November.

The *panhuraw*, equivalent to *palagad* in Luzon, (dry season planting of lowland rice) is planted during the months of December and January in areas under the second type of climate and during the months of June and July under the fourth type. However, the raising of two rice crops a year is not yet very popular in Samar.

As reported in the census of 1960, the wet season crop or first crop occupies a considerable area than the *panhuraw* or second crop which is 64,159.7 hectares for first crop and 15,357.3 hectares for second crop. The probable reason for this is the lack of irrigation systems.

Upland rice is planted, usually by *kaingin* method, on undulating to mountainous areas. Farmers claimed that a newly cleared land produced about 40 to 50 cavans of palay per hectare, when the weather is favorable and there is no incidence of pests. They also claimed that second planting, by

kaingin method, on rolling and steep areas gave only 20 to 30 cavans per hectare under favorable conditions. The usual practice under the *kaingin* method of farming in Samar is planting rice on the clearings twice. After which the areas are either abandoned or are planted to camote, gabi, bananas or abaca and fruit trees. Usually, each rice crop is followed by corn. The first planting in a newly cleared area is locally termed as *tuha* and the second planting is termed *dago.*

Upland rice is planted usually in the months of April, May and June and harvested in August to October. The common varieties planted are locally called *Kabansay, Sugbo-anen, Madyang, Kaputol, Mudbud, Sinan Pablo, Daragangan, Kapisnon, Kabulan, Buracnaga, Kabago, Makarato, Salinaya, Karanog, Sayaanon, Libonglana, Kalambonganay, Kinuto, Katsuki, Macab-a, Kaponsa, Kasulao, Karimon, Kapungo, Karawsi, Kumagaycay, Bulibod, Magsanaya, Burok, Kapalwa, San Pedro,* and *Kalumpit.*

Abaca.—This crop is widely grown in Samar but there is no big plantation like those found in Davao. The Census of Agriculture of 1960 has reported that there were 13,481 farms devoted to the growing of abaca and the total area planted was 13,257.2 hectares with a total production of 8,028,280 kilos of hemp valued at ₱4,306,154. This shows that the average area for each farm is only 0.98 hectares, more or less, and the average production per hectare is about 603.6 kilos of dried abaca fiber.

This crop as observed during the soil survey thrives best in deep and well drained soils of Samar that are medium in texture. This is exemplified by the abaca plantation found in the interior valleys of the town of Las Navas, specifically the areas along the way to barrio Poponton.

The local names of the abaca varieties grown in Samar are *Hilayas, Solsoganon, Linawaan, Lacbangan, Bago, Lawisig, Alman, Banguisan, Inusa, Sambanganay, Samoro, Panaunan, Lagwis,* and *Sabuna-a.* Most of the abaca fibers produced are stripped by hand with the use of the *hagutan.* The stripping of abaca fibers by means of the *hagutan* is very slow and is a back-breaking operation.

Abaca is raised in Samar as a cash crop. Most of the fibers extracted from abaca are exported. Its local use are for making twines, ropes for fishing boats and for making

fishing nets. The only setback of the abaca growing in Samar is the frequent occurrence of typhoons which usually uproot the abaca plants and it requires about six months for a plantation to recover.

Camote.—This crop ranks third in extent and importance in Samar. It is one of the supplements for the staple food of the people. During shortage of rice and corn, which usually happen every year, camote comes in handy. Samar is one of the leading provinces in the Philippines in the production of camote. The contributing factors to this are the topography of the land, the types of soils and the eating habits of the Samareños. The 1960 census of agriculture has reported that 15,007.7 hectares in Samar are devoted to camote with a total production of about 60,443,885 kilos valued at ₱4,021,154.00.

All camote plantations in Samar are in small scale and scattered throughout the island. The ten leading places in its production are Catarman, Calbayog City, Allen, Basey, Lavezares, Gandara, Sta. Rita, Villareal, Balangiga, and Llorente. Coarse textured to silty clay loam soils are favorable for camote growing.

Some of the common varieties grown in Samar are *Karingkit, Kasapad, Sinabuko, Kamasing, Sinintavos, Kahulbo, Kayonting, Rinagayray, Kabotbot, Kapungot, Binayabas, Kabaliw, Kasandig, Mihay, Tinampay, Kalbiganon, Minariana, Sigurador, Kalibre, Ikiran, Karawsi, Sinambirga, Kagaraw, Tabangan, Katimpa, Sukap, Kaagbon, Tres colores, Mecbe, Inasawang, Kalolog, Iningcanto, Kasiko, Ninafuerte, Pinaulino, Gumarao, Talibong, Kagui-ab,* and Samar Big Yellow.

A camote plantation undergoes three consecutive harvesting before it is replanted. The first harvest, locally termed *hinauman,* is done five months after planting. The second harvest, locally termed *panhingoli,* is done two months after the first harvesting. And the last harvest, locally called *katay,* is effected three months after the second harvesting. The first harvest (*hinauman*) gives more tubers than the second harvest (*panhingoli*) ; whereas the last harvest (*katay*) gives the most tubers. The camote farmers, through experience, can detect the location of big tubers that are ready for harvesting.

There is no fixed month for the planting of camote. It is done immediately after the *katay.* In Samar, camote is grown mostly in *kaingin* clearings in the undulating and mountainous

areas, usually after the rice or corn harvest. The fields are not plowed as is done in other provinces of the country. Cuttings of young vines, of about 50 centimeters long, are planted in holes, set about one meter between rows and 50 centimeters in the row. The planting holes are usually dug with a pick or hoe and the vines are planted in such a way that the terminal apex is about 15 centimeters above the ground.

Corn.—This crop is grown throughout Samar. In 1960, there were 18,014 farms reported as cultivated to corn. The area covered by these farms was 16,486.6 hectares which gave a production of 307,244 cavans of shelled corn valued at ₱2,303,049.00. The distribution of this production as reported in the 1960 census are as follows:

Crop	No. of farms	Area (Hectares)	Production (Cavans)	Value (Pesos)
Corn				
1st crop	7,258	4,953.8	107,288	804,563
2nd crop	7,056	4,820.7	87,405	670,587
3rd crop	10,210	6,712.1	112,551	827,899
TOTAL	18,014	16,486.6	307,244	2,303,049

As shown above, three crops of corn are grown in a year in Samar. The third crop covered the biggest area and gave an average production of about 17 cavans to the hectare; the first crop is next in extent and gave an average production of about 19 cavans while the second crop was the least in extent and it gave an average production of about 15 cavans only.

Corn grows best in deep soils that are well drained and fertile. This crop is presumed to be a heavy feeder on plant nutrients, so that, it is not advisable to plant it continuously on the same area for a number of years. However, in sloping and rolling lands it is possible that the soil depletion of a continuously cropped corn field is due to more of soil erosion than the crop itself. Soil erosion is enhanced in corn production due to the nature of planting. Corn plants are usually set at one meter between rows and about 60 to 80 centimeters in the row with two to three plants per hill. They are clean cultured so that the canopy produced by these plants do not offer sufficient protection for the soil from the beating action of the raindrops, thus resulting in the soil erosion of the corn fields.

Generally, corn is planted in Samar in the level to mountainous relief. In most instances, it is planted in *kaingin* clearings found at the hill sides. Under favorable climatic conditions the average production per hectare is 20 cavans. The most common varieties grown in Samar are the White Flint and the Yellow Flint. In 1960, the ten leading places in the production of this crop are Almagro, Daram, Gandara, Calbayog City, Zumarraga, Pinabacdao, Capul, Hinabangan, Wright and San Antonio.

Banana.—Banana is grown throughout Samar, in farms and in backyard. It ranks sixth among the ten leading crops of Samar. In the 1960 Census of Agriculture, there were 30,795 farms in Samar devoted to banana with a total area of about 60,658.8 hectares. The production in that same year was 34,631,127 kilos valued at ₱2,097,692.

This crop grows in any kind of soil provided it is well drained and has sufficient moisture. It grows in the undulating to gently rolling areas with deep soils. However, it grows best on a well drained and fertile alluvial soil, preferably of medium texture. The climate in Samar is suited for banana culture. The only setback is the frequent occurrence of typhoons.

Gabi and galiang.—These crops rank seventh and ninth places, respectively, among the ten important crops of Samar. In 1960, the area planted to *galiang* (Palawan gabi) is 1,003.6 hectares with a production of 5,683,635 kilos valued at ₱468,678.00. The area planted to gabi is 4,271.6 hectares with a production of 14,476,114 kilos valued at ₱1,922,721.00. The ordinary gabi thrives in either dry or wet lands; while *galiang* or Palawan gabi is exclusively a water-loving plant. *Galiang* or Palawan gabi grows best on deep loam, silt loam and silty clay loam soils that are water-logged. This crop is adversely affected by typhoons. The tubers of this root crop is very much relished by the people. Boiled *galiang* tubers and fish with *tuba* is the common food of many people in the barrio during lean months, that is, scarcity of rice and corn.

Cassava.—Cassava, in Samar dialect (waray) is *balinhoy* or *bilanhoy*. This plant thrives in any soil provided it is not water-logged. It grows best in rich, deep, friable and well drained sandy loam to clay loam soils.

Cassava ranks eight place among the ten leading crops of Samar. It is grown throughout Samar mostly in patches in *kaingin* clearings and not in a commercial scale. In 1960, there were 21,680 farms in Samar with a total area of about 5,353.2 hectares planted to cassava. The total production was 24,297,806 kilos of tubers valued at ₱1,316,066.00.

The climate of Samar is favorable for the commercial production of cassava. The cassava flour industry has a bright prospect. Starch factories can be supplied with roots throughout the year because planting and harvesting can be effected at any time of the year.

The census of agriculture of 1960 has listed Almagro, Sta. Rita, Laoang, Daram, Calbayog City, Salcedo, and Gandara as the leading places in Samar in the growing of cassava.

Cassava is raised for local use. It is usually boiled and eaten as a substitute for rice. *Suman, kalamay,* and *bibingka* are home preparations from cassava which are usually sold in the market.

Sugar cane.—Sugar cane crop ranks tenth in importance in Samar. This crop is grown in almost all towns of Samar mainly for home consumption. The canes are used either in making muscovado sugar, *panocha* and *basi* or for chewing. The area devoted to sugar cane in Samar, as reported in the census of agriculture of 1960, was 195.6 hectares and the total production of cane was 6,517 metric tons valued at ₱153,264.00. Of this production, 3,186 metric tons were used for making muscovado sugar and *panocha*, 118 metric tons for *basi*, and the quantity sold for chewing was 3,213 metric tons. The leading towns in the manufacture of muscovado sugar and *panocha* are Calbiga, Jiabong, Villareal, Hinabangan, Santa Margarita, Catbalogan, Zumarraga, Bobon, Catubig and Pinabacdao.

Muscovado sugar, *panocha* and *basi* are prepared in a crude way. The juice of the canes is extracted by means of native wooden crushers drawn by carabaos. To turn the juice into *panocha* and muscovado sugar, it is cooked in big iron pans (kawa).

Sugar cane can be grown on a wide range of topography and soil types. However, it grows best on deep, fertile and well-drained alluvial soils. In Samar, it is grown on steep hillsides and rolling areas. It is planted in unplowed *kaingin*

clearings. The distance of planting is one meter between rows and in the row. The cane points are planted with the use of picks or crowbars. The cane fields are cultivated and weeded with the use of hoes. No fertilizer is used. The varieties of cane grown are Alunan, Badila and other unidentified ones The average yield of these varieties is not known. However, basing from the figures of the 1960 census of agriculture, the general average production per hectare would be 33.32 metric tons.

Tobacco.—Tobacco is one of the promising crops of the Philippines. However, this crop is not extensively grown in Samar. In 1960, there were only 296.5 hectares devoted to this crop or about 0.08 per cent of the total cultivated area of Samar with a production of 202,323 kilos of cured tobacco leaf. The produce is consumed locally by the barrio folks for smoking and chewing.

Fruit trees.—The important fruit trees grown in Samar are orange, guava, jackfruit, santol, mandarin, papaya, avocado, mango, lanzones and pili nut. These fruits are grown for local consumption only. In 1960, the number of fruit trees planted in Samar are as follows:

Kind of fruit tree	No. of trees Planted	No of bearing trees	Production (Kilos)	Value (Pesos)
Orange	19,652	12,137	239,885	72,762
Papaya	68,007	44,968	713,309	59,995
Jackfruit	26,327	13,323	713,505	59,086
Pili nut	4,955	2,720	104,839	40,975
Avocado	883	450	26,160	5,755
Mango	1,065	630	6,823	4,094
Lanzones	259	210	5,359	4,019
Santol	1,031	490	33,928	3,393
Mandarin	6,098	1,040	6,478	1,943
Guava	11,570	2,040	3,612	506

Pineapple.—Pineapple is grown in almost all the towns of Samar, in farms and in backyards. According to the 1960 census of agriculture there were 8,885 farms devoted to pineapple. The total area covered by these farms is 724.2 hectares with a production of 2,585,393 kilos of fruit valued at ₱285,088.00

Coffee.—This crop is grown for local consumption only. In 1960, there were 37,730 coffee trees planted of which 12,380 were bearing which produced 8,458 kilos of berries. The Arabica is the most popular variety being planted in Samar. Observations indicate that this crop can be profitably grown in the rolling areas of Samar. The planting of windbreaks on coffee plantation is suggested to protect or to minimize the destructive effects of typhoons.

Legumes.—Legumes such as peanut, beans (batao, cowpea, lima bean, string beans and bountiful bean), seguidilla and mungo are planted in very limited areas for home consumption. Peanut and mungo are the most extensively grown legumes. There is, however, a shortage of legumes specially beans, in Samar. The production in 1960 is as follows:

Kind	Area Planted (Hectares)	Production (Kilos)	Value (Pesos)
Peanut	866.6	672,587	262,309
Mungo	356.5	185,498	115,009
String beans	64.0	56,744	15,888
Seguidilla	50.2	28,301	9,339
Cowpeas	20.5	17,566	5,270
Batao	9.7	5,248	1,417
Lima beans	3.0	1,305	437
Bountiful beans	0.5	312	81

Vegetables.—In Samar, the vegetables are cultivated in very limited areas. Most of the vegetables are raised in home lots and in small patches in the *kaingin* clearings. School children also grow vegetables in their school gardens. In 1960, the area planted to vegetables was 1,251.1 hectares. At the time of the survey, nobody is engaged in the commercial production of vegetables.

Vegetables production in Samar needs to be encouraged, especially in the big towns and cities like Calbayog and Catbalogan.

AGRICULTURAL PRACTICES

At the time of the survey, the farm practices employed in the culture of lowland rice in Samar were very crude. Plows and harrows were not used by the majority of the farmers. It was only in the agricultural high schools and in seed farm established by the government, where the plows, harrows and other modern farm equipment were used intensively. Most farmers do not weed their fields. Ricefields dominated by weeds were common sights in most lowland rice areas of Samar. Furthermore, ricefields were not provided with dikes

and very few were irrigated. Most of the ricefields were rainfed. The use of commercial fertilizer was not yet popular among the farmers. The fields were prepared mostly by either *payatac, pagulong* or *pacaras* system.

The *payatac* system of land preparation employs a team or teams of carabao hitched to each other, either one after the other or side by side, to trample around the field for puddling the soil before planting.

The *pagulong* system employs a *pagulong*—a rounded piece of wood about 1½ meters long and 45 centimeters in diameter hitched to a team of carabao and drawn around the field. Several *pagulong* are used and the tramplings as well as these *pagulong* crush the grasses and puddle the soil.

The *pacaras* system employs a locally made implement and is applied during the first stage of land preparation. The *pacaras* is made of a wooden board five feet by one foot by three inches with either wooden or iron spikes attached to one side. It is used to cut and crush the grasses. Then, the *pagulong* system is employed before planting.

Contouring, terracing, strip cropping and the construction of irrigation system are not widely done in Samar. In view of these, establishment of more demonstration farms which show the modern farm practices or soil conservation way of farming is imperative.

Crop rotation and diversification are not consciously done in Samar, and if ever done they are only incidental. Crop diversification in some farms is done only to have a continuous supply of food during the year. In such crop diversification system, the farm is divided into small lots and planted to different food crops, like rice, corn, camote, cassava, *galiang* and vegetables. Crop rotation, which is important for the control of weeds, pests and diseases, and for the maintenance of soil fertility, is not well understood by the farmers. Rotation of crops if practiced is employed not for the purpose of maintaining the fertility of the soil, but to satisfy the immediate needs of the farmers. The general practice of the farmers is to fallow the fields after every crop harvest until the next planting season. If all the farmers would only practice crop rotation and crop diversification on their farms they will not only maintain the fertility of the soils but increase the production and farm income as well.

Farm mechanization.—Farm mechanization is almost unknown to the farmers of Samar. This modern innovation is presently limited to some agricultural schools and to some experiment stations of the government, which is only to the extent of mechanized plowing and harrowing of fields.

Fertilization and liming.—The available plant nutrients in the soils may be lost through erosion, leaching, and continuous cropping. Impoverished lands cannot support good growth of crops. Poor crop means low production and poor people. To maintain and/or restore the fertility of the soils, soil amendments in the form of manure, organic and commercial fertilizers must be applied. This, however, is not done by the farmers of Samar.

Today, many of the farmers in Samar are now interested in the use of fertilizers. This fertilizer consciousness of the farmers was brought about by the convincing results obtained from fertilizer experiments on lowland rice, the demonstration farms, and by other farmers' experience on fertilizers. Some coconut farmers are now sold to the use of commercial fertilizers on their plantations.

The application of lime and its beneficial effects to the soil are not well known to the farmers. The farmers are not aware that lime corrects the pH of the soil and at the same time makes the plant nutrients in the soil available to the plants. It stimulates the activities of the soil organisms and improves the physical condition of the soil.

Irrigation and drainage.—Rice is a crop that requires a good control of the water supply during the different stages of its growth. In Samar, irrigated lands are limited in extent. Most of the lowland ricefields are rainfed, so that crop failures are sometimes experienced. The Yearbook of Philippine Statistics published by the Bureau of the Census and Statistics in 1966, has reported that in 1960 there were 6,454.4 hectares of land in Samar composed of 1,384 farms that are under irrigation. This shows that about 6.33 per cent out of the 102,133.2 hectares of land devoted to rice growing are irrigated. If all the lowland ricefields of Samar could be put under irrigation, there is no doubt that it could double its annual production by raising two rice crops a year.

Drainage is not much of a problem in Samar, except in bottom lands which are water-logged throughout the year.

These water-logged areas, however, are utilized by the people for the growing of a special crop, called Palawan gabi or *galiang*. On the rolling areas and steep hills, where the forest cover were removed or where there are *kaingin* clearings, external drainage is excessive. As such, the valuable top-soils are washed away.

LIVESTOCK AND POULTRY INDUSTRY

Samar is a good place for livestock raising. The rolling areas that abound in Samar are suited for pastures. There are wide grasslands that can be utilized for grazing. In 1953, there were only one to a few heads of cattle or carabao raised by farmers in each farm and only two ranches were found, with 50 heads of animals.

Fowls and hogs are not extensively raised. Most of them are raised in backyards. There are only a few individuals who are engaged in poultry and hog raising in a commercial scale. Carabaos and chicken are exported to Manila and other nearby provinces. The kind and number of poultry and livestock in Samar are shown in tables 6 and 7, respectively.

TABLE 6.—*Kind and number of poultry in Samar in 1939, 1948 and 1960.*[1]

Kind	1939	1948	1960
Chicken	412,225	765,576	983,960
Ducks	1,711	9,445	24,609
Geese	94	453	869
Turkeys	24	193	493
Pigeons	299	152	1,619

[1] Data taken from Bureau of the Census and Statistics, Yearbook of Philippine Statistics of 1966, pp. 199–202.

TABLE 7.—*Kind and number of livestock in Samar in 1939, 1948 and 1960.*[1]

Kind	1939	1948	1960
Carabao	77,032	86,613	130,757
Cattle	12,860	4,985	11,042
Horses	1,348	1,174	2,356
Goats	5,030	5,559	24,796
Buffaloes		1	
Sheep	462	268	348
Hogs	126,319	180,349	204,922

[1] Data taken from Bureau of the Census and Statistics, Yearbook of Philippine Statistics of 1966, pp. 204–206.

Small scale cheese making using the milk of carabaos, is found in the municipalities of Gandara and Villareal. The cheese is crudely processed. The cheese products from these towns are mostly consumed locally and some are exported to Catbalogan and Calbayog. This industry should be encouraged. Proper selection and breeding of the good milking animals will surely increase the milk supply for cheese making. The government should, therefore, put up breeding stations in each of the congressional districts of Samar to promote this industry.

The promotion of the livestock industry in Samar has been launched by the Bureau of Animal Industry with the help of other government agencies. Some imported breeds were introduced recently to bolster the livestock industry.

FARM TENURE

Farm tenure refers to the manner in which a farm is held by its operator. In farm tenure classification, the Bureau of the Census and Statistics during the 1960 census year classified farm operators into five categories; namely, (1) full owners, (2) part owners, (3) tenants, (4) farm managers, and (5) farm operators under other conditions. Tenants are further classified as (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 these farms by tenure of farm operator in Samar according to census figures of 1960 are as follows:

Tenure of Farm Operator	Number of Farms	Total Area (Hectares)
Full owner	63,391	245,950.2
Part owner	14,267	69,611.9
Tenants:		
Cash tenant	333	930.1
Fixed-amount-of-produce tenant	1,607	3,875.3
Share-of-produce tenant	11,364	31,570.1
Cash and fixed-amount-of-produce tenant	30	148.5
Cash and share-of-produce tenant	229	617.2
Rent-free tenant	1,140	2,204.3
Other tenant	2,257	8,241.4
Manager	73	1,748.3
Other forms of tenure	935	2,718.4
Total	95,626	367,615.7

TYPES OF FARMS

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 which were 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 of the farm is less than 20 per cent of the total area of the farm; (13) poultry farms are farms which do not qualify as crop farms and satisfy any of these conditions, namely; (a) there are more than 300 chickens regardless of area, (b) there are more than 100 laying chickens or ducks regardless of area, or (c) there are more than 200 other specific kinds of poultry other than chickens; and (14) other farms which are 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, cacao, 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 Samar according to census figures of 1960 are as follows:

Types of Farm	Number	Area (Ha.)
Palay farm	30,382	111,965.5
Corn farm	2,553	4,868.4
Root crop farm	3,658	6,656.0
Coconut farm	47,140	185,531.6
Abaca farm	1,394	7,565.3
Sugar cane farm	15	40.8
Tobacco farm	15	39.3
Vegetable farm	97	128.7
Fruit farm	566	2,023.6
Coffee farm	5	33.0
Hog farm	171	795.0
Livestock farm	107	1,532.0
Poultry farm	62	131.2
Others	9,461	46,305.3
TOTAL	95,626	367,615.7

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

Size of Farm (Ha.)	Number	Area (Ha.)
Under 0.2	323	32.3
0.2 and under 0.5	1,183	380.4
0.5 and under 1.0	3,586	2,208.5
1.0 and under 2.0	24,980	30,584.4
2.0 and under 3.0	20,697	44,814.8
3.0 and under 4.0	13,028	40,950.4
4.0 and under 5.0	8,508	35,191.4
5.0 and under 10.0	15,845	101,123.1
10.0 and under 15.0	5,319	59,568.5
15.0 and under 20.0	1,015	16,528.9
20.0 and under 25.0	524	11,399.1
25.0 and under 50.0	497	15,912.2
50.0 and under 100.0	104	6,400.3
100.0 and under 200.0	16	1,975.3
200.0 and over	1	546.1
	95,626	367,615.7

FARM INVESTMENT

The number of selected farm equipment which corresponds to farm investment in Samar according to the 1960 census are as follows:

Equipment	Number
Plows	27,833
Harrows	26,069
Tractors	58
Harvesting machines	7
Threshers	30
Carts	7,684
Motor vehicles	42
Sugar cane crushers	45
Abaca stripping machines	390
Sprayers	122
Incubators	31

SOIL SURVEY METHODS AND DEFINITIONS

Soil survey is an institution devoted to the study of the soil in its natural habitat. It 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.

The soils, their landscape 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. These horizons of the profile as well as the parent material beneath are studied in detail, and the color, structure, porosity, consistency, texture, and content of organic matter, roots, gravel, and stones are noted. The reaction of the soil and its content of lime and salts are determined either in the field or laboratory. The drainage, both 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 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 soil, 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 characteristics, and similar parent material. It comprises of soils having 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 Catubig series was first found and classified in the vicinity of Catubig, Samar.

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, Catubig loam is a soil type within the Catubig 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 used in the study. 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 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

078245—4

requirement and cultural management from those of the modal soil type. A phase of a type due mainly to degree of erosion, degree of slope and amount of gravel and stones on the surface is usually segregated on the map if the area can be delineated.

A complex is a soil association composed of such intimate mixtures of series, types, or phases 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 Catbalogan, Tingib and others that are mixed together, the complex must bear the name of the two dominant series as Tingib-Catbalogan complex, as the case may be. If there is only one dominant constituent, the complex bears the name of that series or type as Catbalogan or Tingib 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.

A soil survey party, composed of two or more soils men, maps the area and delineates the various soil types, phases, complexes and miscellaneous land types. All natural and cultural features found in the area are indicated on the soil map. These are trails, roads, railroads, bridges, telephone and telegraphic lines; barrios, towns, and cities; rivers and lakes; prominent mountains, and many others.

THE SOILS OF SAMAR

The soils of Samar may be grouped conveniently into three categories. They are (1) the soils of the plains and valleys; (2) the soils of the uplands, hills and mountains; and (3) the miscellaneous land types. The soil types and/or land types falling under each group are given below.

A. Soils of the Plains and Valleys.

	Number
1. Bay clay loam	93
2. Bigaa loam	913
3. Bigaa sandy loam	483

4. Bugko loamy sand	476
5. Bugko sandy loam	477
6. Catubig loam	484
7. Catubig clay loam	485
8. Dolongan loamy sand	479
9. Hernani loam	490
10. Maydolong silt loam	488
11. Maydolong sandy clay loam	489
12. Palapag clay loam	487
13. Pulupandan sandy loam	255
14. Pulupandan clay loam	481
15. Quingua clay loam	109
16. Quingua clay	385
17. San Manuel loam	190
18. San Manuel sandy loam	96
19. San Manuel clay loam	236
20. Silay loam	253
21. Tingib clay	478
22. Umingan loam	322

B. Soils of the Upland, Hills and Mountains.

1. Bayho clay loam	495
2. Bolinao clay	153
3. Catbalogan clay loam	492
4. Tingib-Catbalogan complex	493
5. Faraon clay	132
6. La Castellana clay	305
7. Libertad clay	494
8. Lugo clay loam	730
9. Luisiana clay	239
10. Tacloban clay loam	491
11. Ubay clay loam	172

C. Miscellaneous Land Types.

1. Beach sand	118
2. Hydrosol	1
3. Mt. soils, undifferentiated	45

The location and extent of the soils of Samar Provinces are shown in the accompanying soil map. The area and proportionate extent of each soil type and miscellaneous land type found in Samar Provinces are indicated in Table 8. The parent material, relief, drainage condition, and vegetative cover and/or crops grown in each of the different soils and miscellaneous land types are shown in Table 9 (Key to the Soils of Samar).

TABLE 8.—*Area and proportionate extent of each soil type and miscellaneous land type in Samar Provinces.*

Soil Mapping Number	Soil Type and/or Miscellaneos Land Type	Area[1]	
		Hectare	Per Cent
23	Bay clay loam	1,342.86	0.10
913	Bigaa loam	16,114.36	1.20
483	Bigaa sandy loam	1,074.29	0.08
476	Bugko loamy sand	17,591.51	1.31
477	Bugko sandy loam	671.43	0.05
484	Catubig loam	17,725.79	1.32
485	Catubig clay loam	4,565.73	0.34
479	Dolongan loamy sand	3,357.16	0.25
490	Hernani loam	268.57	0.02
488	Maydol ng silt loam	268.57	0.02
489	Maydolong sandy clay loam	1,074.29	0.08
487	Palapag clay loam	3,222.87	0.24
255	Pulupandan sandy oam	2,954.30	0.22
481	Pulupandan clay loam	805.72	0.06
109	Quingua clay loam	6,982.87	0.52
385	Quingua clay	4,297.16	0.32
190	San Manuel loam	18,128.65	1.35
236	San Manuel clay loam	5,505.74	0.41
96	San Manuel sandy loam	8,325.75	0.62
253	Silay loam	2,014.29	0.15
478	Tingib clay loam	10,205.76	0.76
322	Umingan loam	2,685.73	0.20
495	Bayho clay loam	60,563.12	4.51
153	Bolinao clay	73,051.75	5.44
492	Catbalogan clay loam	434,013.32	32.32
493	Tingib-Catbalogan complex	4,834.31	0.36
132	Faraon clay	79,094.63	5.89
305	La Castellana clay	44,717.34	3.33
494	Libertad clay	18,397.22	1.37
730	Lugo clay loam	12,891.48	0.96
239	Luisiana clay	67,143.15	5.00
491	Tacloban clay loam	31,691.57	2.36
172	Ubay clay loam	1,074.29	0.08
118	Beach sand	4,297.16	0.32
1	Hydrosol	18,665.80	1.39
45	Mt. Soils, undifferentiated	328,431.29	24.46
	Unsurveyed area	34 780.15	2.59
	TOTAL	1,342,863.00	100.00

[1] The area of each soil type and miscellaneous land type was determined by planimeter.

SOILS OF THE PLAINS AND VALLEYS

The soils under this group are secondary soils developed from alluvial deposits. They occupy the plains and valleys and have nearly level to undulating relief. They are the most productive soils in Samar. This group of soils covers a total area of about 129,183.42 hectares. Following are the descriptions of each of the soils under this group.

BAY SERIES

Bay series was first identified and established in the town of Bay in Laguna Province. This series is a secondary soil derived from accumulated sediments that have been carried by streams and washed over by sea waves into its present

location. The relief of this soil series is level to nearly level or flat. It is poorly drained. The profile characteristics of this soil series are as follows:

Depth (cm.)	Characteristics
0–25	Surface soil, dark brown clay to clay loam, sticky and plastic when wet. Boundary to lower layer is smooth and gradual. Water table is present in this layer.
25–60	Upper subsoil, dark green to bluish green clay, sticky and plastic. The lower boundary is 60 centimeters from the surface. Boundary to lower layer is smooth and gradual.
60–140	Lower subsoil, bluish green to gray sandy clay; sticky. Boundary to lower layer is smooth and abrupt.
140–150	Substratum, bluish green to dark green sand; coarse and gritty.

Bay clay loam (23).—Bay clay loam is the only soil type under this series identified and mapped in Samar. It occupies the lowlands adjacent to the hydrosol in Barrio Manunca, Sta. Rita; the lowlands along the coast of Barrio Calotan and Vigan, Gen. MacArthur; the lowlands in Barrio Naga, Quinapundan, and the lowlands in Barrio Tanglad, Hernani. The aggregate area is about 1,342.86 hectares or 0.10 per cent of the total area of Samar. These areas are usually submerged for months during rainy seasons.

The principal crops grown in the soil type are lowland rice and Palawan gabi or *galiang*.

BIGAA SERIES

Bigaa series was first identified and established in the municipality of Bigaa in Bulacan Province. This soil series is a secondary soil derived from alluvial deposits. The soil is deep and moderately fertile. It is characterized by a brown to dark brown surface layer with dark yellowish brown brick red streaks. The subsoil is light gray to dark brownish gray clay with yellowish brown mottlings. The substratum is light gray clay. Iron concretions are present in all the horizons.

Two soil types under this soil series were mapped in Samar—the Bigaa loam and Bigaa sandy loam. The descriptions of the typical profile of this series are given below.

Depth (cm.)	Characteristics
0–30	Surface soil, brown to dark brown clay, clay loam to sandy loam and loam; fine granular in structure; iron concretions are present. Boundary to lower layer is smooth.
30–100	Subsoil, light gray to dark gray clay, sticky and plastic; with reddish brown mottlings; slightly compact; iron concretions are present. Boundary to lower layer is smooth and diffuse.
100–150	Substratum, light gray clay, sticky and plastic; with iron concretions but lesser than those present in the subsoil.

Bigaa loam (913).—This soil type is widely distributed in Samar. It is found in the level lands of the municipalities of San Antonio, Allen, San Jose, Lavezares, Dolores, Oras, San Policarpio, Can-avid, Sta. Margarita, Tarangnan, Gandara and Wright. The aggregate area is about 16,114.36 hectares or 1.20 per cent of the total land area of Samar.

The principal crop grown is lowland rice. Palawan gabi or *galiang* is also grown on this soil type but in a limited extent. The yield of the rice is from 40 to 50 cavans to a hectare. The method used in the preparation of the land for the planting of lowland rice is the *payatac* system. This system is very crude, thus the fields are often not properly prepared so that the rice yields are low. Better harvest can be had if improved methods of rice culture and improved rice varieties will be introduced.

Bigaa sandy loam (483).—This soil type unlike the Bigaa loam which is widely distributed in Samar, is found only in the lowlands along the coast between Can-avid and Taft. It covers an area of about 1,074.29 hectares or 0.08 per cent of the total area of Samar.

The crops grown are coconut, rice and *galiang*. The method of land preparation employed in this soil type is the same as that practiced in Bigaa loam.

BUGKO SERIES

Bugko series was identified at Barrio Bugko, municipality of Mondragon, Northern Samar. This soil series is a secondary soil derived from the accumulations of marine and alluvial deposits. It occurs on nearly level to slightly undulating relief, and slightly elevated from sea level.

The soils of Bugko series are characterized by a dark grayish brown or dark brown to almost black, loose and structureless, loamy sand or sandy loam to loam surface soil, underlain by a light brown to light grayish brown, loose structureless fine sand layer. The substratum is light yellowish brown to light brown, loose and structureless fine sand. They are well-drained soils. Rain water does not stay long on the surface but readily percolates through the soil.

This soil series is very similar to Obando series. It differs only in the absence of marine shells which are present in Obando soils. In both soil series, fine sand layer occurs 30 centimeters below the surface.

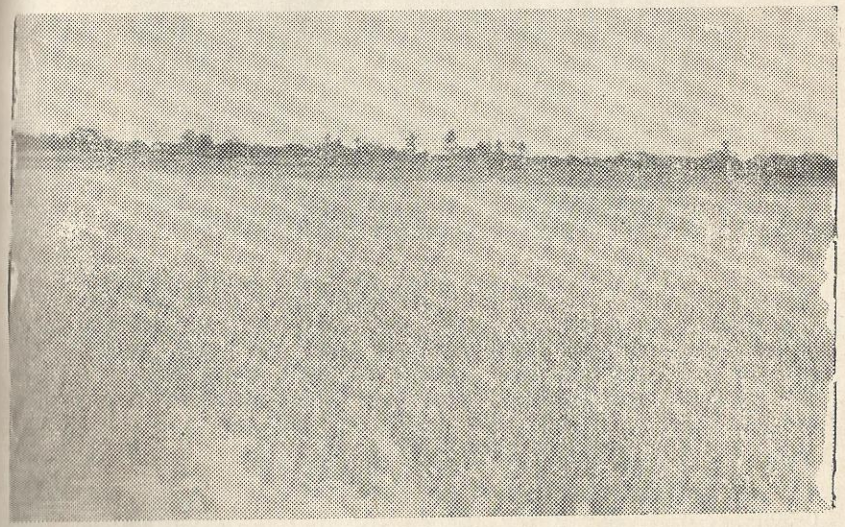

Fig. 23. Landscape of Bugko Series. Rice is the main crop here.

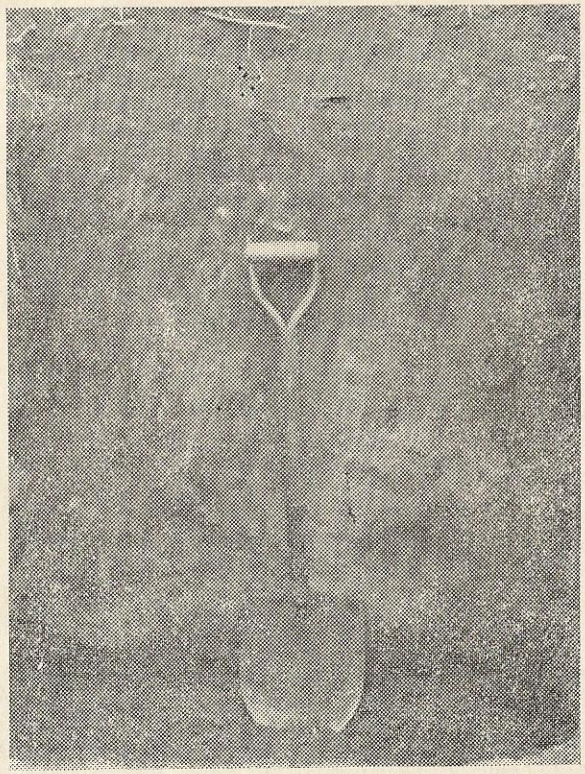

Fig. 24. Typical profile of Bugko Series.

Two soil types under this series were mapped in Samar—the Bugko loamy sand and Bugko sandy loam. The description of the typical profile of Bugko series is given below.

Depth (cm.)	Characteristics
0–30	Surface soil, dark grayish brown to almost black loamy sand or sandy loam, loose structureless. Fairly rich in organic matter content. Boundary to lower layer is smooth and diffuse.
30–50	Subsoil, light brown to light grayish brown fine sand, loose and structureless. Organic matter content is less than that in the above layer. Boundary to lower layer is smooth and diffuse.
50–150	Substratum, light yellowish brown to light brown fine sand, loose and structureless. Organic matter content is nil or almost absent.

Bugko loamy sand (476).—The major portion of this soil type occupies the almost level areas along the coast, about 600 meters wide and 4 kilometers long which stretch from the municipality of San Jose to Pambujan, Northern Samar. Small isolated areas are also found along the coast of the municipalities of Palapag, Northern Samar; Can-avid, Borongan and Llorente, Eastern Samar. The aggregate area is about 17,591.51 hectares or 1.31 per cent of the total area of Samar Provinces.

The crops grown are coconut, camote, gabi, peanut, vegetable, bananas, cassava and some fruit trees. The coconut is the principal crop. It seems adaptable to this soil as shown by their stand and yields. This soil type compares with the other soils of the Philippines in productivity.

This soil type needs the application of organic matter and manures to improve its physical condition and fertility. Planting of cover crops and legumes under the coconut trees is also suggested. Crop rotation must be practiced also.

Bugko sandy loam (477).—This soil type is found in depressions within the Bugko loamy sand at Barrio Bugko, Mondragon; in Lavezares; and in Palapag. Rain water collects on these areas during rainy days and stays on the surface for a while before it is absorbed in the soil. This soil is grown to rice, gabi, camote, cassava, banana and coconut. The principal crop is rice. It is interesting to note that lowland rice is being grown on this soil which is sandy. The explanation to this may be, that the water that flows and accumulates in this soil may have brought enough fine particles which sealed-off the spaces between the soil thus allowing the water to be held long enough on the surface for the needs of the rice plants. Also the frequent precipitation in the area has provided a continuous supply of water for the growing of lowland rice. Thus, the utilization of this soil type for the growing of lowland rice is made possible. The soil management required by this soil type are the same as those of Bugko loamy sand.

This soil type covers an area of about 410 hectares or 0.03 per cent of the total area of Samar Provinces.

CATUBIG SERIES

Catubig series is a newly established soil series in Samar. It was identified in the flood plains along the Catubig River.

Fig. 25. Landscape of Catubig Series.

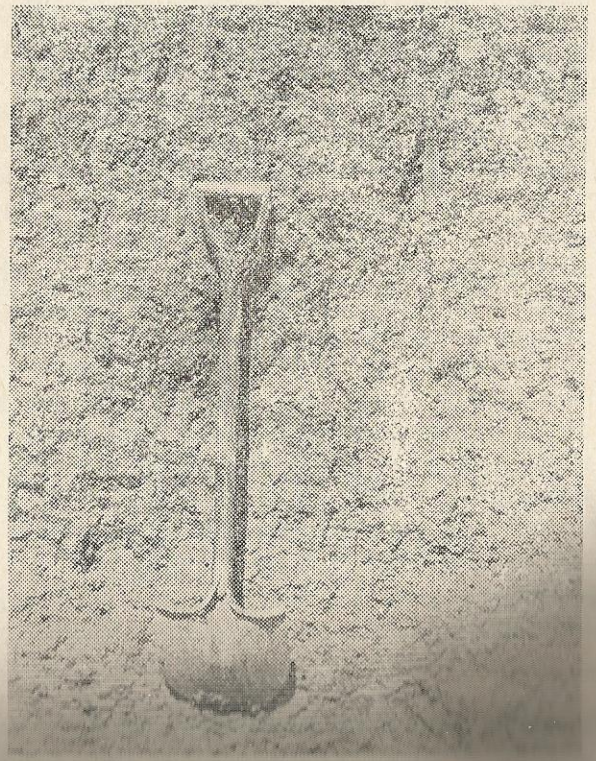

Fig. 26. Typical profile of Catubig Series.

This soil was developed from alluvial deposits washed down from the higher surrounding areas. The surface soil of Catubig series is usually loam and normally without concretions or coarse skeletons. The subsoil consists of two layers—the upper and lower subsoil. The upper subsoil is granular silty clay loam with fine iron concretions. The lower subsoil is blocky to columnar silty clay loam with iron concretions that are bigger in size. As it goes deeper the concretion decreases in number but increases in size. The substratum is silt loam to fine sandy loam. Iron concretion is absent in this layer.

The relief of this soil series is level to undulating. It has a shallow water table, ranging from one to one and-a-half meters from the surface. The present vegetation consists mainly of grasses such as *talahib, tambo, aguingay* and *culape*. Tall *talahib* and *tambo* are growing luxuriantly along the banks of the river.

Two soil types under this series were mapped in Samar—the Catubig loam and Catubig clay loam. The description of the typical soil profile of the series follows:

Depth (cm.)	Characteristics
0–25	Surface soil, yellowish brown to grayish brown (moist); light yellowish brown to light grayish brown (dry); mottled loam; moderately loose when moist and slightly friable when dry; granular in structure. Root penetration is easy. Rich in organic matter; 15 to 25 centimeters deep. Boundary to lower layer is diffuse and smooth.
25–50	Upper subsoil, light brown, brown to grayish brown silty clay loam with plenty of iron concretions; coarse granular structure. Depth is 35–50 centimeters from the surface. Boundary to next layer is diffuse.
50–90	Lower subsoil, light brown to brown to reddish brown silty clay loam with lesser iron concretions but larger in size (2–5 mm. in diameter) than those in the above layer, easily crushed between the thumb and forefinger.
90 below	Substratum, silt loam to fine sandy loam, without concretion.

Catubig loam (484).—This soil type covers the flood plains in the municipalities of Catubig, Laoang, Pambujan and Mondragon, Northern Samar. The aggregate area is about 17,591 hectares or 1.32 per cent of the total area of Samar Provinces.

The relief is level. Drainage is fair to poor. The water table is about one and a half meters from the surface. The area is usually subject to flood during the storms.

The principal crop grown is lowland rice. The lowland rice varieties commonly planted are locally called *Bubud, Kinaraboa, Basayuon, Senador, Memis,* and *Impostol.* The average production is 30 cavans per hectare. This low yield can be attributed to the poor methods of land preparation—the *payatac* and *pagulong* systems.

Upland rice, corn, camote, coconut, banana, sugar cane, gabi and vegetable are also grown in slightly elevated areas usually near the farm houses.

Catubig clay loam (485).—This soil type is similar to Catubig loam in many respects, except in the texture of the surface soil. The relief is nearly level to gently undulating, and the water table is from one to one and a half meters from the surface. This soil type is found in the flood plains along the up-stream course of the Catubig River at the town of Las Navas. It covers an area of about 4,565.73 hectares or 0.34 per cent of the total area of Samar Provinces.

Catubig clay loam is devoted mainly to the growing of lowland rice. The stand of the rice crops in this soil type is generally better than that in the Catubig loam. The average yield of the rice is 35 cavans to a hectare. The relatively low production can be attributed to the poor preparation of the land. The methods employed are the *payatac* and *pagulong* systems.

DOLONGAN SERIES

Dolongan series is a newly established series in Samar. It was identified at Barrio Dolongan in the municipality of Basey. This soil series is derived from the accumulation of organic materials (plant parts) and fine soil materials washed down from the higher surrounding areas.

This soil series is characterized by a very dark gray to black surface soil, consisting of a mixture of fine soil and well-decomposed organic materials underlain by a layer of well-decomposed organic materials. The organic materials are dispersed in water.

Only one soil type was mapped under the series.

Fig. 27. Landscape of Dolongan Series. Note that all coconut recline.

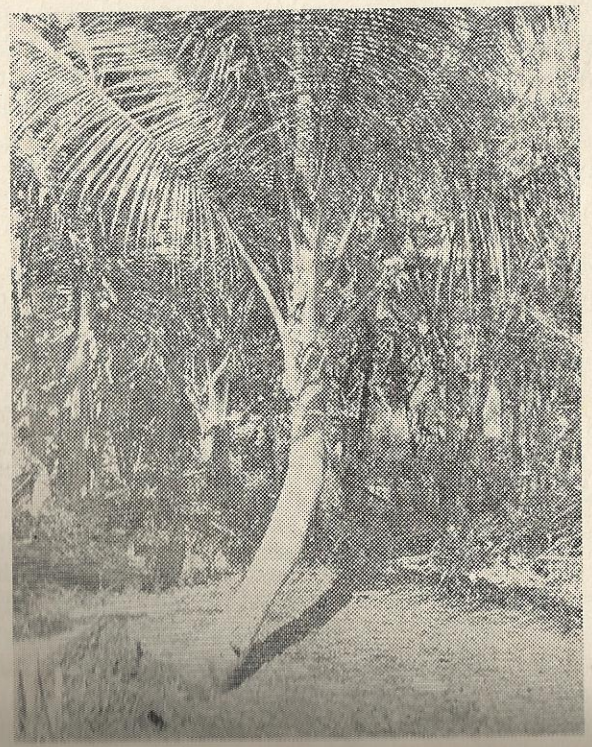

Fig. 28. Reclining coconut tree grown on Dolongan soils.

Dolongan loamy sand (479).—This is the only soil type identified under the series. It covers a nearly level bottom land at Bo. Dolongan in Basey with an area of about 3,357.16 hectares or 0.25 per cent of the total land area of Samar Provinces. The ground water level is at less than one-half meter from the surface. Drainage is poor. The profile description of Dolongan loam is given below.

Depth (cm.)	Characteristics
0–30	Surface soil, very dark gray to black when moist and very dark gray when dry; granular in structure; with plenty of well-decomposed organic matter.
30–70	Subsoil, dark brown to dark grayish brown loam; loose and friable; inter-mixed with plenty of well-decomposed and partly decomposed organic matter. Water table is at 40 centimeters from the surface. Depth is 70 centimeters from the surface.
70 and below	Substratum, dark brown to dark grayish brown muck, loose and structureless. This layer is dispersed in the water.

The crops grown are rice, gabi, *galiang* and some pineapple. The stand of the crops shows that the soil is fertile. The cultivation of the land is difficult and hazardous especially in places where the soil mass is thin because there is the tendency of the soil to give way to heavy load such as a fully grown carabao.

HERNANI SERIES

Hernani series is a newly established soil series mapped in the municipality of Hernani, Eastern Samar. This soil was developed from local alluvium and marine deposits. The extent of soil formation from marine deposits can be seen in the substratum where coralline materials are found. Meanwhile, the local alluvium coming from the surrounding areas have contributed much to the formation of the upper layers of the soil profile.

The surface soil is grayish brown to very dark gray, fine to coarse granular loam, the depth ranging from 20 to 30 centimeters. The subsoil consists of an upper and lower layers. The upper layer is yellowish brown to grayish brown, coarse granular to blocky silty clay loam; depth is 70 centimeters from the surface. While the lower layer is brown, grayish brown to dark grayish brown and blocky silty clay. The lower boundary is 100 centimeters from the surface.

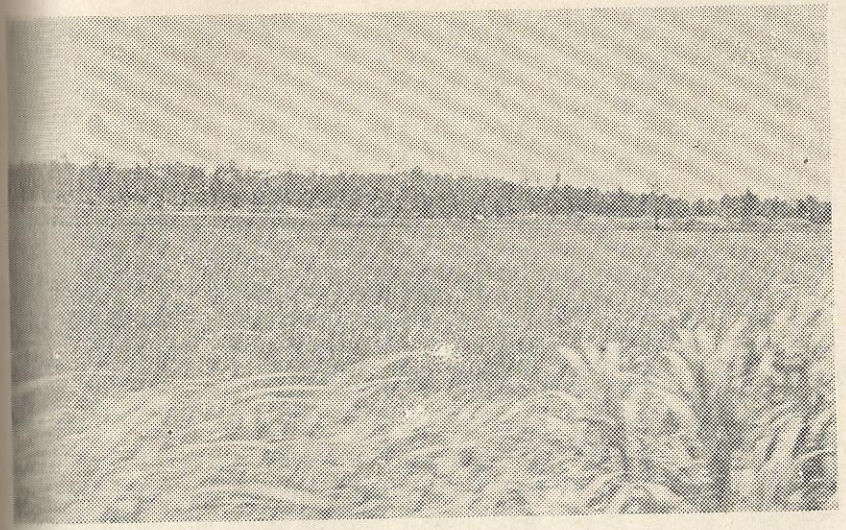

Fig. 29. Landscape of Hernani Series.

Fig. 30. Typical profile of Hernani Series.

The substratum is coralline sand with admixture of some silt, clay and organic matter. It is loose and friable. The depth extends beyond 150 centimeters from the surface.

The area occupied by this soil is nearly level and it is just a few meters above sea level at the higher portion and almost at sea level in the lower portion. It has a poor drainage. Owing to its high water table, the area is underwater almost throughout the year.

The vegetation found are mostly *ticog, tambo, lumbia* and some palms and nipa. The nipa is found along the river banks near the sea coast. Several species of araceous plants like *badiang* and *kiapo* are also found.

Hernani loam (490).—This is the only soil type identified and mapped under this series. It occupies the narrow plains of Hernani from Barrio Padaag to the beach near Barrio Batong. The total area is about 268 or 0.02 per cent of the total land area of Samar Provinces. The profile characteristics of this soil type are given below.

Depth (cm.)	Characteristics
0–30	Surface soil, grayish brown to very dark gray loam; fine to coarse granular in structure, with plenty of organic matter. Easy root penetration. Depth is 20 to 30 centimeters.
30–70	Upper subsoil, yellowish brown to grayish brown silty clay loam to silty clay; coarse granular to blocky structure.
70–100	Lower subsoil, grayish brown to dark grayish brown silty clay; blocky structure. It is more compact than the upper layer.
100–150	Substratum, very light gray, coralline sand with admixture of some silt, clay and organic matter. It is loose and friable.

This soil type is mostly devoted to the growing of lowland rice. Small patches, especially the water-logged areas, however, are planted to Palawan gabi or *galiang*. The medium-late maturing varieties of rice are planted one crop a year. The land preparation is by *payatac* method. The rice is sown in seedbeds in the middle of May and transplanted in the later part of June. Harvesting takes place in October and November. The average yield of rice is only 30 cavans to the hectare. The low production can be attributed to poor land preparation using *payatac* method.

The Palawan gabi or *galiang*, a perennial crop, thrives well in the low-lying areas which are under water throughout the year.

MAYDOLONG SERIES

Maydolong series is one of the newly established soil series in Samar Provinces. It was identified and described in the town of Maydolong. This soil series is derived from local alluvial deposits and marine sediments. This soil is moderately shallow—not beyond 75 centimeters in depth, with medium-textured surface soil underlain by coralline limestone rock. The relief is nearly level which rises just a few inches above sea level. It is under water part of the year.

The common vegetation found are *ticog*, and *tikiw*. The *ticog* is gathered and worked into mats. A description of the typical profile of this soil series is given below.

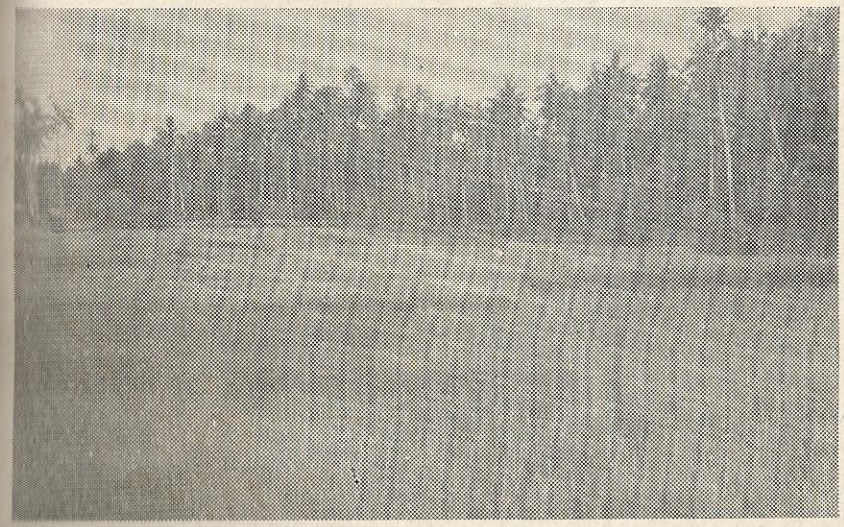

Fig. 31. Landscape of Maydolong Series.

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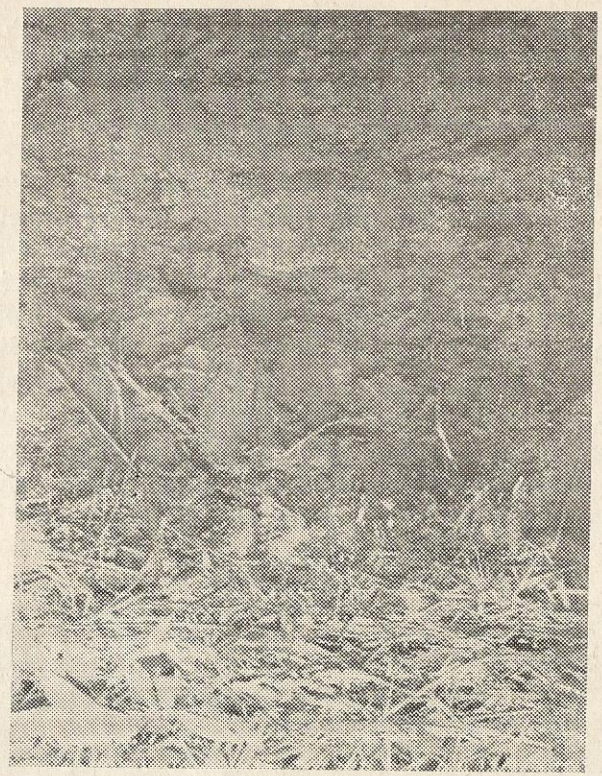

Fig. 32. Typical profile of Maydolong Series.

Depth (cm.)	Characteristics
0–30	Surface soil, grayish brown to very dark gray silt loam to sandy clay loam; loose and granular to blocky structure; with plenty of organic matter. Decaying organic matter is also present on the surface.
30–75	Subsoil, brown, dark brown to very dark gray silty clay loam, loose and granular to blocky structure. Organic matter content is fair.
75 and below	Coralline limestone rock with decaying organic matter in crevices.

Maydolong silt loam (488) and Maydolong sandy clay loam (489) are the two soil types that were delineated and mapped under this soil series.

Maydolong silt loam (488).—This soil type occupies the small, nearly level bottom land between the barrios of San Isidro and Pagbabagnon, San Julian, Eastern Samar. It

covers an area of about 268 hectares or 0.02 per cent of the total area of Samar Provinces.

Rice and Palawan gabi or *galiang* are the only crops grown on this soil because it is always wet or under water.

Maydolong sandy clay loam (489).—This soil type is found in different spots along the coast of the town of Maydolong and in the barrios of San Gregorio, Lauaan and Magallanes, Balangiga, Eastern Samar. The aggregate area is about 1,074.29 hectares or 0.08 per cent of the total land area of Samar Provinces. This soil type is submerged during part of the year.

Lowland rice and *galiang* are the principal crops grown. *Ticog* and *tikiw* are the native vegetation in this soil type.

PALAPAG SERIES

Palapag series is a newly established soil series identified in the town of Palapag, Northern Samar. This soil was developed from alluvial deposits. It is deep, fertile but poorly drained. The relief is level to undulating. The surface soil is clay loam to silty clay loam, brown to grayish brown when wet and light brown to light grayish brown when dry; easily penetrated by roots. The subsoil is composed of two layers, both silty clay loam with iron concretions and gravels of varying sizes, from 1 to 10 millimeters in diameter, in the lower layer. The concretions increase in size as they go deeper. They can be easily crushed. The substratum is sandy loam to sandy clay loam with gravels that are similar to those of the above layer.

The native vegetation are *ticog,* other water-loving plants and second growth forest.

This soil series is very similar to Catubig series except for the presence of gravels in its lower subsoil.

Only one soil type was identified and mapped under this series, Palapag clay loam. The description of the typical soil profile of this soil series is given below.

Depth (cm.)	Characteristics
0–25	Surface soil, brown to grayish brown when wet and light brown to light grayish brown when dry; clay loam to silty clay loam; plastic when wet, with coarse granular structure when dry and easily penetrated by roots. Some tiny limestone granules are present. Boundary to the lower layer is diffuse.

Depth (cm.)	Characteristics
25–35	Upper subsoil, grayish brown to brown coarse granular in structure, mottled silty clay loam; iron concretions, ranging in size from 1 to 2 millimeters which can be easily crushed, are present. Roots easily penetrate this layer.
35–70	Lower subsoil, light brown silty clay loam; coarse granular to blocky in structure. Iron concretions and gravels, ranging from 1 to 10 millimeters in diameter, are present. The concretions can be easily crushed.
70 and below	Substratum, light brown sandy loam to sandy clay loam; coarse granular to blocky in structure; with gravels that are similar to those of above layer.

Palapag clay loam (487).—This soil type occupies the nearly level to undulating narrow strip of land along the proposed road from Barrio Concepcion, municipality of Motiong to the Municipal District of San Jose de Buan. It covers a total area of about 3,222.87 hectares or 0.24 per cent of the total area of Samar Provinces.

The principal crop grown is upland rice. Other crops grown are coconut, camote, corn, banana, cassava, abaca and gabi.

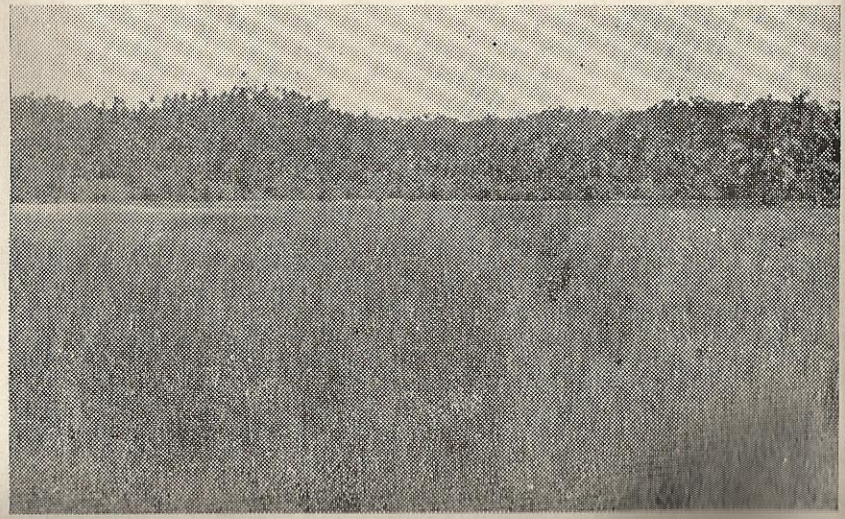

Fig. 33. Landscape of Palapag Series.

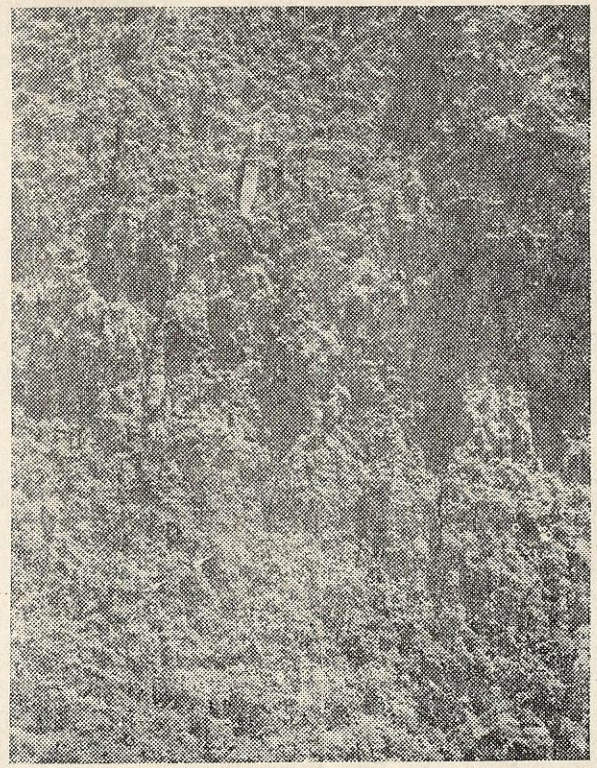

Fig. 34. Typical profile of Palapag Series.

PULUPANDAN SERIES

This soil series was first described and mapped by Pendleton in Negros Occidental in 1930. He described the soil as "developed from recent coastal deposits of sand and shells thrown by the sea as barrier along the beaches." The relief of this soil series is nearly level to very gently undulating. The drainage is excessive owing to its coarse soil materials. It has a dark surface soil underlain by a grayish brown sand layer over a light brown to gray at times reddish gray, sand mixed with a large quantity of marine shells.

Pulupandan series is similar to Obando soils, both are marine deposited sand and shells. They differ slightly in color, quantity of marine shells and in compactness. The Pulupandan series has a darker surface soil, more marine shells and denser substratum than the Obando series.

Two soil types are mapped under this soil series—the Pulupandan clay loam and Pulupandan sandy loam. Following is the profile description of Pulupandan sandy loam representing this soil series.

Depth (cm.)	Characteristics
0–20	Surface soil, black when wet, brownish gray when dry sandy loam; soft, structureless, single-grained and friable. Fairly rich in organic matter content.
20–40	Subsoil, grayish brown sand; slightly compact, structureless, friable, soft and calcareous. Poor in organic matter content. Few marine shells are present.
40–150	Substratum, light brown to gray, at times reddish gray, sand mixed with considerable quantity of marine shells which is moderately compact.

Pulupandan sandy loam (255).—This soil type occupies the areas along the coast of Calbayog City. It covers an area of about 2,954.30 hectares or 0.22 per cent of the total area of Samar Provinces. It has a nearly level relief.

Coconut is the principal crop grown. Other crops grown are camote, cassava and gabi. The coconut and gabi are thriving well.

Pulupandan clay loam (481).—This soil type is found in the two island-towns of Capul and San Antonio. It has a total area of about 805 hectares.

The crops grown are coconut, rice and *galiang*. The average yield of rice is no less than 40 cavans per hectare.

QUINGUA SERIES

Quingua series was established during the survey of Bulacan Province. This soil series, like San Manuel series, is widely distributed in the country. Both are derived from recent alluvial deposits and are deep, fertile and well-drained soils adopted to a wide variety of crops. They differ in color throughout their profile so that the layers can hardly be distinguished. While San Manuel series exhibits a definite stratification with alternating colors of grayish brown, yellowish brown or brownish gray. The relief is level to nearly level.

Like Bigaa and Bantog series, this soil series has reddish brown streaks in the profile, a characteristic of most paddy soils. Quingua soils usually have loose surface soils. The subsoil is of finer texture than the surface soils.

Two soil types were delineated in Samar Provinces under this series, Quingua clay loam and Quingua clay. A description of the typical profile is given below.

Depth (cm.)	Characteristics
0–40	Surface soil, light brown to yellowish brown clay to clay loam, loose, friable and structureless with reddish brown streaks. Boundary to next layer is smooth and diffuse.
40–85	Subsoil, light brown, light reddish brown to dark brown loose to slightly compact and friable silty clay loam or clay loam. Boundary to lower layer is gradual and smooth.
85–150	Substratum, brownish yellow to light brown, loose to slightly compact silty clay loam or clay loam.

Quingua clay loam (109).—This soil type covers a total area of about 6,982.89 or 0.52 per cent of the total area of Samar Provinces. It occupies the flood plains along the national road from Barrio Nabong to Barrio San Rufino, Oquendo; Barrios Nena and Libas, San Isidro; Barrio Del Remedios, Sulat; Barrio Vigan, Gen. MacArthur and Barrio San Pedro, Quinapundan.

This soil type is cultivated mainly to lowland rice and *galiang*. The yield of rice is over 50 cavans per hectare.

Payatac method of land preparation is followed. Employment of better methods of land preparation to increase rice production is suggested.

Quingua clay (385).—This soil type is found along the Oras River from Hipapad to Oras and along Dolores River. It has an aggregate area of about 4,297.16 hectares or 0.32 per cent of the total area of Samar Provinces. It is easily worked on.

The principal crops grown are lowland rice and *galiang*. The method of land preparation for the lowland rice is the same as in the Quingua clay loam.

SAN MANUEL SERIES

San Manuel series was first identified in Tarlac Province. It is one of the most productive soils of the Philippines and the most widely distributed, occurring usually along river courses or in plains principally formed by streams. It is a deep and fertile soil having coarse to medium texture with

nearly level relief. In general, its water table is fairly low but in some places it is high in which case the drainage becomes poor.

This soil series is characterized by brown, grayish brown subsoil. The substratum is yellowish brown to reddish brown, fine to medium sand. It is usually found in low-lying areas, hence, it is subject to flood during rainy periods.

Three soil types under this series were identified and mapped in Samar Provinces. They are San Manuel loam, San Manuel sandy loam and San Manuel clay loam. A profile description of San Manuel loam, representing the San Manuel series, is given below.

Depth (cm.)	Characteristics
0–30	Surface soil, grayish brown to pale brown when dry and brown when wet loam; fine to medium granular structure and friable.
30–80	Upper subsoil, yellowish brown to brownish gray silt loam; medium to coarse granular structure and friable.
80–120	Lower subsoil, dark brown silt loam; fine granular structure.
120 and below	Substratum, yellowish brown to light reddish brown, fine sandy loam to fine or medium sand.

San Manuel loam (190).—This soil type is one of the most widely distributed soil types in Samar. It is found in the municipalities of Catarman, Oquendo, Calbiga, Borongan, Maslog and Matuguinao. The aggregate area is about 18,128.65 hectares or 1.35 per cent of the total land area of Samar Provinces. Many of these areas are subject to floods during periods of heavy rainfall. However, external and internal drainage are good.

Because of its inherent fertility and depth a wide variety of crops are grown. Rice and corn are the most important crops. Other crops grown are coconut, camote, banana, abaca, cassava, gabi and *galiang*.

Plowing this soil when wet tends to form hard and big clods. Therefore, it is advisable to plow and harrow this soil at its optimum moisture content in order to produce good tilth. Better methods of land preparation should also be introduced to increase the yield of lowland rice.

San Manuel sandy loam (96).—This soil type is not widely distributed in Samar. It is found in the flood plains along the roads from Sulat to Taft, from Can-avid to Dolores, and at both sides of the mouth of Cras River. The aggregate area is about 8,325.75 hectares or 0.62 per cent of the total area of Samar Provinces.

This soil is loose, friable and easy to work on but it has the least water-holding capacity among the San Manuel soils. It is devoted, however to diversified crops among the soil types of San Manuel series. The crops grown are rice, corn, coconut, camote, abaca, cassava and gabi.

San Manuel clay loam (236).—This soil type is found in the flood plains along the Laua-an and Balangiga Rivers, along the stream that flows from Barrio Calipquipon to Taft poblacion and in the plains at the northern and southern parts of the town of Gandara. The approximate area is 5,505.74 hectares or about 0.41 per cent of the total area of Samar Provinces.

It is one of the most productive soils in Samar. It is subject to overflows when the rivers swell during rainy periods.

The principal crops grown are lowland rice and *galiang*. The yield of lowland rice, however, is below the national standards of 60 cavans per hectare owing to the crude method of land preparation employed.

SILAY SERIES

This soil series was first described by Pendleton in the survey of Silay–Sarabia area in Negros Occidental. The soils are formed from recent alluvial deposits washed down from the surrounding uplands. The surface soil is light grayish brown or gray to dark grayish brown underlain by a structureless massive and compact grayish brown silt loam layer. The relief is nearly level. External drainage or runoff is slow, while the internal drainage is impeded due to the presence of a compact and hard layer in the profile, locally called *bakias*.

The distinguishing characteristic of this soil series is the presence of a compact and hard layer in the profile caused by a cementing substance, a siliceous substance that binds the soil materials. This compact layer is usually found beneath the surface soil and in many cases, extends to the substratum.

Silay loam is the only soil type mapped and identified under this series in Samar.

Silay loam (253).—This soil type is found in Calbayog and Oquendo, specifically in the barrios of Quiliquili, Navarro, San Policarpio, Matobato, Capo-ocon and Obrero. It covers an area of about 2,014.29 hectares or 0.15 per cent of the total area of Samar Provinces.

The surface soil is gray to dark grayish brown when wet and gray when dry, loam, fine granular structure, friable, loose and mellow. Organic matter content is poor, non-calcareous and very acidic (pH 5.5). Depth ranges from 15 to 20 centimeters. Boundary to subsoil is clear and smooth.

The upper subsoil is grayish brown when wet, gray when dry, friable silt loam but slightly compact and hard when dry. The depth varies from 30 to 35 centimeters from the surface. Boundary to lower layer is clear and smooth. The lower subsoil is brown to grayish brown silt loam, mottled dark brown, massive, strongly compact and hard. No coarse skeleton nor concretion. The depth is from 55 to 60 centimeters from the surface. Boundary to substratum is smooth and diffuse.

The substratum is light gray sandy loam, massive, strongly compact and hard. Beneath is a three-meter-thick layer of dark gray clay.

This soil is principally grown to lowland rice with a few *galiang*. Owing to the presence of the compact layer beneath the surface layer, the impounding of water in this soil is much facilitated, thus making it highly suitable for the growing of lowland rice.

TINGIB SERIES

Tingib series is a newly established soil series in Samar. It was identified in Barrio Tingib, Basey. It is a secondary soil developed from local alluvium brought down by water from the higher surrounding areas. It occurs on nearly level or flat relief slightly above sea level. The water-table is commonly at or near the surface during most part of the year.

This soil series is characterized by a light grayish brown to light gray surface soil with reddish brown streaks. The depth ranges from 20 to 30 centimeters. The subsoil consists of two layers—the upper and lower layers. The upper layer is light gray clay with reddish brown streaks and mottlings and with black concretions. The lower layer is light yellowish brown to grayish brown clay with reddish brown mottlings and concretions. The substratum is light yellowish brown to light grayish brown clay with concretions.

Fig. 35. Landscape of Tingib Series.

Fig. 36. Typical profile of Tingib Series.

Tingib series differs from Bigaa series because the concretions in the former are of manganese while those of the latter are of iron and also they are smaller in size. Furthermore, the latter is better drained than the former. Tingib series also differs from Catubig series in that Catubig series has fewer and smaller concretions.

The description of the typical profile of Tingib series is given below.

Depth (cm.)	Characteristics
0–30	Surface soil, light grayish brown to light gray clay loam with reddish brown streaks; sticky and plastic when wet, hard and cloddy when dry. Rich in organic matter content. Boundary to lower layer is diffuse.
30–50	Upper subsoil, light gray clay with reddish brown streaks; plastic and sticky when wet. Some black manganese concretions are present. Concretions can be crushed easily. Boundary to lower layer is diffuse.
50–80	Lower subsoil, grayish brown to yellowish brown clay; mottled reddish brown, massive, plastic and sticky when wet. Numerous manganese concretions are present. Boundary to lower layer is diffuse.
80–150	Substratum, light grayish brown clay; sticky and plastic and less massive than above layer. Plenty of manganese concretions are present. Concretions range in size from a coarse sand to as big as a corn kernel.

Tingib clay loam (478).—This soil type is found in the lowlands of Basey; Barrios Manunca and Camain, Sta. Rita; Barrios Mambug and Caayon, Calbiga; and Barrio Tagbaya, Hinabangan. The aggregate area is about 10,205.76 hectares or about 0.76 per cent of the total area of Samar Provinces.

The areas covered by this soil type are traversed by a number of creeks. The relief is nearly level or flat. The present vegetation are *tikiw, ticog, arat,* bamboos and other water-loving plants. Lowland rice is the principal crop grown. Coconuts, bananas, fruit trees and vegetables are grown in limited area—on slightly elevated areas. Palawan gabi or *galiang* is also grown in water-logged areas. The rice is planted in June and harvested in December. The average yield of rice is 45 cavans to a hectare. Land preparation is by *payatac* and *pagulong* methods. The ricefields are rainfed.

The rice production can be improved by using improved rice varieties, installation of irrigation-drainage system, application of adequate and right kind of fertilizers, and employment of improved methods of land preparation and approved agricultural practices. Dikes should be installed also in all ricefields for the impounding of water.

UMINGAN SERIES

Umingan series is a secondary soil formed from the accumulations of soil materials carried by water from the surrounding higher areas. It has a level to undulating relief. It is moderately drained. The water table is low, ranging from 3 to 4 meters from the surface. The surface soil is usually dark brown, moderately friable, with good fine granular structure.

The distinguishing characteristic of this series is the presence of a distinct layer of water-worn stones and gravels in the subsoil, ranging from 10 to 15 centimeters thick. In some cases, there are two layers of stone accumulations separated by a layer of sand. The first layer of stones may occur a few centimeters to about a meter from the surface, and the second layer may appear at about 50 to 100 centimeters below the first layer of stones.

The common vegetation consists of cogon, talahib, *alibangbang, binayoyo, culape* and bamboos. Only one soil type, the Umingan loam, under this soil series was mapped in Samar. The description of the typical profile of this soil series is given below.

Depth (cm.)	Characteristics
0–45	Surface soil, brown to yellowish brown silt loam, loam or sandy loam to fine sand, loose, friable, fine granular structure. Some stones are present on the surface in some areas. Boundary to lower layer is clear and smooth.
45–100	Subsoil, brown to reddish brown sandy loam or fine sand to coarse sand, loose and friable. Lower subsoil has a distinct layer of water-worn gravels and stones accumulation of 10 to 15 centimeters thick. In some cases, the accumulation is of two layers separated by a layer of sand.
100–150	Substratum, brown to dark brown or light brown to yellowish brown sand to coarse sand, slightly compact and structureless.

Umingan loam (322).—This soil type is found in Borongan, along Hibug and Borongan Rivers, in Llorente along Tongkil and Llorente Rivers; and in the town of Giporlos. The aggregate area is about 2,685.73 hectares or 0.20 per cent of the total area of Samar Provinces.

This soil type is easy to cultivate and it responds to good soil management. However, it is subject to flood or overflow during torrential rains and storms. The relief is nearly level to slightly undulating.

The crops are coconut, rice, corn, camote, cassava, bananas and gabi. The coconut is the principal crop. The crops have a fairly good stand and the coconut seems to be well adapted to this soil type. The yield of the coconuts averages to about 5,800 nuts or more to a hectare. The productive capacity of this soil may be enhanced by green manuring and regular application of organic matter and fertilizers. The fertilizer applications should be based on soil analysis. In the cases of growing lowland rice, the soil should be puddled thoroughly and dikes should be installed in the fields for the impounding of water. Planting of cover crops, such as kudzu, centrosema and calopogonium, under the coconut plantations is suggested for the control of weeds and to minimize excessive loss of moisture in the soil through evaporation. Crop rotation is also advisable.

Soils of the Uplands, Hills and Mountains

This group of soils makes up the biggest land area in Samar. They cover a total land area of about 827,472.18 hectares. Many of the soils in this group are not fit for cultivation due to their steepness. They are best suited for permanent vegetation and pasture.

BAYHO SERIES

Bayho series is a newly established soil series in Samar. It was identified at Barrio Bayho, Catarman. It is a deep and moderately permeable soil developed from weathered igneous rocks. It occurs on rolling, hilly to mountainous relief.

This soil series is very similar to Luisiana series in relief and in parent material, but differs in the soil color, depth and profile development. Luisiana series is deep while Bayho series is shallower and lighter in color and the profile is less

Fig. 37. Landscape of Bayho Series.

Fig. 38. Typical profile of Bayho Series.

intensively developed than that of the former. It is also similar to Libertad series, except for the absence of concretions which are present in the Libertad series.

This soil series is characterized by a brown to dark brown loam to clay loam granular structure surface soil underlain by a light brown to reddish brown granular clay loam layer containing some soft gravels over a layer of gravels. Some of the gravels can be broken easily between fingers.

Bayho clay loam is the only soil type under this series delineated and mapped in Samar. A description of the typical profile of this series is given below.

Depth (cm.)	Characteristics
0–30	Surface soil, brown to dark brown clay loam granular structure. Many roots are present. Boundary to lower layer is smooth and diffuse.
30– 70	Subsoil, light brown or dark brown to reddish brown clay loam granular to blocky structure with few gravels sporadically embedded. Some of the gravels can be broken easily between the fingers.
70–150	Substratum, light brown to reddish brown clay loam granular to blocky structure with more gravels than the above layer.

Bayho clay loam (495).—This soil type is found on the rolling to hilly and mountainous areas at the southern part of Catarman and Mondragon which are interspersed by the Catubig and San Manuel soils. The area covered is about 60,563.12 hectares or 4.51 per cent of the total area of Samar Provinces.

Coconut and camote are the two principal crops grown. Other crops grown are upland rice, corn, abaca, banana and some fruit trees. Primary and secondary forests cover the uncultivated areas. The Mondragon and Catarman Rivers are the good sources of irrigation water in the area, however, irrigating the area is not feasible due to its rolling and steep relief.

The areas with gentle slopes can be used for the cultivation of seasonal crops provided however, that conservation measures are applied. Those with steeper slopes should be utilized for permanent vegetation like fruit trees or orchard, coconuts, abaca, bananas, and pasture grasses. If utilized for orchard, the trees should be planted along the contours and cover crops should be introduced.

BOLINAO SERIES

Bolinao series was first identified in Bolinao, Pangasinan. It is a primary soil developed from coralline limestone. It occurs on undulating, rolling and hilly to mountainous areas. This soil series is very similar to Faraon series, except in color and consistency of the parent rock. Bolinao soils are brown while Faraon soils are black; and the coralline rock in Bolinao series is harder than that of Faraon series.

Bolinao series is characterized by a reddish brown, dark brown or brown surface layer underlain by grayish brown or light reddish brown subsoil over a layer of reddish brown highly weathered limestone. In some cases, the solum rests immediately over the solid unweathered limestone rocks. Outcrops of limestone rock occur usually on this soil.

Bolinao clay is the only soil type under this soil series identified and mapped in Samar. Below is the description of the typical profile of Bolinao clay.

Depth (cm.)	Characteristics
0–30	Surface soil, reddish brown clay, fine granular structure, compact; very sticky and plastic when wet.
30–80	Subsoil, grayish brown to light reddish brown clay, fine granular structure and compact; sticky and plastic when wet. Limestone gravels and weathered limestone are present.
80–150	Substratum, reddish brown weathered limestone underlain by hard limestone rock.

Bolinao clay (153).—This soil type is one of the most widely distributed soils in Samar. It is found in the upland areas near the coast between San Julian Poblacion toward Barrio Bugas, Borongan; in the rolling areas along the coast from Borongan to Hernani; in the areas from Barrio Matarimao, Salcedo to the town of Guiuan; in the Barrios of Malinao and Calayhon, Taft; and in the islands of Tubabao, Manicani, Calicoan, Biri, Talisay, San Juan, Bani, Buenavista, Batag, Cahayagan and Laoang. The aggregate area is about 73,051.75 hectares or 5.44 per cent of the total area of Samar Provinces. The relief of the lands in most of the islands is undulating to rolling, while those in the mainland is hilly and rough. Outcrops of limestone rock are present in this soil type.

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Rice, corn, and coconuts are the crops grown on this soil type. These crops are grown more extensively in most of the islands than in the mainland. In some places, rice and corn are interplanted between rows of young coconut trees. The uncultivated hilly and mountainous areas are covered with primary and secondary forests.

CATBALOGAN SERIES

This soil series was established in Samar, identified along the road to Wright, about a kilometer from the poblacion of Catbalogan. It is a moderately deep soil derived from weathered stratified shale and sandstone, shale predominating.

This soil is similar to Bauang soils. Both are derived from stratified shale and sandstone. The relief is rolling, hilly and steep to very steep. They differ slightly in color. Bauang series has a brighter red color. The main difference lies in the characteristics of the subsoil. The subsoil of Catbalogan series consists of coarse granular to blocky clay loam upper layer and blocky clay loam lower layer that contains crumbs and fragments of highly weathered shale; while that of Bauang series is only a layer of highly weathered stratified shale and sandstone, the shales are cubical to hexagonal in shape. Catbalogan series also differs from Alimodian series, although both are derived from shale and sandstone, in depth and color. Alimodian soils are deeper and darker in color.

Fig. 39. Landscape of Catbalogan Series.

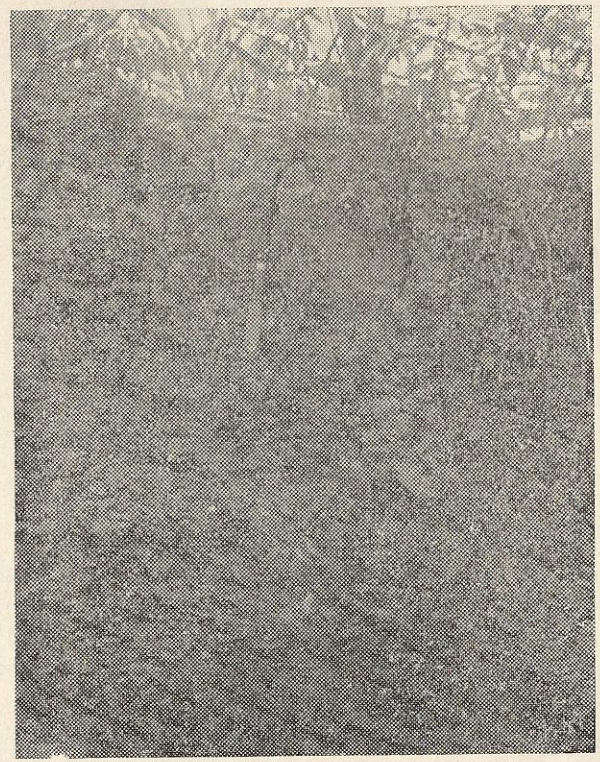

Fig. 40. Typical profile of Catbalogan Series.

Catbalogan soil has slow to very slow permeability and excessive surface run-off. The surface soil is brown to dark gray when moist, light grayish brown to gray when dry, coarse granular to blocky clay loam or silty clay loam. The subsoil is of light yellowish brown coarse granular to blocky clay loam upper layer; and yellowish gray to light gray blocky clay loam lower layer with highly weathered crumbs and blocks of shale. The substratum is clay loam over highly weathered stratified shale and sandstone.

The crops grown are upland rice, abaca, banana, camote, cassava, coconut and some fruit trees. The uncultivated areas are covered with cogon grass and secondary forest. The second growth forest are found mostly in the steeper areas.

Catbalogan clay loam is the only soil type under this soil series delineated and mapped in Samar. The description of the typical profile of this soil is given below.

Rice, corn, and coconuts are the crops grown on this soil type. These crops are grown more extensively in most of the islands than in the mainland. In some places, rice and corn are interplanted between rows of young coconut trees. The uncultivated hilly and mountainous areas are covered with primary and secondary forests.

CATBALOGAN SERIES

This soil series was established in Samar, identified along the road to Wright, about a kilometer from the poblacion of Catbalogan. It is a moderately deep soil derived from weathered stratified shale and sandstone, shale predominating.

This soil is similar to Bauang soils. Both are derived from stratified shale and sandstone. The relief is rolling, hilly and steep to very steep. They differ slightly in color. Bauang series has a brighter red color. The main difference lies in the characteristics of the subsoil. The subsoil of Catbalogan series consists of coarse granular to blocky clay loam upper layer and blocky clay loam lower layer that contains crumbs and fragments of highly weathered shale; while that of Bauang series is only a layer of highly weathered stratified shale and sandstone, the shales are cubical to hexagonal in shape. Catbalogan series also differs from Alimodian series, although both are derived from shale and sandstone, in depth and color. Alimodian soils are deeper and darker in color.

Fig. 39. Landscape of Catbalogan Series.

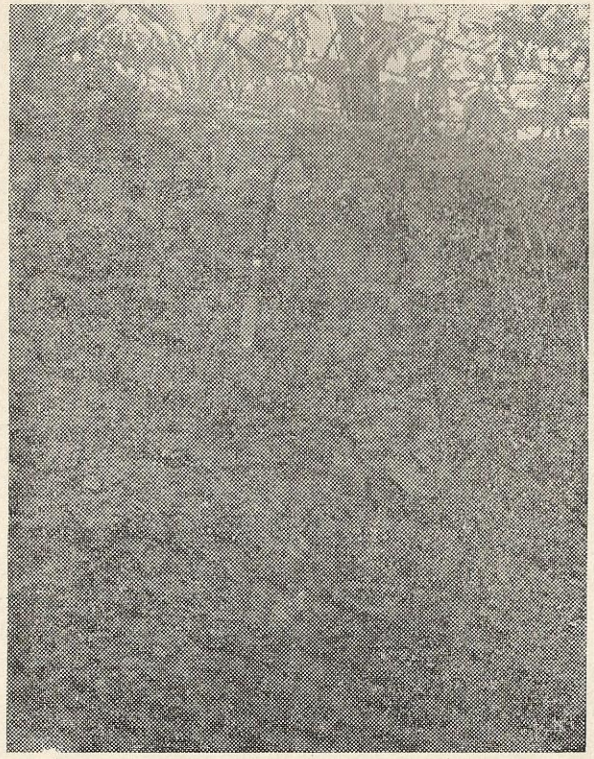

Fig. 40. Typical profile of Catbalogan Series.

Catbalogan soil has slow to very slow permeability and excessive surface run-off. The surface soil is brown to dark gray when moist, light grayish brown to gray when dry, coarse granular to blocky clay loam or silty clay loam. The subsoil is of light yellowish brown coarse granular to blocky clay loam upper layer; and yellowish gray to light gray blocky clay loam lower layer with highly weathered crumbs and blocks of shale. The substratum is clay loam over highly weathered stratified shale and sandstone.

The crops grown are upland rice, abaca, banana, camote, cassava, coconut and some fruit trees. The uncultivated areas are covered with cogon grass and secondary forest. The second growth forest are found mostly in the steeper areas.

Catbalogan clay loam is the only soil type under this soil series delineated and mapped in Samar. The description of the typical profile of this soil is given below.

Depth (cm.)	Characteristics
0–25	Surface soil, grayish brown when moist, light grayish brown to gray when dry clay loam, coarse granular to blocky structure. Boundary to lower layer is gradual.
25–50	Upper subsoil, light yellowish brown clay loam, coarse granular to blocky structure. Brown spots and some crumbs and fragments of highly weathered shale are present. Boundary to lower layer is diffuse.
50–90	Lower subsoil, yellowish gray to light gray clay loam, blocky structure with crumbs and blocks of highly weathered shale. The crumbs and blocks of shale give either reddish brown or reddish black tints when cut. Boundary to lower layer is diffuse.
90 and below	Substratum, yellowish gray to pinkish brown clay loam layer over highly weathered and partly massive stratified shale and sandstone with reddish brown spots or freckles.

Catbalogan clay loam (492).—This soil type occupies the major portion of the rolling and hilly areas in the Eastern, Northern and Western Samar. It covers a total area of about 434,013.32 hectares or 32.32 per cent of the total land area of Samar Provinces.

The crops grown are upland rice, camote, coconut, abaca, cassava, bananas and some fruit trees. Due to the unfavorable relief this soil type should not be utilized for the growing of seasonal and row crops but for permanent crops or for woodland and pastureland. Areas with gentle slopes may be used for some seasonal crops provided conservation measures are employed, otherwise it should be planted to permanent crops like coconut.

FARAON SERIES

Faraon series was first identified and delineated in Negros Occidental. It is a shallow primary soil derived from the weathering of coralline limestone rocks. It occurs usually in hilly and mountainous relief. It has an excessive external drainage and fair internal drainage.

Faraon series is similar to Binangonan series in color and both are derived from limestone rocks. They differ only in the characteristics of their parent rock. The limestone rock in Faraon soils is soft, angular, darker in color and coralline in

nature; while that in Binangonan series is hard, massive and lighter in color. The parent rock of Faraon series resembles that of Bolinao series also. Both are coralline limestone. They differ, however, in color. Bolinao soils are brown while Faraon soils are dark gray.

In Samar, this soil series is represented by one soil type only, the Faraon clay. The description of a typical profile of Faraon clay is given below.

Depth (cm.)	Characteristics
0–30	Surface soil, dark gray to black clay; soft, granular structure, sticky and strongly plastic when wet; slightly hard and brittle when dry. Organic matter content is moderate. Limestone rocks are found on the surface. Boundary to lower layer is abrupt and irregular.
30–45	Subsoil, dark yellowish gray clay, slightly compact with granular structure sticky and strongly plastic when wet but hard when dry. Partially weathered limestone rocks are present. Boundary to lower layer is clear and smooth.
45–150	Substratum, upper layer is yellowish gray, soft and weak granular in structure highly weathered limestone. Thickness is 5 to 15 centimeters. Lower layer is light gray to almost white, porous and soft limestone which can be easily broken.

Faraon clay (132).—The major portion of this soil type covers the strip of land in the upland area adjacent to Mt. soils, undifferentiated, about the center of Samar mainland, from the vicinity of Barrio Poponton, Las Navas extending to Barrio Balangigon, Basey. Other places where this soil type can be found are in Catbalogan, along the coast from Barrio Maulong to Barrio Bono-anan; between the towns of Sebastian and Calbiga, hemmed by San Manuel loam, Tingib clay loam and by the hydrosol; and in the islands of Capul, Dalupirit and Guintacan. The aggregate area is about 79,094.63 hectares or 5.89 per cent of the total area of Samar Provinces.

The cultivated crops are rice, coconut, corn, bananas and gabi. The coconut is the principal crop. The uncultivated

areas in the mainland of Samar are covered mostly by secondary and primary forests, while those in other areas are under grasses, mostly cogon.

LA CASTELLANA SERIES

La Castellana series was first established in Negros Occidental during the survey of the province. It is a primary soil developed from a mixture of igneous rocks such as andesite, basalt, breccia, volcanic tuff and other rocks. It occurs on rolling and hilly relief.

The surface soil is brown to black when dry, brown to dark brownish gray when wet. The subsoil is brown to dark grayish brown or light brown clay with occasional red mottlings, and contain plenty of pebbles and some boulders. The substratum is gray to reddish gray or reddish brown clay with pebbles and boulders. The outstanding characteristic of this soil series is the presence of numerous boulders on the surface.

Only one soil type, La Castellana clay, was identified and mapped in Samar. The description of the soil profile is given below.

Depth (cm.)	Characteristics
0–30	Surface soil, dark brown to black when wet, gray to light brown when dry, friable when moist, fine granular structure, stony clay; numerous boulders are present on the surface; rich in organic matter content; acidic, pH 5.5. Boundary to lower layer is irregular and clear.
30–50	Subsoil, brown, mottled with reddish brown and gray clay, slightly compact and fine granular structure, with plenty of pebbles and some boulders; acidic, pH 5.5. Boundary to lower layer is irregular and broken.
50–150	Substratum, gray to reddish brown clay; compact and hard; with pebbles and boulders; acidic, pH 5.5.

La Castellana clay (305).—This soil type is found in the rolling lands along the northwestern coast of Samar, from Lavezares, Northern Samar to Tinambacan, Western Samar; and in the rolling areas of San Jose, Northern Samar down to Barrio Santander, Bobon, Northern Samar. The aggregate area is about 44,717.34 hectares or 3.33 per cent of the total area of Samar Provinces.

The crops grown in this soil type are coconut and camote. The coconut is the principal crop.

LIBERTAD SERIES

Libertad series was identified in Barrio Libertad in the municipality of Lavezares. This is a primary soil derived from weathered igneous rocks. It occurs on rolling relief.

This soil series is similar to Bayho and Luisiana series in color and occurs on similar relief. All of them are red soils. However, the color of Libertad soils is slightly lighter than that of Luisiana soils. Libertad soils are deeper than Bayho soils but shallower than Luisiana soils. The main difference of Libertad series from either Luisiana or Bayho series is the presence of concretions in the former which are absent from either of the last two series. Likewise, Libertad series has the most dense subsoil and more pronounced horizon differentiation than the other two soil series.

Libertad series is characterized by a brown to dark brown, coarse granular to blocky surface soil that can be penetrated easily by roots. The subsoil is yellowish brown reddish yellow or yellowish red clay loam to silty clay loam with iron concretions, which produce brownish yellow color when crushed. The substratum is columnar and blocky silty clay loam with iron concretions.

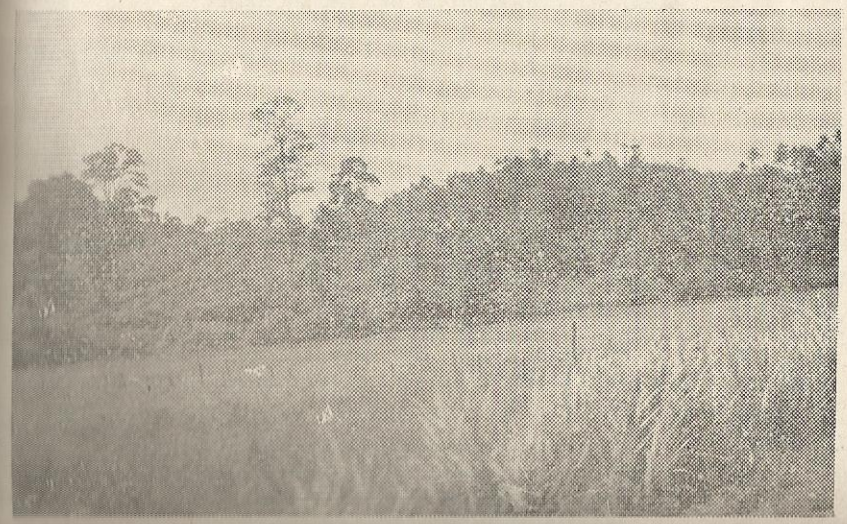

Fig. 41. Landscape of Libertad Series.

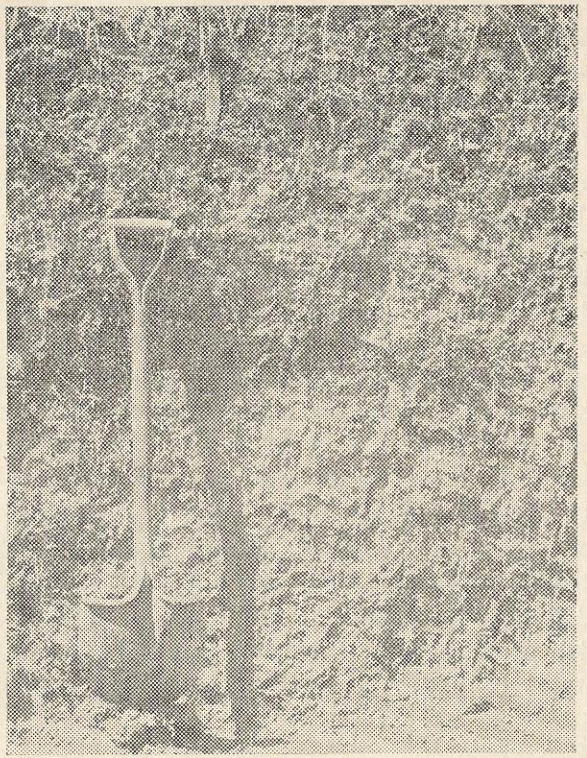

Fig. 42. Typical profile of Libertad Series.

Only one soil type, the Libertad clay, was identified and mapped in Samar. The description of the typical soil profile of Libertad clay is given below.

Depth (cm.)	Characteristics
0–15	Surface soil, brown to dark brown when moist, light brown to reddish brown when dry, clay; coarse granular to blocky structure; fair in organic matter content. Boundary to lower layer is clear and wavy.
15–35	Upper subsoil, yellowish brown when moist, brownish yellow when dry, clay loam; coarse granular to blocky structure with iron concretions which produce light yellow streaks. Boundary to lower layer is diffuse.
35–85	Lower subsoil, yellowish brown when dry, reddish yellow when moist, silty clay loam; columnar and blocky structure. Many iron concretions are present which produce brownish yellow to yellow color when crushed. Layer appears as an interwoven orange, red and yellow mass.
85 & below	Substratum, yellow silty clay loam; columnar and blocky structure; has many prominent yellow and light yellow mass. At 130 centimeters deep and downward, the iron concretions are usually absent.

Libertad clay (494).—This soil type occupies the rolling areas between the towns of Lavezares and San Jose which extend southward to the Bugtasan River and to the foot-hills of Mt. Saamong. It covers a total area of about 18,397.22 hectares or 1.37 per cent of the total land area of Samar Provinces. The southern portion of this soil type is drained by the Bugtasan River to the western coast. The Lavezares-San Jose Road passes through the northernmost portion of the area.

The crops grown on this soil type are rice, coconut, camote, corn, bananas, cassava and sugar cane. Cogon, *talahib,* shrubs and secondary forest are found on the uncultivated areas.

LUGO SERIES

Lugo series was first identified and mapped in Cebu Province. This soil series was developed from soft, porous, and light gray to gray shale. It occurs on rolling to hilly relief. Lugo soils, like Faraon soils, are well-drained. Although the shale rocks are highly impregnated with carbonates no limestone rock is found in this soil series. Stratified materials laid in horizontal layers are present in the profile. In areas that are highly eroded, limy shale gravels are present on the surface of the land.

The soil of Lugo series is black and clayey like that of Faraon series. It is very sticky and plastic when wet and slightly hard when dry. The subsoil is dark brown to yellowish brown and clayey also.

Lugo clay loam is the only soil type identified in Samar under this series. The description of the typical soil profile of Lugo clay loam is given below.

Depth (cm.)	Characteristics
0–20	Surface soil, very dark gray to black clay loam; slightly friable, medium to fine granular structure, sticky and strongly plastic when wet, slightly hard when dry. Fair in organic matter content. Boundary to lower layer is smooth and diffuse.

20– 35	Subsoil, dark brown to yellowish brown clay; coarse granular structure; slightly friable, sticky and strongly plastic when wet and slightly hard when dry. Boundary to lower layer is smooth and abrupt.
35–150	Substratum, grayish brown silty clay; weak coarse platy structure. Very gritty, both in dry and wet conditions. Lower layer is consolidated grayish white, calcareous shale.

Lugo clay loam (730).—This soil type is found in the northeastern side of Gamay extending beyond Gamay-Palapag municipal boundary. The total area covered is about 12,891.48 hectares or 0.96 per cent of the total area of Samar Provinces.

This soil type has a rolling to mountainous relief. This soil is droughty and the streams found in the area usually dry up during dry seasons. In areas where erosion sets in, gravels or fine fragments of calcareous shale are found on the surface.

Coconuts and camote are the two important crops grown. The coconut trees do not grow well. In most cases they are stunted, chlorotic and unproductive. The average annual yield is 45 nuts per tree. *Ipil-ipil* is also grown on this soil type. The roots of the *ipil-ipil* penetrates the soil to a depth of more than one and a half meters. The uncultivated areas are covered with forest.

This soil type is not fit for cultivation owing to its relief. But it is suited for pasture. It should be always under vegetative cover and the existing forest trees should be preserved to protect the soil against erosion.

LUISIANA SERIES

Luisiana series is one of the most widely distributed upland soils of the Philippines. It can be found in all parts of Luzon, Visayas and Mindanao. It is a primary soil developed from igneous rocks, mostly basalts and andesites. It occurs on rolling and mountainous relief. External drainage is excessive while internal drainage is good. This series has a fair permeability.

Luisiana series resembles Antipolo, Alaminos and other red soils which were developed from basaltic rocks. The differentiating characteristics of this series from the other red soils are its dark or bright red deep soil, usually more than 200 centimeters deep; absence of mineral fragments in the profile; and

the very gradual change of soil color from the surface soil down to the substratum. Owing to the gradual change in color, the demarcation line between horizons or layers is sometimes difficult to determine. It has a clayey texture from the surface to the substratum.

Luisiana clay is the only soil type delineated and mapped in Samar under this soil series. The description of the typical soil profile of Luisiana clay is given below.

Depth (cm.)	Characteristics
0–30	Surface soil, dark reddish brown to yellowish red clay; fine granular structure, slightly compact to very friable, sticky and plastic when wet. Moderate in organic matter content. Root penetration is deep. Boundary to lower layer is smooth and diffuse.
30–110	Subsoil, dark reddish brown clay; medium to coarse granular structure; slightly sticky and plastic when wet and slightly hard when dry. Poor in organic matter content. Boundary to lower layer is smooth and diffuse.
110 & over	Substratum, yellowish red to almost red clay; speckled or splotched with cloudy deep red color; fine granular structure; slightly compact, slightly hard when dry and slightly sticky when wet. This layer extends to over 200 centimeters from the surface.

Luisiana clay (239).—This soil type is found in the rolling and rugged areas in the municipalities of Llorente, Hernani, Gen. MacArthur, Quinapundan, Balangiga, Giporlos and Salcedo; in the areas between Barrio Loquilocon, Wright and Barrio Calipquipon, Taft. The Wright-Taft Road passes through this area. The aggregate area is about 67,143.15 hectares or 5.0 per cent of the total area of Samar Provinces.

The principal crop is coconut. Other crops grown are corn, rice, bananas, and sugar cane. Forest occupies the uncultivated areas.

The average yield of corn is 7 cavans per hectare while that of rice is 10 to 15 cavans per hectare.

Accelerated erosion is the greatest or main problem in the cultivated areas.

This soil type is best suited for permanent crops such as coconut, coffee, cacao, etc. Seasonal crops may be grown in areas with less than 10 per cent slope provided appropriate

soil conservation measures are employed. Bare areas with steep slopes should be placed under permanent vegetation and the existing forest cover should be preserved or protected to minimize if not prevent soil erosion.

TACLOBAN SERIES

Tacloban series was first established in the province of Leyte. It is a primary soil derived from shale. It occurs on hilly to mountainous relief. Stones and boulders are not present.

The soil of this series is characterized by a reddish brown to dark brown surface layer over a yellowish brown clay loam subsoil underlain by highly weathered shale. The weathered shale does not show any stratification as seen in most shale formation. Beneath the weathered shale layer are unweathered consolidated hard igneous rocks extending to an indefinite depth.

Tacloban clay loam is the only soil type that was identified and mapped in Samar under this soil series. The description of the typical profile of Tacloban clay loam is given below.

Depth (cm.)	Characteristics
0–20	Surface soil, dark brown to brown clay loam; coarse granular structure. Slightly sticky and plastic when wet, slightly compact and hard when dry. Fair in organic matter content. Boundary to lower layer is smooth and gradual.
20–45	Subsoil, yellowish brown clay loam; slightly sticky and plastic when wet, slightly compact and slightly hard when dry. Poor in organic matter content. Boundary to lower layer is smooth and gradual.
45–150	Substratum, yellowish brown, coarse platy structure; highly weathered shale; slightly friable when wet, slightly compact and slightly hard when dry. Beneath is unweathered, hard igneous rock that extend to an indefinite depth.

Tacloban clay loam (491).—This soil type is found in the island-towns of Daram and Zumarraga and in the towns of Talalora and Basey. The total area covered is about 31,691.57 hectares or 2.36 per cent of the total area of Samar Provinces.

The crops grown are rice, coconut, camote, corn, sugar cane and cassava. The uncultivated areas are forested.

This soil type is best suited for permanent vegetation and/or pasture. Areas with moderate slopes can be planted to permanent crops such as coconut and fruit trees. Areas devoid of vegetation should be protected, especially those having steep slopes, against erosion by planting forest trees. Existing forest should be preserved.

UBAY SERIES

Ubay series was first identified and described in the province of Bohol. This soil series is derived from the weathering of shale, sandstone and conglomerate. It occurs on undulating, rolling and hilly relief. The soil is characterized by light reddish brown to dark brown surface soil that reaches to a depth of from 20 to 25 centimeters. The subsoil is brownish red to dark brown sandy clay to gravelly clay, columnar structure, with concretions underlain by a yellowish brown to brick red gravelly and gritty clay horizon over layers of shale, sandstone and conglomerate. Iron concretions are plenty in both the subsoil and substratum. In some cases, a distinct layer of iron concretions can be found in the lower subsoil. Severely eroded areas appear like the Luisiana or the Antipolo series due to the exposure of the subsoil or substratum which impart the red color to resemble the cited soil series. In places where the slope is gentle or in depressions, concretions are strewn carpetlike on the surface. In this case, this soil looks like that of Buenavista and Prensa series.

Ubay clay loam is the only soil type identified and mapped in Samar under this series. The description of the typical soil profile of Ubay clay loam is given below.

Depth (Cm.)	Characteristics
0–20	Surface soil, brown to black when wet, gray to light brown when dry, clay loam; fine granular structure, friable when moist. Moderately rich in organic matter content. Acidic, pH 5.5. Boundary to lower layer is clear and irregular.
20–70	Subsoil, brown clay to sandy clay with reddish brown and gray mottles; with concretions; fine granular structure; slightly compact. Stones and even boulders are present. Acidic, pH 5.5. Roots seldom penetrate this layer. Boundary to lower layer is irregular and broken.

70–150	Substratum, gray to reddish brown clay; compact and firm; concretions are present; acidic, pH 5.5. Stones and boulders are present.

Ubay clay loam (172).—This soil type is found at Barrio Loquilocon, Wright, in the vicinity of the road junctions. It covers an area of about 1,074 hectares or 0.08 per cent of the total area of Samar Provinces.

The crops grown are corn and camote. The average yield of corn is 15 cavans to a hectare. Farming practices commonly followed are rather exploitive. Good soil management and proper system of cropping are wanting. It is suggested therefore, that appropriate soil conservation measures and good soil management should be employed in order to prevent the land from becoming submarginal.

Tingib-Catbalogan complex (493).—This soil complex is composed of Catbalogan soils and Tingib soils which are in intricate pattern. The delineation of the individual soil cannot be made due to the limitation of the scale of the base map used (1:200,000), hence, it is mapped as a single unit, a soil complex. The soils found in the level areas belong to the Tingib series possibly Tingib clay; while those in the rolling and hilly portions are of the Catbalogan series, most likely Catbalogan clay loam.

Tingib-Catbalogan complex is found in the vicinity of the barrios of Bagolbas, Alegria, Sta. Elena, San Juan and San Pedro along the west coast of Sta. Rita. It is hemmed by the Dolongan loamy sand, Tacloban clay loam, Catbalogan clay loam, and by the hydrosol. The Catbalogan-Basey Road passes through this area. The total area covered by this soil complex is about 4,834.31 hectares or 0.36 per cent of the total area of Samar Provinces.

The crops grown are rice, coconuts, camote, bananas and corn. Uncultivated areas are forested.

Miscellaneous Land Types

The areas covered by the miscellaneous land types which are about 351,427.25 hectares, are considered non-agricultural lands. Some of them have no true soil or without definite soil characteristics. Others are rough mountainous areas that are inaccessible.

The miscellaneous land types found in Samar are the undifferentiated soils, hydrosol and the beach sand.

Mountain soils, undifferentiated (45).—These are the soils found on the rough mountainous areas of Samar that are inaccessible. The types of soils in these areas have not been ascertained. However, they are generally shallow and oftentimes stony. The surface drainage is excessive. This miscellaneous land type covers an aggregate area of about 328,464.29 hectares of 24.46 per cent of the total area of Samar Provinces. This land type is not suited for cultivation but for permanent vegetation.

Hydrosol (1).—Hydrosol are areas that are under water most of the time. They are commonly known as swamps and marshes. They are generally found at the mouth of rivers or near the bays. Most of them have brackish or salty water. The native vegetation in these areas consists of water-loving plants such as *bakauan, larangay, api-api, pagatpat, tabigi* and nipa palms. Economic crops cannot be grown in these areas because of the presence of excessive water and the high concentration of salts. *Bakauan* trees are usually cut and use as firewood. The leaves of the nipa palms are made into shingles and use as roofing materials.

The hydrosols in Samar are found in the towns of Basey, Sta. Rita, Villareal, Pinabacdao, San Sebastian, Hinabangan, Wright, Motiong, Jiabong, Sta. Margarita, Tarangnan, Calbayog City, Lavezares, San Jose, Pambujan, Lao-ang, Palapag, Lapinig, Arteche, San Policarpio, Dolores, Can-avid, Taft, San Julian, Gen. MacArthur, Quinapundan and Giporlos. The aggregate area is about 18,665.80 hectares or 1.39 per cent of the total area of Samar Provinces.

Many of these areas are good sites for fishponds especially for raising *bangus*. In fact, *bangus* raising is a promising industry in the province.

Beach sand (118).—This miscellaneous land type is found generally along the sea coasts. It is composed of sand deposited through wave action. It has no developed soil profile. The mappable areas are found in the towns of Gamay, San Julian, Maydolong, Llorente, Hernani, Salcedo, Guiuan, Marabut, Allen, and Palapag. All these areas, except that in Gamay, occupy narrow strips along the coast. That in Gamay is relatively

TABLE 9.—*Key to the Soils of Samar Provinces.*

Soil Mapping Number	Soil Type or Miscellaneous Land Type	Parent Material	General Relief	Drainage		Present Use/Vegetation	Recommended Conservation Measures
				External	Internal		
20	Bay clay loam	Alluvium	Level	Poor	Poor to Very poor	Rice and galiang.	Installation of dikes in rice paddies; irrigation system; protection from flood; fertilizer application.
203	Bigaa loam				Poor		
480	Bigaa sandy loam					Rice, galiang and coconut.	
476	Bugko loamy sand		Nearly level	Good	Good to excessive	Coconut, camote, banana, cassava.	Green manuring, crop rotation, application of farm manure, fertilizer and organic matter.
477	Bugko sandy loam		Depression				
484	Catubig loam		Nearly level	Poor	Poor	Rice, coconut, camote, banana, cassava, gabi.	Same as Bay clay loam.
485	Catubig clay loam					Rice and galiang.	
474	Dolongan loamy sand		Level	Waterlogged	Very poor	Rice, galiang and forest	Installation of irrigation and drainage systems; dikes; application of fertilizers.
480	Hernani loam					Rice and galiang.	
478	Tinglo clay					Rice, coconut and galiang	
488	Maydolong silt loam					Rice and galiang.	Same as above plus crop rotation and green manuring.
489	Maydolong sandy clay loam						
487	Pulupag clay loam			Poor	Poor	Rice, galiang, coconut, camote, corn, banana.	

TABLE 9.—*Key to the Soils of Samar Provinces.*—(Continued)

						cassava, abaca, and gabi.	
109	Quingua clay loam		Nearly level	Good to excessive	Good	Rice and galiang.	Crop rotation, green manuring, application of organic matter, manure and fertilizers.
365	Quingua clay						
255	Pulupandan sandy loam					Coconut, camote, cassava gabi.	
481	Pulupandan clay loam					Rice and galiang.	
190	San Manuel loam					Rice, coconut, camote, corn, banana, abaca, cassava, gabi.	Fertilization, liming, crop rotation, green manuring, irrigation and drainage; installation of dikes in rice paddies.
96	San Manuel sandy loam						
206	San Manuel clay loam						
253	Silay loam			Fair	Poor	Rice and galiang.	Same as Bay clay loam.
252	Umingan loam			Good	Good	Rice, coconut, camote, corn, banana, cassava, gabi.	Same as San Manuel soils.
495	Bayho clay loam	Andesite	Rolling to hilly and mountainous	Good to excessive		Rice, corn, coconut, banana, abaca, cassava, gabi, camote, forest.	Occasional cultivation on rolling lands. Reforestation on steep bare areas. Control grazing on pasture lands. Crop rotation, green manuring and strip cropping or terracing on crop land. Application of manure, organic matter and fertilizer. Contour planting of fruit trees.
355	Bolinao clay	Coralline limestone					
482	Catbalogan clay loam	Shale and sandstone				Rice, corn, coconut, camote, banana, gabi, sugar cane; grasses and forest.	
202	Faraon clay	Coralline limestone					
305	La Castellana clay	Igneous rocks				Rice, coconut, camote, banana and gabi.	
494	Libertad clay					Rice, corn, coconut, camote, banana, cassava, sugar cane and forest.	
197	Lugo clay loam	Shale			Fair	Rice, corn, coconut, camote, banana, gabi; forest.	
209	Luisiana clay	Igneous rocks					
491	Tacloban clay loam	Shale				Rice, corn, coconut, camote sugar cane, cassava; forest.	Strip cropping, contour planting, terracing, crop rotation, green man-

TABLE 9.—*Key to the Soils of Samar Provinces.*—(Continued)

172	Ubay clay loam	Shale, sandstone and conglomerate.	Level and rolling to hilly and mountainous	Good			Rice, corn, coconut, camote, sugar cane, cassava, banana and gabi.	turing, contour farming, fertilizer application and organic matter addition, manuring and cover cropping.
498	Tingib-Catbalogan complex	Alluvium and shale and sandstone		Poor to excessive	Poor to fair		Rice, coconut, camote, banana, corn, forest.	Same as Tingib and Catbalogan soils.
118	Beach sand	Marine deposits	Nearly level	Good to excessive	Good to excessive		Coconut	Same as Pulupandan soils.
1	Hydrosol		Depression	Underwater	Poor		Wildlife, fishpond and for recreation.	
46	Mt. Soils, Undifferentiated		Rolling, hilly	Good to excessive	Fair		Forest	Selective logging

wide. The aggregate area covered by this land type is about 4,297.16 hectares or 0.32 per cent of the total area of Samar Provinces. Most of the areas are planted to coconut. This land type requires the application of a large amount of organic matter to improve its physical condition. Planting of cover crop is advisable to prevent the soil from being blown away and also to minimize excessive loss of moisture due to evaporation.

MORPOLOGY AND GENESIS OF SOILS

The soil is a natural body covering the surface of the earth. It is formed from materials produced through the interactions of the factors of soil formation, such as climate, parent material, relief, biological forces and time. These different factors are acting individually and simultaneously. The forces of climate, for instance, acting upon the parent rock causes it to crumble and further breaking down into soil. Development is manifested by the differentiation of the soil profile into layers or horizons. The degree of development is directly dependent on the exerted influence of each of the factors. If the influence of climate and biological factors have exerted more than the other factors, the soil thus formed may have reached the stage of maturity; but if the influence of parent material, relief and time are more pronounced than the effect of climate and biological forces, the soil that may have formed may be semi-mature or young. On an area with very steep slope and under heavy rainfall, for instance, the developing soil may remain young, because the effects of climate and relief are more pronounced than the other factors. On the other hand, in slightly sloping or undulating areas where the effects of climate and biological forces are more than that of relief and parent material, the developing soil may reach the stage of maturity. While in areas having flat relief and where the effects of climate and biological forces are more pronounced than that of parent material, relief and time, the soil that may have developed may reach the stage of senility. We have in existence many different soils due to the effects of the different factors of soil formation and the presence of various rocks from which the soils are derived. The characteristics of the individual soil are the expression of the effects of different factors of soil formation. The soils, therefore, can be differ-

entiated from one another through their individual characteristics, just like us or any individual person segregated from a group thru individual characteristics..

The formation of the soils of the plains and valleys is the results of degradation and agradation of the soils. The effects of geologic forces, as influenced by vegetation, relief and climate, give rise to the formation of the soils of the plains and valleys. The stages of their occurrence are expressed by the degrees of soil development. If the factors of soil formation have no marked effect, the soil formed will be very young or maybe a recent deposit only.

In Samar, basaltic and andesitic rocks are predominant, although other basic intrusives are present. The hills and mountains, which make up the greater portion of Samar, are made up mainly of basalt, andesite, sandstone, shale and in some places of coralline limestone. The small, narrow and discontinuous coastal plains and flood plains or valleys are of alluvium and littoral deposits.

Basing on parent material, relief, mode of formation and drainage condition, the soils of Samar maybe grouped as follows:

1. *Profile Group II, Class A.*—Young alluvial fans, flood plains or other secondary deposits having slightly developed profile underlain by unconsolidated materials. Medium to coarse textured and having good to excessive drainage condition. Relief is nearly level to gently sloping.

Bugko loamy sand
Bugko sandy loam
Pulupandan sandy loam
Pulupandan clay loam
Quingua clay loam
Quingua clay
San Manuel sandy loam
San Manuel clay loam
San Manuel loam
Umingan loam

2. *Profile Group II, Class B.*—Young alluvial fans, flood plains or other secondary deposits having slightly developed profile underlain by unconsolidated materials. Normally poorly drained due to either high water table or excess water because of location or position.

Dolongan loamy sand
Hernani loam
Maydolong silt loam
Maydolong sandy clay loam
Tingib clay loam

3. *Profile Group III, Class B.*—Older alluvial fans, alluvial plains or terraces having moderately developed profile underlain by unconsolidated materials. Generally deep soils with moderately dense subsoil. Relief is generally level to slightly sloping or gently undulating and poorly drained.

Bay clay loam
Bigaa loam
Bigaa sandy loam
Catubig loam
Catubig clay loam
Palapag clay loam

4. *Profile Group IV, Class B.*—Older plains or terraces having slightly developed profile underlain by unconsolidated materials. Dense clay subsoil. Normally poorly drained. Relief is nearly level.

Silay loam

5. *Profile Group VIII, Class D.*—Upland areas developed on hard igneous rocks such as basalt or andesite or diorite. Relief is rolling, hilly and mountainous or steep.

Bayho clay loam
La Castellana clay
Libertad clay
Luisiana clay

6. *Profile Group VIII Class E.*—Older terraces or upland areas developed from the weathering of stratified sedimentary rocks, such as shale and sandstone. Relief is generally rolling and steep.

Catbalogan clay loam
Lugo clay loam
Tacloban clay loam
Ubay clay loam

7. *Profile Group VIII, Class F.*—Older terraces or upland areas developed on weathered product of limestone. Relief is rolling, hilly, steep or mountainous.

Bolinao clay
Faraon clay

LAND-USE AND SOIL MANAGEMENT

Generally, the existing farm practices in Samar in 1953, are not in accordance with the accepted principles of proper soil conservation and good soil management where "the soil is to be

utilized according to its needs." This concept is premised on the assumption that the soil will never be wasted if erosion is controlled and its productivity is maintained at a high level. This can be possible through proper utilization of the land and/or employment of good soil management practices that promote optimum favorable conditions for the normal growth of plants.

In Samar, antiquated farm practices handed down by our forefathers are still in use during the time of the survey. *Kaingin* system of farming is commonly practiced. The improved methods of agricultural practices are wanting. The common mistake of the farmers is the cultivation of sloping lands without providing measures for the control and prevention of erosion. Measures for the maintenance of the soil fertility are either unknown or neglected. The use of leguminous crops, the type of crop designed for maintaining soil fertility, are disregarded. The presence of these crops on farms is merely incidental. The existing practices in Samar are not conducive to good soil conservation.

In the growing of lowland rice, levees or dikes for impounding water in rice paddies are not employed. The rice fields are prepared very crudely and hurriedly. In most cases, the plow and harrow are never used in the preparation of the land but instead the *payatac, pagulong* or *pacaras* systems are employed. In these methods, the fields are not properly prepared so much so that the weeds are not destroyed or killed. Because of this practice almost all ricefields in Samar are dominated by weeds that compete with the rice plants, thus, rice yields are often very low.

Majority of the farms in Samar are not provided with irrigation system. The existing irrigation facilities could not supply adequate water for most of the ricefields.

A change from the old system of farming to the scientific method should be given serious consideration. The farmers should be made to understand that their present methods of farming are wasteful and detrimental to the economy of Samar. It should be made known to them that the greater portion of their farms calls for proper soil conservation measures and good soil management, such as crop rotation, green manuring, application of fertilizers and manures, strip cropping, terracing, and the like. Above all, the farmers should be taught to use their lands in accordance with their use capabilities. Slightly sloping lands should be plowed and harrowed along the contour.

Strip cropping, crop rotation and green manuring must be practiced in the growing of seasonal crops. Areas with moderate slopes may be cultivated occasionally for field crops but their best use is for permanent crops or orchard and pasture. Those with steeper slopes must be placed under permanent forest.

WATER CONTROL ON THE LAND

In any agricultural enterprise, the control of water is a problem. It involves not only minimizing excessive runoff that causes erosion and damage to the soil but also the application and retention of water and its removal from the soil as needed.

Control of water in Samar is concerned with irrigation, drainage, the protection of the land from floods or overflows, and the control of excessive runoff which causes erosion. Excess water in level areas is bound to injure or inhibit plant growth, except rice, when not remove. Excessive runoff on sloping areas if allowed to continue will surely erode and damage the land, especially the cultivated and bare areas. Low-lying areas or bottom lands if not protected from floods are bound to suffer crop damages.

The plains of Samar can be made more productive if irrigation system can be provided, especially the soils of Mondragon, Catarman and Pambujan. It would also provide a greater degree for crop diversification. The growing of lowland rice has a better chance of success and two crops a year can be raised with the presence of adequate irrigation water. Numerous rivers and streams abound in Samar which are sure sources of water for irrigation if properly harnessed. Along with irrigation, drainage facilities must be installed. The low-lying areas or bottom lands which are under water, especially during periods of heavy rainfall, must be reclaimed through the provision of an adequate drainage system. Besides the provision of drainage facilities on these low-lying areas, they should be protected from overflows or floods through the installation of levees or dikes along the periphery or along the banks of the river and diversion ditches in the areas that lie on the foot of the mountains should be constructed to protect them from the on-rushing runoff coming from the uplands.

The biggest problem met by farmers in Samar is the control of runoff. Many of the cultivated and denuded hills and mountains have lost a considerable amount of soil and many farms

have been damaged due to the unchecked excessive runoff. In many instances, considerable erosion damages have made farms unproductive. Gullies have appeared and have deepened considerably, thus rendering the farms useless. It becomes imperative, therefore, that the farmers should be taught the proper land use. The present farm practices must be changed. Better farm practices that conform with the requirements of the land should be employed. Immediate reforestation of denuded areas must be done and further forest destruction must be stopped.

PRODUCTIVITY RATINGS OF THE SOILS OF SAMAR

The productivity of a soil is its capability to produce a specified crop or sequence of crops under a specified system of management. In this report soil productivity rating is based on the average crop yield of a soil type in relation to national standards established. The yield being obtained without the use of fertilizer or soil amendments. 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 judgments based on comparisons of the characteristics of soils and basic knowledge of plant requirements.

Table 10 indicates the productivity ratings of the soils of Samar for the major crops grown in the province. The productivity ratings were developed mainly from estimates based upon observations and interviews supplemented by a few records and census data, thus their reliability may be only considered fair. The soil productivity rating or index for a given crop is expressed in terms of a standard index of 100. Thus, a productivity rating of 75 for a certain crop means that a soil is about three fourths as productive relative to the national standard, or in terms of production the soil could produce 45 cavans of palay of lowland rice wherein the national standard is 60 cavans of palay.

TEXTURAL CLASSES OF THE SOILS OF SAMAR PROVINCES

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

TABLE 10.—Productivity ratings of the soils of Samar Province.

Soil Types	CROP PRODUCTIVITY INDEX[1]										
	Lowland Rice 100=60 cavans	Upland Rice 100=20 cavans	Coconut 100=3,750 nuts	Camote 100=8 tons	Corn 100=17 cavans	Banana 100=900 bunches	Sugar Cane 100=80 piculs	Abaca 100=15 piculs	Cassava 100=15 tons	Galiang 100=10 tons	Gabi 100=5 tons
Bay clay loam	90									80	
Bigua loam	80									80	
Bigua sandy loam	70	70	80							80	
Bugko loamy sand			100	60		50			70		
Bugko sandy loam	70	70	120	70		60			80	80	160
Catubig clay loam	90										160
Catubig loam	80	80	80	80	80	80	80			80	160
Dolorgan loamy sand	70		60							80	160
Hernani loam	80									80	160
Mardolong sandy clay loam	80									90	
Mardolong silt loam	80							80	80		
Palapag clay loam	80	90	80	80	80	80				70	
Pala'andan clay loam	50		70						60		120
Pala'andan sandy loam			80	60						90	
Quingua clay	90									90	
Quinqua clay loam	90									80	
San Manuel clay loam	90	80	120	90	80	80		80	80		160
San Manuel loam	80	60	120	90	90	60		70	90		160
San Manuel sandy loam	60										80
Silay loam	90		70							80	
Tingib clay loam	80	70	80	80	70	60		60	60		120
Umingan loam	70	60	60	60	60	60		60	60		100
Bayho clay loam		50	60	60	60	60			50		100
Bolinao clay		60	50	70	60	60	50	50	60		100
Catubalogan clay loam		50	60	60	60	60					100
Faraon clay		50	60	70	60	60	50		60		
La Castellana clay		60	50	60	60	60	50				50
Libertad clay		50	60	60	60	60	50	50	60		120
Lugo clay loam		60	60	60	60	60					100
Lusiana clay		60	50	70	60	60		50	60		140
Tacloban clay loam		80	80	80	80	80	80		80		
Ubay clay loam			80								
Beach sand											

[1] The soils of Samar are given indices that give the approximate average yield of each crop in per cent of the standard yield. The standard represents the approximate yield obtained without the use of fertilizers on the extensive and better soil types of the Philippines in which the crop is most widely grown. Most of the indices are estimates and determined inductively. Absence of an index indicates that the crop is not commonly grown on the particular soil type.

scientist frequently checks his field textural classification against laboratory results.

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

Sand.—Sand is loose and single-grained. The individual 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 fall 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. 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 textural classes of soils delineated during the soil survey is attained through mechanical analysis. Generally, field classifications coincide with the results of the mechanical analysis. However, there are instances when field classification and laboratory classification vary. Some soils exhibit clayey textures in the field. They are sticky and plastic when wet, hard or brittle when dry, but actually when analyzed their clay contents are low. Under these circumstances, the field classifications are maintained except when their clay contents are so low that their final textural classifications are those established by the laboratory.

The soil separates are sand, silt, and clay. Sand includes particles from 2.0 millimeters 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 2.0 millimeters such as gravels, pebbles, and cobbles are considered coarse skeleton. Class names such as sand, silt, silt loam, clay loam, clay, 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, so that 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 wherein the conventional jar, hydrometer, and thermometer were used. Analysis was made without removing the organic matter from the soil.

LAND CAPABILITY CLASSIFICATION AND CONSERVATION GUIDE FOR THE SOILS OF SAMAR PROVINCES

Land capability classification is a scheme of grouping soil types together for their proper utilization. Utilization, from

[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 11.—*Average mechanical analyses of the surface soils of Samar Provinces by the Bouyoucos method.*

Soil Mapping Number	Soil Mapping Unit	Sand (2–0.05 mm.) *Per Cent*	Silt (0.05–0.002 mm.) *Per Cent*	Clay (Below 0.002mm.) *Per Cent*
23	Bay clay loam	36.4	34.0	29.6
913	Bigaa loam	38.4	36.4	25.2
483	Bigaa sandy loam	50.4	30.0	19.6
476	Bugko loamy sand	84.4	8.0	7.6
477	Bugko sandy loam	68.0	24.4	7.6
484	Catubig loam	50.8	30.0	19.6
485	Catubig clay loam	20.4	51.6	27.6
479	Dolongan loamy sand	82.4	9.4	8.2
490	Hernani loam	28.4	48.0	23.6
488	Maydolong silt loam	(No analysis)		
489	Maydolong sandy clay loam	50.8	26.6	22.6
487	Patapag clay loam	40.4	29.6	30.0
255	Pulupandan sandy loam	76.4	13.4	10.2
481	Pulupandan clay loam	21.4	46.4	32.2
109	Quingua clay loam	20.0	51.4	29.6
385	Quingua clay	29.6	28.8	41.6
190	San Manuel loam	40.8	42.4	16.8
96	San Manuel sandy loam	67.2	22.2	10.6
236	San Manuel clay loam	33.4	38.4	28.2
253	Silay loam	33.0	41.4	25.6
478	Tingic clay loam	22.0	44.4	33.6
322	Umingan loam	50.0	34.0	16.0
495	Bayho clay loam	35.6	36.0	28.4
153	Botinao clay	27.2	32.0	40.8
492	Catbalogan clay loam	12.4	39.0	48.6
132	Faraon clay	24.4	27.6	48.0
305	La Castellana clay	27.2	24.0	48.8
494	Libertad clay	22.0	40.4	37.6
730	Lugo clay loam	36.4	23.0	41.6
239	Luisiana clay	29.2	36.0	34.8
491	Tacloban clay loam	33.2	34.0	32.8
172	Ubay clay loam	88.0	12.0	
113	Beach sand			

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.

Three major factors are considered in land capability classification. They 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. In the Philippines, the three major problems on soils are (1) erosion and runoff, (2) wetness and drainage, and (3) root zone and tillage limitations, such as shallowness, stoniness, droughtiness, and salinity or alkalinity. These problems are the bases for the designation of subclasses in each capability class, except capability class

A; and are indicated by "e" for erosion and runoff; "w" for wetness and drainage; and "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 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 and 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.

San Manuel loam
San Manuel sandy loam
San Manuel 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 necessary to minimize seepage.

TABLE 12.—*Land capability classification of the different soils and miscellaneous land types of Samar.*

Soil Mapping Number	Soil/Miscellaneous Land Type	Possible Unit (Slope-Erosion Class)[1]	Land Capability Class or Subclass
96	San Manuel sandy loam	a-0	A
190	San Manuel loam		
236	San Manuel clay loam		
23	Bay clay loam	a-0	Bw
913	Bigaa loam		
483	Bigaa sandy loam		
484	Catubig loam		
485	Catubig clay loam		
488	Maydolong silt loam		
489	Maydolong sandy clay loam		
487	Palapag clay loam		
109	Quingua clay loam		
385	Quingua clay		
253	Silay loam		
322	Umingan loam	a-0	Bs
479	Dolongan loamy sand	a-0	Cw
490	Hernani loam	c-2	Ce
478	Tingib clay loam	d-2	De
493	Tingib-Catbalogan complex		
118	Beach sand	a-0	Ds
476	Bugko loamy sand		
477	Bugko sandy loam		
255	Pulupandan sandy loam		
481	Pulupandan clay loam		
153	Bolinao clay	b-1	Be
495	Bayho clay loam	c-1	Ce
492	Catbalogan clay loam	c-2	
132	Faraon clay	d-1	De
305	La Castellana clay	d-2	
494	Libertad clay	d-3	M
730	Lugo clay loam	e-1	
239	Luisiana clay	e-2	
491	Tacloban clay loam	e-3	N
172	Ubay clay loam	f-0	
493	Tingib-Catbalogan complex	f-1	
45	Mountain soils, undifferentiated	----------	N
1	Hydrosol	----------	X

[1] The slope-erosion units are the possible conditions that may exist in each soil type. Any other unit with an erosion class more than the one indicated above will be classified under the next capability class or subclass.

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 could 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.

Bolinao clay
Bayho clay loam
Catbalogan clay loam
Faraon clay

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 problems. Adopt special soil management practices and observe easily applied conservation practices.

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 nutrients 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 water-holding capacity and also 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 clay loam
Bigaa loam
Bigaa sandy loam
Catubig loam
Catubig clay loam
Maydolong silt loam
Maydolong sandy clay loam
Palapag clay loam
Quingua clay loam
Quingua clay
Silay 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 but the subsoil is heavy.

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

Bayho clay loam
Bolinao clay
Catbalogan clay loam
Faraon clay
La Castellana clay
Libertad clay
Lugo clay loam
Luisiana clay
Tacloban clay loam
Ubay clay 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 conditions, 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 can 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 Cw

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

Dolongan loamy sand
Hernani loam
Tingib clay loam
Tingib–Catbalogan complex

Subclass Cw land is nearly level and occurs in depressions. The soil is deep; the topsoil is medium to coarse textured;

078245——8

and the subsoil is slowly permeable. It is also moderately wet.

Frequent overflow is the problem.

When properly drained many kinds of crops common in the area will do well on this land. Lowland rice can be grown but well designed irrigation and drainage systems for the proper control of water in each paddy are recommended.

After a good drainage system is established a good soil management program should be adopted. It should include a good crop rotation wherein a legume is utilized as a green manure crop and the application of lime, fertilizers, farm manures, and compost. For green manuring, crops with deep root systems are recommended, because this practice improves the structure of the subsoil and it increases the rate of water infiltration. The banks of all drainage and irrigation ditches must be well sodded.

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. Suited for pasture or forest or permanent crops.

Bayho clay loam
Bolinao clay
Catbalogan clay loam
Faraon clay
La Castellana clay
Libertad clay
Lugo clay loam
Luisiana clay
Tacloban clay loam
Ubay clay loam
Tingib–Catbalogan complex

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 be 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 or permanent crops.

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
Bugko loamy sand
Bugko sandy loam
Pulupandan clay loam
Pulupandan sandy loam

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 land 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 fruiting vegetables.

Land Capability Class M

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

Bayho clay loam
Bolinao clay
Catbalogan clay loam
Faraon clay
La Castellana clay
Libertad clay
Lugo clay loam
Luisiana clay
Tacloban clay loam
Ubay clay loam
Mountain soils, undifferentiated

Class M is steep and is very severely to excessively eroded, or shallow land. Stones or 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 tree 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 legume 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 restrictions. But best suited to forest with very careful management and restrictions.

Bayho clay loam
Bolinao clay
Catbalogan clay loam
Faraon clay
La Castellana clay
Libertad clay
Lugo clay loam
Luisiana clay
Tacloban clay loam
Ubay clay 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 more, and excessive erosion make this land not suitable for cultivation.

Land under this capability class could 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. Land along the shore or very near the sea and at the mouth 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, fish ponds, farm ponds, or recreation as the case may be.

In the construction of fish ponds 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.

II. SOIL EROSION SURVEY

The soil erosion survey of Samar was conducted simultaneously with the soil classification survey of the Island in 1952 to 1953. The purpose of the survey was to determine the extent and progress of soil erosion that had taken place in the area.

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 of erosion 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 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 by 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 cultivated farms the crops offer very little protection for the soil. Crops than can cover the ground well will give some protection for the soil but clean tilled row crops are conducive to erosion. Sloping lands 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 of 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 only 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 investigations conducted by the United States De-

partment 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, most of the farm lands are rolling and hilly. These are planted to upland rice, corn, and tobacco 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 most places is seldom practiced. Rice, tobacco and corn are planted from year to year on the same area. 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.—This is another factor contributing to the destruction of soil and forest. Very often *kaingin* clearings are made 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.

Fig. 43. Soil erosion has set in several places in Samar especially in Catbalogan soils as shown above.

Fig. 44. Portions of the eroded areas in Gandara, Northern Samar.

Variations in the depth 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 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

Erosion conditions in Samar vary widely because of differences in relief, vegetative cover, farm practices and erodibility of the soil. Areas with nearly level to level relief are very slightly eroded or the erosion that has taken place is very negligible; while the sloping, hilly and mountainous areas have varied erosion conditions—from no apparent erosion to seriously eroded conditions. Some areas have already lost about over three-fourths of the original surface soil. However, there is a wide area which appears to be not affected with erosion though the relief is quite steep and this could be attributed to the thick vegetative cover that remain untouched.

Soil damages due to erosion is confined to cultivated upland areas as a result of faulty farm practices and neglect for the protection of the soil from erosion. Cultivated areas, which are oftentimes devoid of vegetative cover part of the year or scantily covered with vegetations are seriously eroded in a number of places. The survey revealed that about 872,724,432 tons of soil had been washed away already in Samar. This covers a total land area of 330,440 hectares or 23.98 per cent of the total land area of Samar Provinces. If the unsurveyed areas would be investigated, it may still reveal some losses of soil in that part of Samar Provinces.

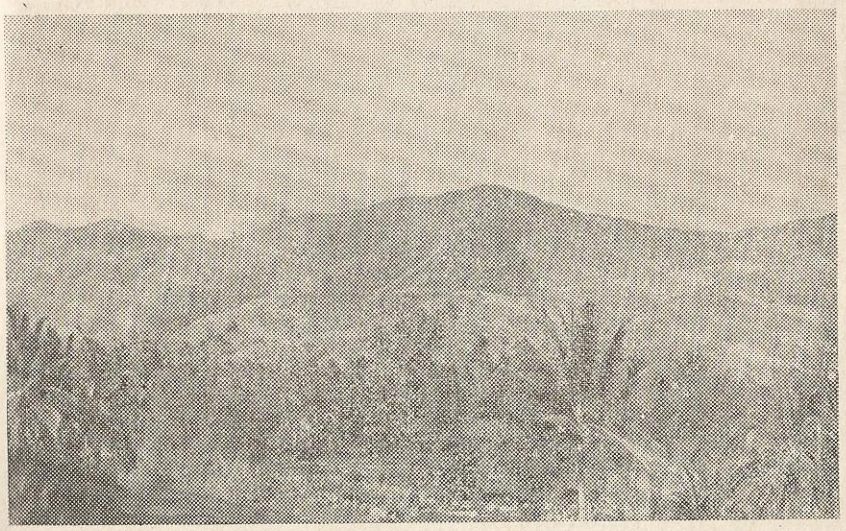

Fig. 45. Burning of the cogon grasses promote soil erosion in Catbalogan soils.

The extent of erosion to which the soils of Samar have been subjected are shown in Table 13 and the estimated amount of soil lost from each of the soil area are shown in Table 14.

To supplement Table 13, the locations of each of the soil types and miscellaneous land types under each group are given below.

Bay clay loam (23).—This soil type is found in Bo. Manunca, Sta. Rita; Bo. Calotan and Bo. Vigan, Gen. MacArthur; Bo. Naga, Quinapundan; and in Bo. Tanglad, Hernani.

TABLE 13.—*The extent of erosion in the different soil areas of Samar with their corresponding hectarage and percentage.*

Types of Erosion	Erosion Class	Extent of Soil Loss	Soil Types and/or Miscellaneous Land Types	Area[1] (Hectare)	Per Cent
No apparent erosion	0	No sheet erosion and no gullying	Bay clay loam Bigaa loam Bigaa sandy loam Bugko loamy sand Bugko sandy loam Catubig loam Catubig clay loam Dolongan loamy sand Hernani loam Maydolong silt loam Maydolong sandy clay loam Palapag clay loam Pulupandan sandy loam Pulupandan clay loam Quingua clay loam Quingua clay San Manuel loam San Manuel sandy loam San Manuel clay loam Silay loam Tingib clay loam Umingan loam Beach sand Hydrosol	152,146.38	11.33
Slight sheet erosion	1	Less than one-fourth of original surface soil removed	Bayho clay loam Faraon clay Catbalogan clay loam Tacloban clay	39,077.31	2.91
Moderate sheet erosion	2	One-fourth to three-fourth of original surface soil removed	Bayho clay loam Bolinao clay Catbalogan clay loam Tingib-Catbalogan complex Faraon clay La Castellana clay Lugo clay loam Libertad clay Luisiana clay Tacloban clay loam	264,006.87	19.66
Serious sheet erosion	3	Over three-fourth of original surface soil to one-fourth of subsoil removed	Catbalogan clay loam La Castellana clay	18,934.37	1.41
Normal erosion	W	Soil loss thru erosion is counterbalanced by soil formation	Bayho clay loam Bolinao clay Catbalogan clay loam Faraon clay La Castellana clay Libertad clay Lugo clay loam Luisiana clay Tacloban clay loam Mt. soils, undifferentiated	833,917.92	62.10
	Not	Known	Unclassified areas	34,780.15	2.59
TOTAL				1,342,863.00	100.00

[1] Area was determined by the use of the planimeter.

TABLE 14.—*Estimated soil loss through erosion in Samar.*

Types of Erosion	Erosion Class	Area (Hectare)	Average Soil Depth Loss[1] ((cm.)	Estim ated Amount of Soil Loss[2] (Tons)
No apparent erosion	0	152,146.38		None
Slight sheet erosion	1	39,077.31	6	34,044,864
Moderate sheet erosion	2	264,006.87	20	750,186,240
Serious sheet erosion	3	18,934.37	33	88,493,328
Normal erosion	W	833,917.92		None
Unclassified		34,780.15		None
TOTAL		1,342,863.00		87 2,724,432

[1] Average depth of Samar soils: (a) surface—26 cm.; (b) subsoil—30 cm.

[2] Based from Gustafson, A.F. "Using and Managing Soil."
(a) Weight of soil per acre at 7 inches (17.8 cm.)—1,000 tons;
(b) 2.471 acres—1 hectare;
(c) Weight of soil per hectare at 1 cm. deep—138.8 tons

$$(2.471 \times \frac{1{,}000}{17.8}).$$

Bigaa loam (913).—This is found in the municipalities of San Antonio, Allen, San Jose, Lavezares, Dolores, Oras, San Policarpio, Can-avid, Sta. Margarita, Tarangnan, Gandara, and Wright.

Bigaa sandy loam (483).—This is found along the coast between Can-avid and Taft.

Bugko loamy sand (476).—This soil type is found along the coast from San Jose to Pambujan and in the municipalities of Palapag, Can-avid, Borongan and Llorente.

Bugko sandy loam (477).—This soil type is found within the Bugko loamy sand occupying depressions at Bo. Bugko in Mondragon; Lavezares; and in Palapag.

Catubig loam (484).—This soil type covers the flood plains of Catubig, Las Navas, Laoang, Pambujan and Mondragon.

Catubig clay loam (485).—This soil type covers this flood plains along the up-stream of Catubig River at Las Navas.

Dolongan loamy sand (479).—This soil type occupies the bottom lands in Bo. Dolongan and vicinities at the municipality of Dasey.

Hernani loam (490).—Hernani loam is found in the municipality of Hernani, from Bo. Padoag extending toward Bo. Batag.

Maydolong silt loam (488).—This soil type occupies the bottom land between Bo. San Isidro and Bo. Pagbabangnan in San [illegible] town.

Maydolong sandy clay loam (489).—This is found in different spots along the coast of Maydolong; and in the barrios of San Gregorio, Laua-an and Magallanes in the town of Balangiga.

Palapag clay loam (487).—This soil type occupies the narrow strip of nearly level area from Bo. Concepcion, Motiong to the municipal district of San Jose de Buan and in the flood plains south of Palapag town proper.

Pulupandan sandy loam (255).—This is found along the coast of Calbayog City.

Pulupandan clay loam (481).—This is found in the island town of San Antonio and Capul. It lies near the beach sand and Faraon clay.

Quingua clay loam (109).—This soil type occupies the flood plains along the national highway between Bo. Nabong and Bo. San Rufino, Oquendo; at Bo. Nena and Bo. Libas, San Isidro; at Bo. Del Remedios, Sulat; at Bo. Vigan, Gen. MacArthur; and at Bo. San Pedro, Quinapundan.

Quingua clay (385).—This is found along the Oras River from Hipapad to Dolores and along Dolores River.

San Manuel loam (190).—This soil type is widely distributed. It is found in the municipalities of Catarman, Oquendo, Calbiga, Borongan, Maslog and Matuguinao.

San Manuel sandy loam (96).—This soil type occupies the flood plains along the road from Sulat to Taft and from Canavid to Dolores; and at both sides of the mouth of Oras River.

San Manuel clay loam (236).—This is found in the flood plains along the Laua-an and Balangiga Rivers; from Bo. Calipquipon to the poblacion of Taft and in the northern and southern sections of the town of Gandara.

Silay loam (253).—This is found near the coast of Calbayog City. It extends from Bo. Quiliquili to Sta. Rita. This is adjacent to Pulupandan sandy loam.

Tingib clay loam (478).—This soil type is found in the bottom lands of Basey, Sta. Rita, Calbiga and Hinabangan.

Umingan loam (322).—This soil type occupies the flood plains along Hibug and Borongan Rivers, along Tongkip and Llorente Rivers, and the plains in Giporlos.

Beach sand (118).—This miscellaneous land type occupies the areas along the beaches found in the towns of Gamay, San Julian, Maydolong, Llorente, Hernani, Salcedo, Guiuan, Marabut, Allen, and Palapag. Except the area in Gamay, all other areas are in narrow strips.

Hydrosol (1).—This land type covers the areas that are under water or swamp lands. This land type is generally found at the mouths of rivers and near the bays such as Lao-ang, Lapinig, Alugan Bays; Taft; San Julian; Gen. MacArthur; Basey; La Paz, Basey; Villareal; Pinacbacdao, Hinabangan, San Sebastian, Wright; Jiabong, Motiong; Tarangnan; Sta. Margarita; Tinambacan, Maao; Allen and San Jose.

Bayho clay loam (495).—This is found in the southern section of Catarman and Mondragon.

Bolinao clay (153).—This soil type is found near the coast between San Julian Poblacion and Bo. Bugas, Borongan; between Borongan and Hernani; from Bo. Matariano, Salcedo to Guiuan; in Barrios Malinao and Calayhan, Taft; and in the islands of Tubabao, Calicoan, Biri, Talisay, San Juan, Boni, Buenavista, Batag, Cahoyagan and Lao-ang.

Catbalogan clay loam (492).—This soil type occupies the greater portion of the rolling and hilly areas in Samar Provinces. In Eastern Samar, it occupies the rolling land facing east from Gamay to Borongan; in Western Samar, the rolling lands in the southwest facing the island-towns of Zumarraga and Daram; and in the rolling areas that stretch in a southwesterly direction from the northeastern tip to the west coast.

Tingib-Catbalogan complex (493).—This is found in the vicinities of the barrios along the west coast of Sta. Rita such as Bagalbos, Alegria, Sta. Elena, San Juan and San Pedro. It is hemmed by the Tacloban clay, Dolongan loamy sand and Catbalogan clay loam.

Faraon clay (132).—The greater bulk of this soil type occupies the rolling areas found about the middle of the mainland from the vicinity of Bo. Poponton, Las Navas to Bo. Balagigon, Basey; near the coast from Bo. Maulong to Bo. Bono-anan, Catbalogan; between the towns of Calbiga and San Sebastian; and in the islands of Capul, Dalupirit, and Guintacan.

La Castellana clay (305).—This is found in the rolling areas along the northwestern section of the mainland between La-

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vezares and Tinambacan; and in the rolling land between San Jose and Bo. Santander, Bobon.

Libertad clay (494).—This soil type occupies the rolling lands between Lavezares and San Jose, which expands southward and terminates near Bugtasan River.

Lugo clay loam (730).—This is found in the municipality of Gamay, at the northeastern side and extending beyond the boundary to Palapag.

Luisiana clay (239).—Luisiana clay is found in several places, such as in the municipalities of Llorente, Hernani, Gen. MacArthur, Quinapundan, Balangiga, Giporlos and Salcedo; and also in the rolling and hilly areas between Bo. Loquilocon, Wright and Bo. Calipquipon, Taft.

Tacloban clay loam (491).—This soil type is found in the towns of Talalora and Basey and in the island-towns of Zumarraga and Daram.

Ubay clay loam (172).—This is found in the vicinity of the road junctions at Bo. Loquilocon, Wright.

Mt. soils, undifferentiated (45).—This miscellaneous land type occupies the steep hills and mountains of Samar Provinces.

Unclassified areas.—These areas were not surveyed due to lack of transportation facilities during the time of the survey in 1953.

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. 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 so 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 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 in-

creases, people tend to overwork the soil. Overworking the soil inevitably results in 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.

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 allows 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 arrenged 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 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 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 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 assists 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 on subsequently contribute much to erosion control.

An efficient system of soil management in support to vegetative and mechanical measures is, indeed, 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 or kinds of soils 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 SAMAR PROVINCES

Common Name	Scientific Name	Family
Abaca	*Musa textilis* Nee	Musaceae
Achuete	*Bixa orellana* Linn.	Bixaceae
Agiñgai	*Rottboellia exaltata* Linn.	Gramineae
Agor	*Fimbristylis miliaceae* (Linn.) Vahl.	Cyperaceae
Alugbati	*Basella rubra* Linn.	Basellaceae
Ampalaya	*Momordica charantia* Linn.	Cucurbitaceae
Anibong	*Oncosperma tigillaria* (Jack.) Ridl.	Palmae
Anonas	*Anona reticulata* Linn.	Anonaceae
Apitong	*Dipterocarpus grandiflora* Blanco	Dipterocarpaceae
Aroma	*Acacia farnesiana* (Linn.) Willd	Leguminosae
Arrowroot	*Maranta arundinacea* (Linn.)	Marantaceae
Atis	*Anona squamosa* Linn.	Anonaceae
Avocado	*Persea americana* Mill.	Lauraceae
Badiang, Biga	*Alocasia macrorrhiza* (Linn.) Schott.	Araceae
Bakauan	*Rhizophora mucronata* Lam.	Rhizophoraceae
Balangut	*Typha capensis* Rohrb.	Typhaceae
Bamboo	*Bambusa spinosa* Roxb.	Gramineae
Banana	*Musa sapientum* Linn.	Musaceae
Bangkal	*Nauclea orientalis* Linn.	Rubiaceae
Batao	*Dolichos lablab* Linn.	Leguminosae
Batad	*Andropogon sorghum* (Linn.) Brot.	Gramineae
Betel nut	*Areca catechu* Linn.	Palmae
Binayoyo	*Antidesma ghaesembilla* Gaertn.	Euphorbiaceae
Boho	*Schizostachyum lumampao* (Blanco) Merr.	Gramineae
Breadfruit	*Artocarpus communis* Forst.	Moraceae
Buñgalon	*Cumingia philippinensis* Vidal	Bombacaceae
Buri	*Corypha elata* Roxb.	Palmae
Cabbage	*Brassica oleracea* Linn. var. *capitata L.*	Cruciferae
Cacao	*Theobroma cacao* Linn.	Sterculiaceae
Cadios	*Cajanus cajan* (Linn.) Milsp.	Leguminosae
Caimito	*Chrysophyllum cainito* Linn.	Sapotaceae
Camote	*Ipomoea batatas* (Linn.) Poir	Convolvulaceae
Cassava	*Manihot esculenta* Crantz	Euphorbiaceae
Cashew	*Anacardium occidentale* Linn.	Anacardiaceae
Chico	*Achras sapota* Linn.	Sapotaceae
Coconut	*Cocos nucifera* Linn.	Palmae
Coffee	*Coffea arabica* Linn.	Rubiaceae
Cogon	*Imperata cylindrica* (Linn.) Beauv.	Gramineae
Corn	*Zea mays* Linn.	Gramineae

Common Name	Scientific Name	Family
Cotton	*Gossypium hirsutum* Linn.	Malvaceae
Cowpea	*Vigna sinensis* (Linn.) Savi.	Leguminosae
Dayap	*Citrus aurantifolia* (Christm.) Swingle	Rutaceae
Derris	*Derris eliptica* (Roxb.) Benth.	Leguminosae
Duhat	*Eugenia cumini* (Linn.) Druce	Myrtaceae
Eggplant	*Solanum melongena* Linn.	Solanaceae
Gabi	*Colocasia esculentum* (Linn.) Schott. and Endl.	Araceae
Garlic	*Allium sativum* Linn.	Liliaceae
Ginger	*Zingiber officinale* Rose.	Zingiberaceae
Guijo	*Shorea guiso* (Blanco) Blume	Dipterocarpaceae
Guisok	*Shorea balangeran* (Korth.) Dyer	Dipterocarpaceae
Guava	*Psidium guajava* Linn.	Myrtaceae
Ipil	*Intsia bijuga* (Colebr.) O. Kuntze	Leguminosae
Ipil-Ipil	*Leucaena glauca* (Linn.) Benth.	Leguminosae
Icmo	*Piper betle* Linn.	Piperaceae
Jackfruit	*Artocarpus heterophyllus* Lam.	Moraceae
Kalamansi	*Citrus microcarpa* Bunge	Rutaceae
Kamias	*Averrhoa bilimbi* Linn.	Oxalidaceae
Kamachili	*Pithecolobium dulce* (Roxb.) Benth.	Leguminosae
Kapok	*Ceiba pentandra* (Linn.) Gaertn.	Bombacaceae
Katuray	*Sesbania grandiflora* (Linn.) Pers.	Leguminosae
Kondol	*Benincasa hispida* (Thumb.) Cogn.	Cucurbitaceae
Lagolo	*Acrostichum aureum* Linn.	Polypodiaceae
Lanzones	*Lansium domesticum* Correa	Meliaceae
Lauan	*Pentacme contorta* (Vidal) Merr. and Rolfe	Dipterocarpaceae
Lumbia	*Metroxylon sagu* Rottb.	Palmae
Mabolo	*Diospyros discolor* (Willd.)	Ebenaceae
Macopa	*Eugenia mallaccensis* Linn.	Myrtaceae
Madre cacao	*Gliricidia sepium* (Jacq.) Steud.	Leguminosae
Maguey	*Agave cantala* Roxb.	Amaryllidaceae
Malunggay	*Moringa oleifera* Linn.	Moringaceae
Mango	*Mangifera indica* Linn.	Anacardiaceae
Melon	*Cucumis melo* Linn.	Cucurbitaceae
Millet	*Panicum miliaceum* Linn.	Gramineae
Molave	*Vitex parviflora* Juss.	Verbenaceae
Mungo	*Phaseolus aureus Roxb.*	Leguminosae
Mustard	*Brassica integrifolia* (West) Schultz.	Cruciferae
Narra	*Pterocarpus indicus* Willd.	Leguminosae
Nipa	*Nypa fructicans* Wurmb.	Palmae
Onion	*Allium cepa* Linn.	Liliaceae
Orange	*Citrus aurantium* Linn.	Rutaceae
Paayap	*Vigna sinensis* (Linn.) Savi.	Leguminosae
Pagatpat	*Sonneratia caseolaris* (Linn.) Engl.	Sonneratiaceae
Palauan	*Cyrtoxpherma merkusii* (Hassk.) Schott.	Araceae

Common Name	Scientific Name	Family
Pandan	*Pandanus tectorious* Solander	Pandanaceae
Papaya	*Carica papaya* Linn.	Caricaceae
Patani	*Phaseolus lunatus* Linn.	Leguminosae
Patola	*Luffa cylindrica* (Linn.) M. Roem.	Cucurbitaceae
Pechay	*Brassica chinensis* (Linn.)	Cruciferae
Peanut	*Arachis hypogaea* Linn.	Leguminosae
Pepper	*Capsicum annuum* Linn.	Solanaceae
Pineapple	*Ananas comosus* (Linn.) Merr.	Bromeliaceae
Pummelo	*Citrus maxima* (Brum.) Merr.	Rutaceae
Radish	*Raphanus sativus* Linn.	Cruciferae
Rice	*Oryza sativa* Linn.	Gramineae
Santol	*Sandoricum koetjape* (Burn. Fl) Merr.	Meliaceae
Sincamas	*Pachyrrhizus erosus* (Linn.) Urb.	Leguminosae
Sineguelas	*Spondias purpurea* Linn.	Anacardiaceae
Sitao	*Vigna sesquipedalis* Fruw.	Leguminosae
Squash	*Cucurbita maxima* Duch.	Cucurbitaceae
Sugar cane	*Saccharum officinarum* Linn.	Gramineae
Talahib	*Saccharum spontaneum* (Linn.)	Gramineae
Tambo	*Phragmites vulgaris* (Lam.) Trim	Gramineae
Tamarind	*Tamarindus indica* Lam.	Leguminosae
Tangile	*Shorea polysperma* (Blanco) Merr.	Dipterocarpaceae
Tanglad	*Andropogon citratus* DC.	Gramineae
Tibig	*Xylocarpus granatum* Koenig	Meliaceae
Ticog	*Fimbristylis globulosa* (Retz.) Kunth	Cyperaceae
Tindalo	*Pahudia rhomboidea* (Blanco) Prain.	Leguminosae
Tobacco	*Nicotiana tabacum* Linn.	Solanaceae
Tomatoes	*Lycopersicum esculentum* Mill.	Solanaceae
Tugui	*Dioscorea esculenta* (Lorur.) Burkill	Dioscoreaceae
Ubi	*Dioscorea alata* Linn.	Dioscoreaceae
Upo	*Lagenaria leucantha* (Duch.) Rusby	Cucurbitaceae
Watermelon	*Citrullus vulgaris* (Schrad.)	Cucurbitaceae
Yakal-saplungan	*Hopea plagata* (Blanco) Vidal	Dipterocarpaceae

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