REPUBLIC OF THE PHILIPPINES

DEPARTMENT OF AGRICULTURE AND NATURAL RESOURCES

BUREAU OF SOILS

MANILA

Soil Report 26

SOIL SURVEY OF NEGROS ORIENTAL PROVINCE PHILIPPINES

BY

ALFREDO BARRERA
Chief of Party

JOSE JAUG
Member



CONTENTS

ILLUSTRATIONS	
INTRODUCTION	
DESCRIPTION O	f the Area
CLIMATE	
AGRICULTURE	
SOIL SURVEY D	METHODS AND DEFINITIONS
THE SOILS OF	NEGROS ORIENTAL
Soils of t	he Lowland
Rolling U	pland Soils
	and Soils
Non-Agric	eultural Soils
	ND GENESIS OF NEGROS ORIENTAL SOILS
PRODUCTIVITY	RATINGS OF NEGROS ORIENTAL SOILS
MECHANICAL A	Analysis of Negros Oriental Soils
FIELD DETERM	INATION OF SOIL TEXTURAL CLASS
LAND CAPABIL	ITY CLASSIFICATION OF NEGROS ORIENTAL SOILS
	OILS OF NEGROS ORIENTAL
SUMMARY	
GLOSSARY OF C	COMMON ECONOMIC PLANTS FOUND IN NEGROS ORIENTAL
	CITED
SOIL MAP OF 1	Negros Oriental Province (in pocket)

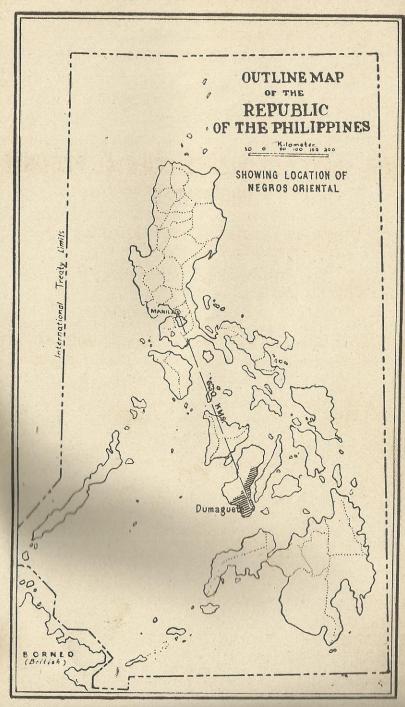


Figure 1. Outline map of the Republic of the Philippines showing the location of Negros Oriental Province.

REPUBLIC OF THE PHILIPPINES

DEPARTMENT OF AGRICULTURE AND NATURAL RESOURCES

BUREAU OF SOILS

MANILA

Soil Report 26

SOIL SURVEY OF NEGROS ORIENTAL PROVINCE PHILIPPINES

BY

ALFREDO BARRERA Chief of Party

JOSE JAUG

Member and sold sold



MANILA BUREAU OF PRINTING 1960

DEPARTMENT OF AGRICULTURE AND NATURAL RESOURCES

Hon. JUAN DE G. RODRIGUEZ
Secretary of Agriculture and Natural Resources

Hon. Jose Trinidad
Undersecretary for Agriculture

Hon. AMANDO M. DALISAY
Undersecretary for Natural
Resources

BUREAU OF SOILS

MARCOS M. ALICANTE, Director

FRED C. BURNS
Technical Adviser on Soils, ICA

ILLUSTRATIONS

TEXT FIGURES	Page
1. Outline map of the Republic of the Philippines showing the location of Negros Oriental Province Fronti	spiece
2. Map of Negros Oriental showing relief and general pattern	- 4
9. Climate map of Negros Oriental	18
10. Graph of the first type of climate in the Philippines and of Siaton, Negros Oriental	16
of Dumaguete City	17
PLATE 1	
3. The level areas between coast and mountains are densely populated and intensively cultivated	5
4. Interior areas are rugged and mountainous. Notwith- standing steep slopes, forests were cleared for corn and	
upland rice	5
PLATE 2	
5. The national road follows the coast line of the province. Bridges washed away by floods are temporarily replaced by ferries like the one at Guihulngan	9
6. An ocean-going vessel loading copra at Dumaguete City, the capital and principal seaport of the province	9
PLATE 3	
7. Salt making, by solar evaporation of sea water impounded in tile lined beds, is an important industry of Manjuyod. The industry is not year round as it operates only during the dry season	12
8. Pottery is a home industry of people living near Dumaguete City. Jars, pots for kitchen and garden, and other pottery products are made	12
PLATE 4	
and coconut	25
it when kaingin farmers came to stay. Upland rice and	25
111	
	1. Outline map of the Republic of the Philippines showing the location of Negros Oriental Province

		PLATE 5
Fig.	14.	Profile of Siaton sandy loam. The surface layer is much darker than the underlying layers
Fig.	15.	Coconut is one of the leading crops grown on Siaton sandy loam. It thrives well on this soil type
		PLATE 6
Fig.	16.	Profile of Isabela clay. The surface soil is characteristically black. Note the fine texture of the soil in each of the different layers
Fig.	17.	Sugar cane is the principal crop grown on Isabela clay in Negros Oriental. Installation of a good drainage system is necessary for this crop on this soil type
		PLATE 7
Fig.	18.	Profile of Faraon clay. Note the shallow black surface layer above the coralline limestone
Fig.	19.	Landscape of Faraon clay, steep phase. Steep slopes of this soil type, which should never be under cultivation, are planted to corn thereby promoting erosion
	411	PLATE 8
Fig.	20.	Profile of Lugo clay. The thin dark surface layer overlays a thick mass of soft calcareous shale
Fig.	21.	Landscape of Lugo clay in central Siquijor Island. Most of the surface soil has been eroded due to improper use of the land. Building in foreground once housed the offices of a manganese mine
		PLATE 9
Fig.	22.	Profile of La Castellana clay. The solum is shallow under- lain by unconsolidated rock materials imbedded in clay soil
Fig.	23.	Landscape of La Castellana clay. Rolling to hilly, it is usually under grass. Boulders scattered over the surface is a typical characteristic of the series
		PLATE 10
Fig.	24.	Profile of Zamboanguita clay loam. The soil is dark, deep and fairly friable with fine granular structure
Fig.	25.	Landscape of Zamboanguita clay loam. The rolling, grass

covered slopes of this soil type is suitable for pasture

INTRODUCTION

Toll classification and soil erosion survey of an area are undertaken for scientific as well as for practical ends. Knowledge of the physical, chemical, and biological properties of the physical, chemical, and biological properties of a necessary if a sound basis for agricultural program a desired. This knowledge may be acquired from field and aboratory studies of soils, hence the reconnaissance soil survey. The loss of precious soil through erosion by natural man-made causes is ruining many Philippine farms. Assint the day when our farms, grasslands, and forests shall being presented, because the existence and livelihood, directly and indirectly, of our people depend on how well our soils are miserved and their inherent fertility maintained. With this tall in view, the soils of Negros Oriental Province were classified.

1

SOIL SURVEY OF NEGROS ORIENTAL PROVINCE PHILIPPINES

DESCRIPTION OF THE AREA

Location and extent.—Negros Oriental Province lies south Manila in a NNE-SSW position. It occupies the eastern side of the Island of Negros and is separated from Negros Decidental by a natural barrier of rugged mountain chains which extend from the northeastern coast to the southwestern In of the island. This chain of mountains is incidentally the regional boundary of eastern and western Visayas. Tañon Strait separates Negros Oriental and Cebu Province. The southern side of the province is bounded by the Mindanao and Julu Seas, while its northern side is bounded by the province Negros Occidental. The province has a total land area of 11,640 hectares. The province, aside from the mainland, also Includes the island subprovince of Siquijor and a few smaller Islands. The city of Dumaguete, 384 aerial miles from Manila, Is the site of the provincial government. Dumaguete City and Bacolod City in Negros Occidental are linked by a 335-kilometer Mighway which skirts the northwestern, northern and eastern masts of the island. Larena, the capital of Siguijor sub-prov-Ince is east of and about 20 aerial miles from Dumaguete

Oriental Province as of the actual soil cover of Negros

Kind of land	Area in hectares	Percentage	
mmereial forest a commercial forest b march and mangrove a and cultivated land	217,210 91,280 3,050 220,100	40.86 17.17 0.57 41.40	
Total	531,640	100.00	

Wearbook of Philippine Statistics, 1946.

Relief and drainage.—The province is topographically a contrast to that of her sister province, Negros Occidental. The former is characterized by low, but serrated mountain ranges which in most parts are close to the shore line. The highest

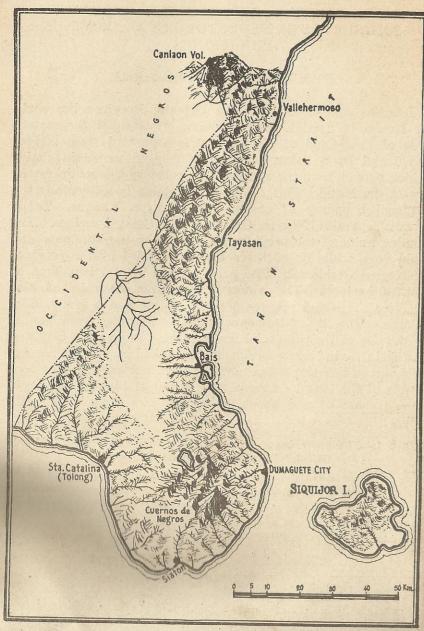


Fig. 2. Map of Negros Oriental showing relief and general pattern of drainage.

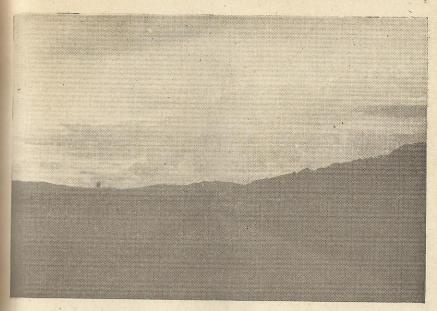


Figure 3. The level areas between coast and mountains are densely populated and intensively cultivated.

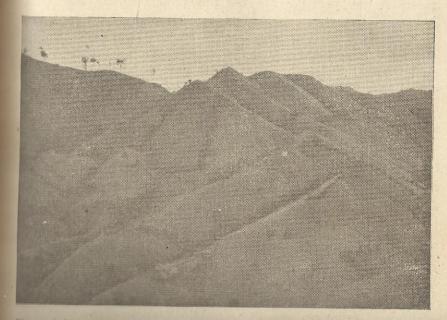


Figure 4. Interior areas are rugged and mountainous. Notwithstanding steep slopes, forests were cleared for corn and upland rice.

mountain peak in the province is Canlaon near the town of Vallehermoso which is 2,465 meters high. Another high peak is Cuernos de Negros, west of Dumaguete City which rises to a height of 2,000 meters. From the economic standpoint, the physical features of Negros Oriental can be interpreted as one which cannot adequately support a growing population. The subprovince of Siquijor like the mainland, is also basically possessed with rugged topography.

In general the province is adequately furnished with ample drainage system. With the exception of one river around the district of Bais, all drain toward the eastern and southern coastal regions and finally empty into the sea. Most of the rivers and streams whose headwaters originate from the rugged mountainous regions are short and swift. The flow of rivers in Tolong, La Libertad, Tanjay, Siaton, Malabaya, and even many small ones is so swift. The destruction caused when these rivers overflow their banks or change their courses is immense. From March through May these rivers and streams run dry. During the typhoon months, on the other hand, they become swollen bringing about destructive floods. Most of the rivers in the province are not navigable even by fair sized bancas.

Water supply.—The supply of water is adequate. Most of the towns have water systems which are either of the gravity or pump types. People of towns which have no water system rely on surface wells as their source of drinking water.

Vegetation.—In the so-called unexplored upland and mountainous areas of the province, primary forest is the principal vegetal cover. The narrow coastal regions are devoted to the cultivation of coconut, corn, kapok, bananas, sugar cane, etc. There are patches of open and cogon lands in the interior upland areas of the province, and along the beaches are some discontinuous growth of mangrove trees. The existence of secondary forests, of which this province is no exception, is the result of careless lumbering and the evil practice of "kaingin" system of cultivating annual crops. In some upland and rugged sections are found areas devoid of vegetation. This condition is true in the northern part of the province where the people do not have enough space to till. The utilization of steep hillsides for the culture of crops will result to untold adverse consequences to both man and the soil. The same condition is commonly observed in the subprovince of Siguijor whose population is so

dense that hillsides are cultivated to annual crops to meet the increasing needs of the inhabitants.

Geology.—Tertiary sedimentary rocks possibly Pliocene age predominate most part of Negros Oriental. Running as a narrow coastal belt are coralline limestone formations from the upper-most part in Vallehermoso down to Dumaguete and other portions in Tolong in the south. Siquijor Island is mainly of coralline limestone formation except the central area between Lazi and Larena which is calcareous shale. Extensive areas of coralline limestone are also found in the interior of Bagtic. The whole of the southern peninsula is of andesitic to basaltic lava flow of the late Tertiary and Quartenary age. Fringing along the coastal shores specially on mouths of rivers and along the main source of the Ilog River are flood plains of recent alluvium which form most of the rich agricultural areas of the province.

During the time of mountain-making movements intrusions of igneous rocks came about. Previous to this, according to Smith, there might have been land connection with Cebu; later through down-folding and faulting, the sea encroached so as to cover the sunken area now known as the Tañon Strait. The high fertility of the soils in the eastern coastal plains may be attributed to the leaching of lime rich in phosphorus from the upper hills.

Organization and population.—The last episode in the political, social and cultural history of Negros Oriental Province under the Spanish regime dates back to 1890 when it enjoyed the autonomy of an independent province. Prior to 1734, Negros Oriental was under the jurisdiction of the province of Cebu. When the Spanish conquerors landed in the province they found there were no thriving native settlements like in other points of the Archipelago. The name of the Island was changed from Buglas to Negros by the Spaniards because of the numerous Negrito tribes. Managuit, as the Moro pirates named Dumaguete, was perhaps the only settlement in the province found by the conquerors to be existing. After 1734, the province was reconstituted with Negros Occidental. The Island of Negros became one military district and this remained as such until 1856 when the island was changed to a politico-military province. In 1890, Negros Occidental and Negros Oriental were again separated each becoming a politico-military province.

The sugar industry of the two provinces came into being since 1850 on account of the opening of the ports of Iloilo and Cebu.

When the Spanish government collapsed in 1898, the two provinces were again reunited under a Filipino Revolutionary Government headed by Acting Governor Juan Araneta and retained its old name of Politico-Military Government of Negros. After the surrender of the Filipino Revolutionary Government to the American Forces of Occupation Negros Oriental was declared a separate province together with the subprovince of Siquijor which used to be under the jurisdiction of the Province of Bohol. On May 1, 1901, the civil government of Negros Oriental was established.

During the early part of the American rule, great progress was achieved in all lines of human endeavors. Sanitation, education, religion, industry, public works construction, etc. were given due consideration and emphasis. In the field of education, the province was one of the first provinces in the whole Archipelago to have a higher institution of learning. In 1900 the famous Silliman Institute (now Silliman University) was founded by Dr. Horace B. Silliman.

The rapid progress of the province during the American and Commonwealth regimes was interrupted in 1941 by the outbreak of the Pacific War. Like other places in the Philippines, Negros Oriental suffered materially, economically and otherwise from the ravages of the Japanese occupation. After the arrival of the liberating American Forces, reconstruction and rehabilitation started at once and progressed steadily since.

During the census of 1948, the province (mainland and the subprovince) had twenty six towns. The following figures * indicate the increase in population of the province since 1903.

Year		Population
1903	110721 (1.10	201,494
1918	AND THE RESIDENCE OF THE PROPERTY OF THE PARTY OF THE PAR	272,524
1938		394,680
1948		418,623

Transportation and market.—The geographical location of the City of Dumaguete makes it the nerve center of transportation and commerce of the province. The town of Bais handles comparatively lesser volume of trade than Dumaguete City. It is the second important port of the province. Larena and Lazi play a major role in the interisland trade for the subprovince of



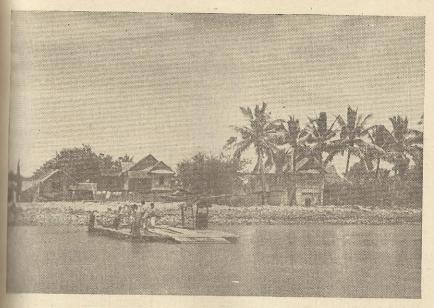


Figure 5. The national road follows the coast line of the province. Bridges washed away by floods are temporarily replaced by ferries like the one at Guihulngan.

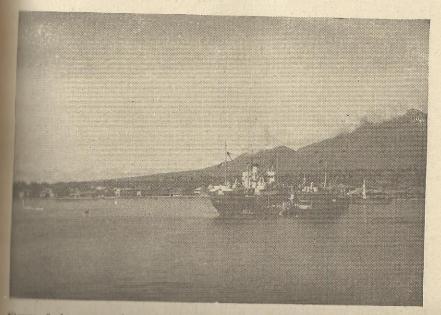


Figure 6. An ocean-going vessel loading copra at Dumaguete City, the capital and principal seaport of the province.

Siquijor. Inter-island and ocean-going vessels dock at Dumaguete almost every day. These vessels unload different merchandise, such as hardware, dry goods, machinery and equipment, rice, corn, etc. The most important export crops of the province are sugar and copra. Other agricultural products from the subprovince and other towns of the mainland are brought to Dumaguete City where they are finally transported to Cebu and Manila. Sugar, however, is loaded direct at the port of Bais. Business transactions like wholesale and retail merchandizing are mostly handled by Chinese and Indian nationals.

Two big overland transportation companies, the Visayan Rapid Transit and the Uy Matiao Transportation, maintain regular runs between Dumaguete City and Bacolod City. Other transportation companies also have connections in other points of the province. Road connections between the southern towns and Dumaguete is rather poor. Paving is third class Macadam. while building and maintenance of bridges over intermittent and perennial streams are inadequate. The road from Dumaguete City runs along the coast to reach New Tolong, 102 kilometers to the south. The provincial road linking Dumaguete City and the northern towns, on the other hand, has stretches of either concrete, asphalt, or gravel surfaces. With the exception of the ferry at La Libertad, all rivers are bridged. The national highway between Dumaguete City and Bacolod City follows the coast line. Its length from Dumaguete to the Negros Oriental-Negros Occidental boundary is 147 kilometers. From the town of Vallehermoso the highway branches to the interior town of Canlaon and thence to La Castellana in Negros Occidental.

There is a regular air connection between Dumaguete and Cebu, Dumaguete and Iloilo via Bacolod, and Dumaguete and other Mindanao ports like Dipolog, Cagayan, Davao, and Cotabato. The Dumaguete-Manila route is via either Cebu or Iloilo.

Cultural development and improvement.—Popular elementary education is maintained by the government in all sections of the province where there are enough inhabitants to warrant the opening of public schools. Secondary school instruction is also maintained by the government. In the City of Dumaguete a general high school curriculum, trade school course, and courses in home economics for girls are given. In some big towns,

regional high schools are established. Private high schools are usually found in towns with no public high schools. The Silliman University in Dumaguete City, which offers collegiate courses in law, chemistry, engineering, education, theology, nursing, home economics, etc., has an estimated enrollment of about 6,000 students during the school year 1948–1949. A contemplated course in agriculture will be offered pretty soon. Another institution of learning of collegiate level is the St. Paul Academy also located in Dumaguete City. Silliman University is a Protestant educational institution while St. Paul a Catholic school. There is a subprovincial high school at Larena, the educational and trade center of the Island of Siquijor.

The District Forest Headquarters and Forest Station are located in Dumaguete and Tolong respectively. A small saw-mill is located in the vicinity of Tanjay. The Bureau of Plant Industry maintains a public agricultural extension service with various primary objectives. The distribution of selected seeds and improved planting materials like budded, grafted, in-arched, marcotted fruit trees are handled by this office in addition to its routinary work in combating plant pests and diseases, checking untoward outbreak of swarms of migratory locusts and army worms.

Private and public hospitals and clinics are found in Dumaguete City and in other big towns in the province. The Provincial and Mission hospitals located at Dumaguete City are typical. Besides these, District and Municipal Health Officials also exercise great care in protecting the health of the people. The Bureau of Lands, District Fishery Warden, the Public Defender hold their offices right in the City of Dumaguete. The office of the Provincial Veterinarian and that of the Bureau of Animal Industry are also located in Dumaguete. These offices are charged with the combating of animal diseases and other maladies of livestocks and poultry, aside from maintaining pure or imported breeds to improve our native stocks.

Radio and telegraphic communications of the Bureau of Posts are located in Dumaguete City and other important towns of the province. The Philippine National Bank has a branch office in Dumaguete.

Larena is the capital of the subprovince of Siquijor. It is the place where the Lieutenant Governor and other subprovincial officials of the island hold office. The highway connecting

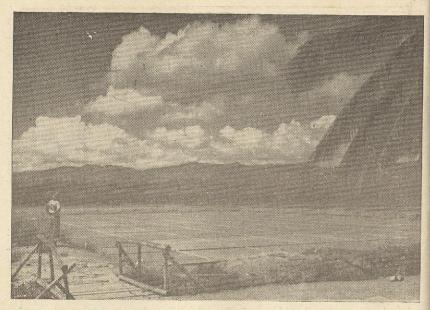


Figure 7. Salt making, by solar evaporation of sea water impounded in tile lined beds, is an important industry of Manjuyod. The industry is not year round as it operates only during the dry season.

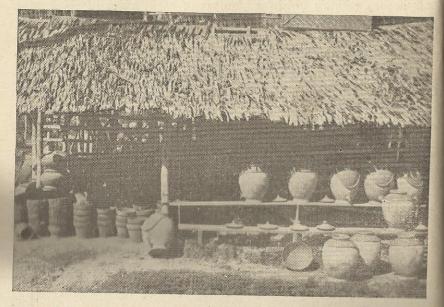


Figure 8. Pottery is a home industry of people living near Dumaguete City. Jars, pots for kitchen and garden, and other pottery products are made.

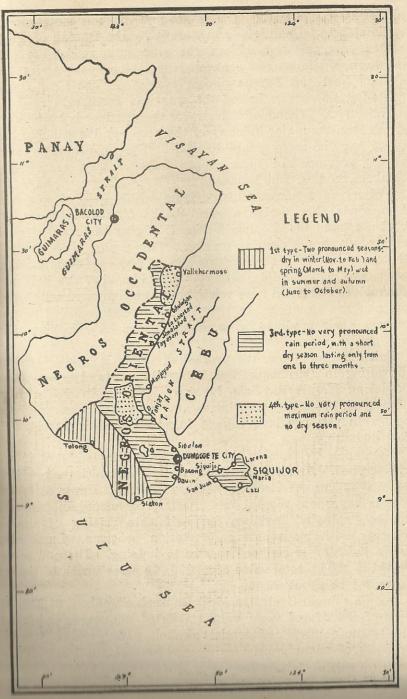


Figure 9, Climate map of Negros Oriental.

all towns in the island is adequate and in good condition. A radio station is maintained in Larena by the Bureau of Posts. Water transportation before the war was good. Ports in northern Mindanao are connected by motor boat service that call on Lazi and Larena almost everyday. The Cebu-Dumaguete-Larena service before the war was excellent.

Industries.—The chief industry of the province is agriculture. It has been the major industry of the people and is still expected to be one for many years to come. The important products of the province are sugar, copra, kapok, cacao, corn, hemp, bamboos, kadios, and bananas.

Pottery is a home industry from which most people near Dumaguete City derive a great part of their income. The region around the city has a deposit of clay material which is very good for pot and jar making. This region is incidentally the only place in the whole province of Negros Oriental where good clay material for pottery is found making the bulk and volume of production here relatively large compared with other parts of the province. In 1949 there were 32 recorded pottery makers, their products being mainly water jars, cooking pots, and garden pots.

Salt manufacturing, the process of which is similar to that prevailing in Parañaque, Las Piñas, Bacoor and other towns bordering Manila Bay is a lucrative industry in the town of Manjuyod. Sinamay weaving is another industry many of the people in the province engage in although this industry is fast dwindling.

Manganese deposits in the outskirts of Larena, Siquijor are being mined. Another natural resource from which the province derives an income are its primary forests. However, these forests have now receded into the interior mountainous areas due to "kaingin" farming, indiscriminate cutting of timber together with inadequate reforestation program. Lumbering as an industry is confined mostly to logging. There was reported in 1956 a total value of 23,296,000 pesos worth of timber estimated at about 66,560 cubic meters.

The Bais Sugar Central, aside from producing about 41,378,780 kilos of centrifugal sugar valued at 6,738,800 pesos for export, also manufactures commercial alcohol, paper and other byproducts of sugar cane.

Cattle raising is fast becoming an important industry in the province. Nearly 18,000 heads of cattle worth 1,554,700 pesos

was reported in 1948. The southern part of the province is the chief cattle producing area. Some towns in the north also engage in this industry although to a limited extent.

CLIMATE

The climatic condition of Negros Island is influenced by the existence of the mountain range running almost centrally along the whole length of the island from the north to the south. Since the climatic characteristics in the Philippines are influenced by the prevailing monsoons flowing from east to west, it then follows that this mountain barrier becomes the responsible single factor in the existence of two types of climate in the island of Negros.

The whole eastern part of Negros Oriental, including the entire island of Siquijor, falls under the third type of climate which is characterized by no very pronounced maximum rainfall with a short dry season of from one to three months. The other half (see rainfall map) falls under the first type which is characterized by a distinct wet and dry season. A dry month is one wherein rainfall is less than two inches. On the eastern part of Negros Oriental (third type), although it is relatively dry from January to April, the average monthly rainfall is over two inches. In Dumaguete and Vallehermoso the recorded rainfall below two inches was only for the month of April. On the other hand, the heaviest rainfall occurs in October ranging from 7.57 in Dumaguete and 10.08 inches in Bais.

The southwestern part of the province is under the first type of climate. The dry months are from January to April. February and March have as low as 0.49 inches and 1.05 inches rainfall respectively. The rainy months are May through December with the period from August to October receiving the most rainfall.

The temperature for the entire province is relatively uniform averaging from 26.1 to 27.7 degrees centigrade. The maximum temperature is about 34.8 degrees, the minimum about 20.8 degrees centigrade.

Relative humidity is low from February through August vanging from 74 to 79 percent. It increases to a certain extent up to 83 percent in some months of the year. The humidity is high during the rainy part of the year.

The northern part of the province experiences occasional typhoons more than the southern part.

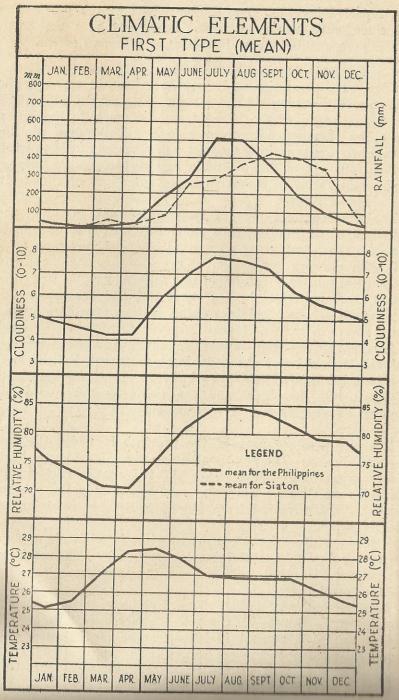


Figure 10. Graph of the first type of "Umate in the Philippines and of Siaton, Negros Oriental."

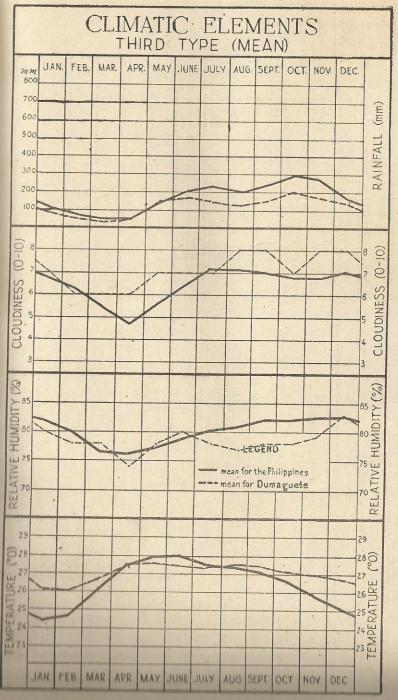


Figure 11. Graph of the third type of climate in the Philippine and of Dumaguete City.

2.—Average monthly rainfall and rainy days in Negros Oriental Province

11			000 811184191081	174
	Larena Siquijor (8 years)	days		
	Larena (8 y	inches	21.0.1.4.0.1.4.0.1.1.4.0.1.1.4.0.1.1.4.0.1.1.4.0.1.1.4.1.1.4.1.4	96.69
	Hda. Villahermoso (19 years)	days	31 80 80 80 80 80 80 80 80 80 80 80 80 80	127
Third type of climate	Hda. Vill	inches	46221174484769774 69246769774 7022867769774	58.86
Third type	Hda. Palanas, Bais (19 years)	days	11 - 9 2 0 1 1 4 4 7 7 5 8	140
	Hda. Pala (19 3	inches	4.94 2.47 2.45 2.45 2.39 5.06 5.26 8.32 10.08 8.68 8.68	72.53
	guete ars)	days	41 0 0 0 0 1 1 4 1 1 1 1 1 1 1 1 1 1 1 1 1	155
	Dumaguete (38 years)	inches	6 6 8 2 4 4 6 6 4 4 6 6 7 7 7 7 8 8 2 8 9 2 7 7 4 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9	16.99
	Tolong (5 years)	days	4000 2117 852 12 15 15 15 15 15 15 15 15 15 15 15 15 15	126
of climate	Tol (5 y	inches	0.91 10.05 1	18.61
First type of climate	first type of	days	6 6 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	111
	Siaton (9 years)	inches	0.43 0.58 0.58 0.58 0.58 0.58 0.58 0.58 0.58	90.84
¥ 100 minutes (100 minutes)	r		January February March Juril May Juril May Juril May	Annual

the Monthly

Table 3 .- Monthly temperature and relative humidity in Negros Oriental 1

	Maximum °C	Normal °C	Minimum °C	Relative humidity-%
anuary	30.0	26.1	21.0	8
ebruary	30.7	26.1	20.8	79
larch	31.3	26.8	21.6	78
pril	32.3	27.5	22.0	76
Any.	32.9	27.6	22.7	- 78
une	33.0	27.4	21.9	78
uly	33.9	27.4	21.4	79
ugust	34.8	27.7	21.9	7'
eptember	34.6	27.5	21.7	80
ctober	32.8	27.1	22.0	80
lovember	31.9	27.0	22.1	81
December	31.4	26.8	21.4	8:
Asan-Annual	35.1	27.1	20.3	7

Data from Census of the Philippines, 1918.

AGRICULTURE 2

Negros Oriental, in spite of being rugged and mountainous, is an agricultural province and the majority of the populace eke out their living from the soil. Its main crops are corn, sugar cane, palay, coconuts, root crops, abaca, and tobacco. Unlike Negros Occidental, Negros Oriental Province has very limited level areas. Corn is extensively grown and cultivated throughout the province as it is the chief and staple food of the people. There is one modern sugar central in the town of Bais. The central mills all the sugar cane raised in the plantations In Bais and in the neighboring towns of Tanjay and Manluyod. The presence of the sugar central in Bais makes sugar cane the most important crop in this section of the province. Highland plateaus and very narrow valleys are found in the western interior which are mostly utilized for upland rice, corn, and root crops. Some small areas for lowland rice culture are found on intermittent creek beds and in very narrow valleys.

The farm area of the province is 125,529.32 hectares. It is classified according to use as follows:

Kind of land	Area (Ha.)
Cultivated land	84,430.98
Idle land	19,272.48
Pasture land	10,973.52
Forest land	6,069.22
Other lands	4,783.12

² Data on area, production, and value of crops were taken from the 1948 Census of Agriculture, Bu. of the Census and Statistics.

125,529.32

CROPS

Food crops harvested from cultivated land are insufficient for the support and consumption of the population of the province. Rice and vegetable are brought from neighboring provinces. Root crops and other staple substitutes are limited in quantity. Corn, copra, tobacco, and tomatoes are, however, shipped to other provinces.

Corn.—The most extensively cultivated crop in Negros Oriental is corn. The total area planted to corn for the first, second, and third crops was 115,324 hectares in 1948. A total of 1,114,691 kilos valued at 12,859,228 pesos was produced. This did not include green corn of 4,945,564 ears valued at 19,291 pesos which was harvested from an area of 494.08 hectares.

In level areas, the field is plowed two or three times and then harrowed. Furrows are laid out one meter apart. Three or four seeds are dropped into each hill, the hills being 70 to 80 centimeters apart. With this method of planting about six to eight gantas of corn seed are needed to cover one hectare. Harvest takes place after four months. Machinery is rarely if ever used in the whole operation.

Table 4.—Area, production, and value of leading crops of Negros Oriental in 1948

Crops	Area hectares	Production	Value-Pesos
Sugar cane Centrifugal Muscovado and panocha Molasses Corn	5,680.00	41,378,780 kg. 768,200 kg. 10,993,470 kg.	P6,738,800 168,900 424,020
1st crop 2nd crop 3rd crop Coconut Food nuts Copra Dessicated Home-made oil	51,793.92 38,088.00 25,441.41 23,110.00	568,901 cav. 328,331 cav. 217,459 cav. 474,400,000 kg. 4958,000 kg. 19,300,000 kg. 19,300,000 kg. 75,980 kg.	6,390,461 3,903,464 2,565,303 46,249,600 7,334,000 936,030 73,530
Palay 1st crop, lowland 2nd crop, lowland Upland Tobacco Abaca Sweet potato Cassava Gabi Beans, dry	$\begin{matrix} 6,740.07\\ 1,115.64\\ 2,991.69\\ 1,990.00\\ 1,640.00\\ 4,166.09\\ 3,760.72\\ 390.00\\ 490.00 \end{matrix}$	158,991 cav. 21,556 cav. 43,029 cav. 620,860 kg. 1,148,000 kg. 4,316,220 kg. 4,183,558 kg. 1,365,000 kg. 206,000 kg.	1,832,205 219,853 467,174 465,650 459,200 410,620 337,781 205,750 120,560

a Excluded from total area, production and value.

In the rolling and mountainous areas, *kaingin* method of agriculture is widely practiced. The land is cleared of grass and weeds with trowel or bolo after which holes for corn seeds are made. A standard distance between holes is not adopted

because in rocky places soil spaces are located only between rocks. Clean culture is more predominant in *kaingin* areas than in flat places. The harvest from *kaingins* is generally less than from flat regular farms due to soil erosion in the former.

The most popular varieties of corn found in the province are the Cebu White Flint, Tinigib, Misamis, and White Glutinous. The Yellow Flint is only occasionally planted.

The production per hectare of these varieties depends upon many factors such as the season of planting, type of soil, methods of culture, and control of plant pests and diseases. Normally, the production ranges from six to nine cavans of shelled corn per hectare. It was observed that corn thrives pretty well where the soil is of limestone origin, in sandy loam to light clay loam, and in deep and well drained soils.

Guihulngan, La Libertad, Vallehermoso, Manjuyod, and Tanjay are the chief corn producing towns of the province.

Coconut.—Coconut is second to corn in area planted. It is one of the chief exports of the province. The crop is grown in almost every town and barrio along the coast. Some big plantations are found in the rolling and mountainous regions of the interior about five kilometers from the shore toward the western part of the province.

According to the census report of 1948 some 23,110 hectares were planted to coconut; there were 2,085,443 bearing trees, from which were gathered 2,770,268 nuts for food purposes, 68,408,954 nuts for copra making, and 182,833 nuts for oil manufacture. Smoked, sundried, and machine dried copra reached an output of 14,523,951 kilograms. Coconut oil and tuba are the secondary products of the coconut industry. Coconut oil output in 1948 was 17,965 liters while tuba was 3,375,551 liters. The coconut industry in 1948 gave a total revenue of 14,673,660 pesos to the province.

Tanjay, Ayuquitan, Guihulngan, and Tolong are the leading towns in copra production. Machine dried copra is produced in Tanjay, Ayuquitan, and Bais. Tuba is practically gathered in all towns of Negros Oriental, especially in towns along the coast.

Nut gathering is done once in every three months. According to local farmers an average of eight to nine nuts per tree is gathered each harvest from a stand of 10 to 15 years of age. All matured and some semi-matured nuts are included in the harvest.

Sugar cane.—Sugar is next to copra in importance as an export product. Sugar cane is intensively cultivated in Bais and in nearby towns. The sugar central in Bais mills all the sugar cane grown in this locality. Before the war the Central Azucarera de Bais had a milling capacity of 3,500 tons of cane in a 25-hour work period. This mill also operates plants for distilling alcohol and for the manufacture of cellulose and paper. Sugar cane which cannot be milled in this central are brought to San Carlos, Negros Occidental particularly those raised in Vallehermoso and Guihulngan. Several muscovado mills are found throughout the province.

In 1938 the total area planted to sugar cane was 6,145.42 hectares. Bais and Tanjay each had 2,088.81 and 2,037.20 hectares respectively. In 1948 Negros Oriental had a total area of 7,275.46 hectares planted to sugar cane producing 421,271.7 tons of cane valued at 9,898,179 pesos. The Bais sugar central produced 644,659 piculs of centrifugal sugar.

The culture of sugar cane is partly modernized in Bais, Tanjay, and Manjuyod in the eastern central section, and in Guihulngan and Vallehermoso in the northern section of the province. The sugar central which takes care of the milling of the sugar cane raised in this community encourages the farmers to use machinery for the breaking of the soil as well as fertilizer application such as ammonium sulfate, Warnerphos, or Leunaphos at the rate of 150 to 600 kilograms per hectare. The application of these fertilizers, however, depends upon the fertility of the soil and the financial capacity of the farmers. Organic fertilizers such as guano, farm manure, or rotted debris are also utilized to increase the fertility of the soil. Organic fertilizers have more lasting effects than inorganic ones because the former also improve the physical as well as biological conditions of the soil.

There is not much difference in the cultural management of this crop from that of other provinces growing sugar cane. The cane fields are plowed and harrowed two or three times. Immediately after, furrows of one meter apart are laid. Cuttings are then set at about 80 to 100 centimeters distance. About 60,000 to 80,000 seedlings are required per hectare. The first off-baring and weeding operation takes place when the seedlings are about a foot high. Hilling-up is done about two to three months after planting which is usually just after the application of fertilizer. Two or three months after hilling-up

another off-baring operation is done to be followed in turn by another hilling-up process. The interval between the last off-baring and last hilling-up for sugar cane plants is from one to two months. The last procedure just mentioned ends the weeding and cultivation of the cane plants. Harvesting takes place from the twelfth month to the fourteenth month after planting.

More fertilizer is usually applied to ration crops than to first plantings. In Bais, Tanjay, Guihulngan and Vallehermoso the production ranges from 80 to 120 piculs of sugar per hectare. In other places only about 40 to 60 piculs per hectare is obtained.

Seldom is any other crop ever rotated with sugar cane. This crop is planted in the same piece of land year after year. The variety P.O.J. 2878 do very well in poorly drained areas and is preferred to other varieties of sugar cane by farmers in the province.

Palay.—The staple food of the majority of the people of Negros Oriental, like the people of Cebu Province, is corn. Palay is, therefore, not as extensively cultivated as corn. Rice is usually grown by the Ilongos in Tolong and in Canlaon. Most of the inhabitants of these towns are immigrants from Panay and Negros Occidental.

The statistical report of 1948 shows that an aggregate area of 10,847.40 hectares was planted to this crop. Out of this hectarage first crop of lowland rice occupied 6,740.07 hectares; second crop, lowland rice, 1,115.64 hectares; and upland rice, 2,991.69 hectares. The production of this crop in 1948 was valued at ₱2,519,232. The leading towns in the production of palay are Tolong, Vallehermoso, Tanjay, Lazi in Siquijor Island and Ayungon.

The planting season for lowland rice depends largely upon rainfall. In Siaton and Tolong the rainy season begins as early as May and June. Regular planting in these places commences in June or July. On the other hand, in northern Negros Oriental like Guihulngan, Tanjay and Vallehermoso planting season starts in September or October. The variation of rainfall in different parts of the province accounts for early and medium late maturing varieties being planted in the north, and the medium late and late maturing varieties in the south. The standard varieties of rice cultivated in the province are Apostol, Elon-clon, Macan, Milagrosa, Ramelon, Raminad, Se-

raup-Ketchil and of late introduction the Wagwag. If proper soil management, water and fertilizer requirements are met, the Apostol and Wagwag varieties are claimed to be heavy yielders. For rain-fed areas of lowland rice Apostol is also recommended, and for areas with available and adequate supply of irrigation water Wagwag is recommended. The average yield of other lowland rice varieties under irrigation is only 35 cavans per hectare while Wagwag is claimed to yield from 70 to 90 cavans.

The land for upland rice culture is prepared earlier than that for lowland rice. Two plowings and harrowings are adequate to make the soil in fine tilth, unless the field is too weedy wherein three plowing and harrowings may be necessary. Broadcasting is the common method used by the farmers in planting palay. Cutsiam, Lubang Pula, Mangasa, Sinadyaya, and Magsanaya are among the official standard upland varieties found in this province aside from the native varieties. Upland culture requires more weeding than lowland rice culture.

Tobacco.—Tobacco is a secondary crop rotated with corn or upland rice. The northern section of the province raises most of the tobacco and only a very negligible quantity is produced in the southern part. Guihulngan produced the most tobacco in 1938 with 1,104.22 hectares devoted to this crop. This area is about 60 per cent of the total area of 1.833.27 hectares planted in the whole province with a corresponding yield of 724,822 kilos of leaf tobacco or 67.5 per cent of the provincial total production of 1,071,187 kilos. The total value produced by the whole province in 1938 was ₱72,899.00 of which more than 50 per cent or ₱43,493 was credited to the town of Guihulngan. In 1948 the province had about 1.990 hectares planted to tobacco producing a crop worth 465,650 pesos. The average yield of tobacco is 399 kilos per hectare. La Libertad. Vallehermoso, and Jimalalud are the other tobacco producing towns of the province. Lazi is the leading tobacco producing town in the island of Siguijor. A tobacco bodega of the Tabacalera and its purchasing agent is situated in Guihulngan.

Fiber crops.—The province, according to the census of 1939, devoted a total hectarage of 1,895.28 to abaca and realized a production of 1,211,067 kilograms of clean fiber valued at 72,105 pesos. In 1948, a total of 1,640 hectares was planted to abaca producing 1,148,000 kilos of fiber worth about 459,200 pesos. Luzuriaga, the leading abaca producing town of the province,



Figure 12. The coastal plains are planted to rice, corn, sugar cane and coconut.

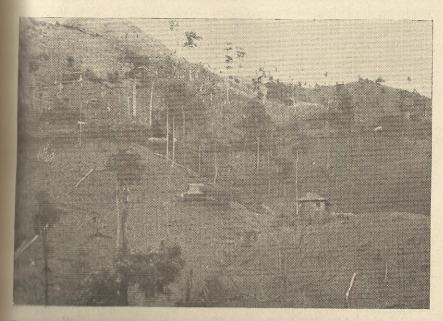


Figure 13. What was once a primary forest, and what is left of it when kaingin farmers came to stay. Upland rice and corn are planted on the steep mountain slopes.

in 1938 had an output of 788,834 kilograms which is about 65 per cent of the total production of the whole province.

Abaca plantations or stands of Negros Oriental are located in the higher elevations of from 600 to 1,500 feet above sea level where the climate is cool and the rainfall frequent. Generally the soil in these places is deep loam to sandy loam. The topography is rolling to mountainous, but the slope rises gradually so that erosion of the surface soil is hardly noticeable. Other than Luzuriaga, the towns that produce abaca are Tayasan, Manjuyod, Ayungon, and Sibulan. The produce of these towns, put together, is even less than that of Luzuriaga.

Other fiber crops grown are maguey, kapok, and cotton. The 1938–1939 crop of maguey occupied 228.59 hectares which produced 109,659 kilograms of marketable fiber valued at 3,970 pesos. Kapok and cotton are considered minor crops which are commonly used for pillow stuffings.

Root crops.—Several kinds of root crops are grown in the province, the most important ones being sweet potato, cassava, gabi and ubi. These crops are commonly or popularly known as substitute foods. In Negros Oriental, as in most parts of the country, in times of rice or corn crop failures, food shortage and the like, root crops serve as the staple food. During the Japanese occupation the production of root crops was intensified as the people depended more and more on these foods for subsistence.

Sweet potato occupies the largest area among root crops grown with Guihulngan, Tolong, Bais, and Lazi as the main producing localities. Cassava is mostly grown in the island of Siquijor, and in the towns of San Juan, Bais, and Tayasan; gabi in Guihulngan, La Libertad, Tayasan, Bais and Vallehermoso; and ubi in Tayasan, Guihulngan, La Libertad, Ayungon and Ayuquitan. Tugue is grown as a backyard or garden crop throughout the province.

In 1938 camote, cassava, gabi and ubi covered an estimated area of 3,130.86 hectares. The total production was 6,170,543 kilograms valued at 158,950 pesos. In 1948 the total area planted to these crops was 8,806.63 hectares producing 10,299,293 kilos valued at 954,156 pesos.

Legumes.—The important leguminous crops of Negros Oriental are mungo, peanut, and soybeans. In 1938, 661.81 hectares were planted to these legumes from which 193,297 kilograms worth 24,847 pesos were realized. After World War II the

area devoted to legumes was considerably expanded. The production in 1948 is shown below.

Crops	Area (Ha.)	$Production \ (kg.)$	Value (Pesos)
Heans	490.00	206,000	₱120,560
Mungo	404.89	62,823	46,206
Peanut	250.00	80,000	32,000
	1,144.89	348,823	₱198,766

Sitao, cowpeas, patani, batao, and the like are also grown in limited quantities.

Vegetables.—Vegetable growing in Negros Oriental is limited in extent. So far, only Vallehermoso and Ayungon produce eggplants and tomatoes in commercial scale. Other towns that supply the local market with vegetables are Guihulngan, Tayasan, and La Libertad for onions; Lazi for patola; Siaton and Zamboanguita for squash.

Ayungon leads all towns in the production of tomatoes. Out of 72,948 kilograms produced in 1938, some 31,702 kilograms were raised in Ayungon. Tayasan ranks first in cabbage production. The town produced 8,618 kilograms out of 15,777 kilograms total provincial production in 1938. Lazi in Siquijor Island seems to monopolize garlic production. Out of the provincial production of 3,572 kilograms, more than 95 per cent or 3,265 kilograms were raised in Lazi. This town also produced 25,106 out of 33,538 fruits of patola. La Libertad raised more ampalaya than any other town. Out of 14,816 fruits produced in the province, 9,372 fruits were contributed by La Libertad.

The leading vegetable crops of the province are malungay leaves, onions, tomatoes, yautia and eggplants. In 1948 the extent, production and value of these leading crops are as follows:

Crops	Area	Production	Value
Malungay	248,207 trees	1,116,912 kg.	₱245,632
Onion	294.22 ha.	190,112 kg.	62,297
Tomato	192.05 ha.	229,005 kg.	56,802
Yautia	126.86 ha.	363,105 kg.	54,468
Eggplant	321.40 ha.	189,290 kg.	36,600

Fruit trees and tree crops.—In 1938 only 365,306—peso worth of fruits grown in Negros Oriental was reported. Banana was

the leading fruit in terms of financial returns. The following are the five leading fruit and tree crops of the province:

Kind of tree	Number of trees	Production	Value
Banana	1,267,171	2,430,882 bunches	₱2.389.269
Jackfruit	68,725	649,452 fruits	246,593
Mango	20,806	4,095,303 fruits	
Papaya	99,216	2,096,198 fruits	
Chico	7,591	5,091,168 kg	123,710

Guihulngan leads in the production of bananas; Guihulngan and La Libertad in jackfruits; Manjuyod, mangoes; Tayasan, papayas; Guihulngan, kapok; Tayasan, cacao; Tayasan, Guihulngan and Luzuriaga, coffee; Guihulngan and Lazi, kalamansi; La Libertad and Guihulngan, oranges; Guihulngan and La Libertad, breadfruit; Siquijor and La Libertad, lanzones.

LIVESTOCK AND POULTRY INDUSTRY

The livestock industry of the province has been retarded considerably because of the war as shown by Table 5.

Table 5.—The number and value of Livestock and poultry for three different years in Negros Oriental

Kind of livestock	1	938	1945	1948		
	Number	Value	Number	Number	Value	
Carabaos Cattle Horses Hogs Goats Sheep Buffaloes Chicken Ducks Turkeys Geese Pigeons Guinea fowls Rabbits	50,669 59,564 12,780 204,022 32,114 3,400 245 749,791 4,219 347 229 10,373 191	P1, 359, 225 692, 982 178, 950 1, 209, 060 9, 536 27, 491 222, 109 2, 690 747 331 1, 754	18,220 6,290 4,490 48,500 4,440 610 237,460 1,890 230 450	26,450 17,870 6,040 122,410 12,840 1,700 666,290 3,670 280 480	P3,597,200 1,554,690 440,921 4,161,944 166,920 28,900 1,382,588 9,910 1,620 1,970	

Carabao is the principal work animal. Some carabao cows are milked for local consumption. In 1939 about 1,728 liters of milk were obtained from these farm animals.

FARM TENURE

The farm operators in the province are grouped into four, namely, owners, part-owners, managers, and tenants. Tenants may be share tenants, share-cash tenants, or cash tenants.

The number and percentage distribution of farm operators in Negros Oriental in 1938 and 1948 are as follows:

The second of th	19	38	1948		
Types of farm operators	Number	Per cent	Number	Per cent	
Owners	20,867	43.99 12.16	25,546 3,359	47.3 6.2	
hare tenants	20,665	43.56	19,146	35.40 0.10	
Share-cash tenants	39	0.08	49 5,814	0.10	
Farm managers	29	0.06	78	0.10	
Total	47,440	100.00	54,042	100.0	

The number and percentage distribution of farm areas according to farm tenure for 1938 and 1948 are as follows:

Types of farm operators	19	38	1948		
Types of farm operators	Area (Ha.)	Per cent	Area (Ha.)	Per cent	
wners fart owners_ inre tenants_ and tenants_ there cash tenants_ there tenants_	66,087.97 13,438.63 30,751.82 2,084.44 209.74	54.24 11.03 25.23 1.71 0.17	69,288.20 8,551.29 26,728.56 178.87 1,177.90 10,611.71	55.20 6.80 21.30 0.10 0.90 8.50	
arm managers	9,289.37	7.62	8,992.79	7.20	
Total	121,861.97	100.00	125,529.82	100.0	

The number of farms by size is as follows:

Area (Ha.)	193	38	1948		
Area (IIa.)	Number	Per cent	Number	Per cent	
0 to 0.99 1 to 4.99 5 to 9.99 10 to 19.99 20 and up	20,971 24,139 1,535 453 842	44.20 50.88 3.24 0.96 0.72	20,324 30,135 2,112 1,011 460	37.61 55.76 3.90 1.87 0.86	
Total	47,440	100.00	54,042	100.00	

Tenancy is commonly observed on short season annual crops such as lowland and upland rice, corn, legumes and root crops. The usual sharing system provides that two-thirds of the produce goes to the tenant if he owns the work animal and one-third goes to the landlord. On the other hand, if the landlord owns the work animals, the crop or crops are shared equally. In all cases the seeds are shared by both landlord and tenant but the operating expenses are all borne by the latter.

AGRICULTURE

The average size of farm cultivated by a tenant is very small. It is only 1.09 hectares.

Coconuts, abaca, sugar cane, and other perennial crops are usually administered by farm managers. Laborers, animals and machinery are either owned or hired by the farm owners. In some cases the farms provide quarters for laborers to induce farm hands to stay permanently on the farm.

FARM INVESTMENT

Based from the census of 1939, Negros Oriental had 35,852 pieces of plows, 5,058 pieces of harrows, 969 farm carts, and 2,577 sleds. These equipment were valued at ₱389,916. The work animals were mostly carabaos. In the same year, there were 40,386 work animals. The aforementioned figures, because of the destruction brought about by war, are greatly reduced as of this writing. Not recorded are the farm machinery, such as tractors, disc plows and harrows, and other mechanized farm equipment.

TYPES OF FARM

Farms have been classified by types in order to convey more accurately the degree of diversification existing in Philippine agriculture. The relationship of the area planted to a particular crop or group of crops to the total area of cultivated land in each farm constituted the usual basis for the classification by types of farm.

The twelve types of farm groups and the basis for the inclusion of farms in each group are as follows:

- 1. Palay farms—the area planted to lowland and/or upland palay was equal to 50 per cent or more of the area of cultivated land.
- 2. Corn farms—the area planted to corn was equal to 50 per cent or more of the area of cultivated land.
- 3. Abaca farms—50 per cent or more of the cultivated land was planted to abaca.
- 4. Sugar cane farms—the area planted to sugar cane was equal to 50 per cent or more of the area of cultivated land.
- 5. Coconut farms—50 per cent or more of the cultivated land was planted to coconuts.

- 6. Fruit farms—the calculated area planted to fruit trees was equal to 50 per cent or more of the area of cultivated land.
- 7. Tobacco farms—the area planted to tobacco was equal to 50 per cent or more of the area of cultivated land.
- 8. Palay-tobacco farms—the area planted to palay and tobacco were each equal to at least 25 per cent of the area of cultivated land.
- 9. Vegetable farms—the area planted to camote, mungo, soybean, tomato, sitao, cowpeas, patani, beans, kadios, onion, radish, eggplant, cabbage, gabi, watermelon and/or potatoes was equal to 50 per cent or more of the area of the cultivated land.
- 10. Livestock farms—having (1) an area of 10 hectares or more, (2) more than 10 heads of cattle, horses, goats and sheep, and (3) less than 20 percent of the total farm area used for the production of crops, fruits or nuts.
- 11. Poultry farms—there were more than 300 chicken or 200 ducks and less than 2 hectares cultivated of the entire area.
- 12. Other farms—could not be classified under any of the above eleven groups.

Table 6 shows the area of cultivated land by type of farm and by tenure of farm operator in Negros Oriental.

of Farm Operator in Negros Oriental. Tenure TABLE 6.—Area of Cultivated Land by Type of Farm and by

	Others	6,824.45 613.50 2,251.80 11.57 379.00 529.15 524.67	11,134.14
	Poultry		
	Live- stock	9.00	9.00
	Root	197.18 7.82 44.24 0.22 20.39 19.32	289.17
Ha.)	Vege-	16.18 1.95 2.87 0.40 1.24	22.64
by Type (Tobacco	54.14 0.46 12.76 1.20 4.44	73.00
Area of cultivated Land by Type (Ha.)	Fruit	75.67 7.11 5.14 7.78 2.86 0.27	98.83
	Coconut	8,539.64 1,268.98 1,102.56 1,102.56 1,750.18 2,025.43	14,725.78
A	Sugar	3,327,59 760,40 501,10 34,25 271,43 273,89 2,344,96	7,513.62
	Abaca	308.11 31.28 95.82 22.23	457.44
	Corn	18, 629, 93 3, 731, 27 16, 850, 65 50, 64 50, 69 4, 653, 90 369, 98	44,337.06
	Palay	2,897.20 470.96 1,000.40 30.66 2.40 1,061.54 307.14	5,770.30
Total Area of cultivated Land (Ha.)		40,870.09 6,893.73 21,876.34 146.53 731.50 8,316.58 5,596.21	84,430.98
Tenure of farm operator		Full owners. Part owners. Share tenants. Cash tenants. Other tenants.	Total

Bureau Agriculture. of

SOIL SURVEY METHODS AND DEFINITIONS

Soil survey is an institution devoted to the study of the soil in its natural habitat. It consists primarily of (1) the determination of the morphological characteristics of soils, (2) grouping and classifying them into individual units according to their characteristics, (3) their delineation on the map, and (4) the description of their characteristics in reference to the growth of plants and their relationship to agriculture and other activities of man.

The soils, their landscapes and underlying formations are examined systematically in as many locations as possible. Borings with the soil auger are made, test pits are dug, and exposures such as those found in road and railroad cuts are studied. Each excavation, road or railroad cut exposes a series of layers or horizons called collectively the soil profile. These horizons of the profile as well as the parent material beneath this profile are studied in detail and the color, structure, porosty, consistency, texture, and content of organic matter, roots, gravels, and stones are noted carefully. The reaction of the soil and its contents of lime and salts are determined by simple tests. The drainage, both external and internal, and many other external features, such as relief of the land, climate, and natural and artificial cultures, are taken into consideration, and the relationship of the soil and the vegetation and other environmental features are studied.

On the basis of both the external and internal characteristics, the soils are grouped into classification units, of which the two principal ones are (1) soil series and (2) soil type. A phase (3) of a soil type is defined on the basis of soil characteristics that are of importance in land-use. When two or more of these principal mapping units are in such intimate or mixed pattern that they cannot be clearly shown on a soil map, they are mapped or grouped into a (4) complex. Areas that have no true soil, such as river beds, coastal beaches, or bare rocky mountainsides are called (5) miscellaneous land types. Areas that are inaccessible like mountains and great forest lands, and whose classification is of no agricultural importance for the present, are classified as 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 soils having essentially the same general color, structure, consistency, range of relief, natural drainage condition and other important external and internal characteristics. In the establishment of a series, a geographic name is selected, usually that of the locality where the soil was first identified. For example, the Zamboanguita series was first found and classified in the vicinity of Zamboanguita.

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, silt loam, silty clay loam, clay loam or clay is added to the series name to give the complete name of the soil. For example, Zamboanguita clay loam is a soil type of the Zamboanguita 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 unit of mapping. Because of 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 in phases. A minor difference in relief may cause a change in agricultural operation or in the kind of machinery to be used. The phase of a type with a slight degree of accelerated erosion may present different fertilizer requirements and other cultural management practices that are different from those of the real 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 soil is usually segregated on the map, if the area can be delineated.

A soil complex is a soil association composed of such intimate mixtures of series, types, or phases that cannot be indicated separately on a map. This is mapped as a unit and is called a complex. If in an area there are several series such as San Manuel, Taal and others that are mixed together, the two dominant series must bear the name of the complex, as San Manuel-Taal complex. If there is only one dominant constituent, that series or type bears the name of the complex as Taal complex or San Manuel complex.

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

The soil survey party, usually composed of two or three 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 telegraph lines, barrios, towns, cities, rivers and lakes, prominent mountains, and many others.

THE SOILS OF NEGROS ORIENTAL

Soil is a mixture of rock fragments, organic matter, water, and air in greatly varying proportion which has layers developed through the action of climate and living organisms. In two reneral groups, it may include soils developed in place like those we see as uplands or hills and mountains, or those previously existing soils that have been washed down and deposited in place like the plains. The former soil is said to be residual or primary soils; the latter is transported or secondary soils.

Table 7.—Showing soil types, area, relative extent and crops grown in Negros Oriental

Soil types	Area ¹ (Ha.)	Per cent	Crops grown
San Manuel fine sandy loam	4,370	.82	Corn, coconut— vegetables, tobacco, fruit trees.
San Manuel loam	5,380	1.02	Sugar cane, corn, coconut, vegetables, tobacco, fruit trees.
an Manuel— Taal complex	4,460	.84	Sugar cane, corn, coconut, vegetables, tobacco, fruit trees.
Slaton sandy loam	4,600	.86	Coconut, corn, fruit trees, vegeta-
Mandawe clay	1,030	.20	Lowland rice, corn, coconut, sugar
Isabela caly	13,110	2.47	Sugar cane, corn, rice.
Dauin sandy loam	80	.02	Coconut, vegetables.
Dauin clay	800	.15	Lowland rice.
Datuan clay	5,500	1.04	Corn, coconut.
Faraon clay	22.880	4.32	Corn, coconut, fruit trees.
Inlinao clay	18,740	3.52	Corn, coconut, fruit trees.
Ligo clay	8,080	1.52	Corn, coconut, fruit trees.
Tupi fine sandy loam	4,300	.81	Abaca, coconut, corn, fruit trees, coffee.
Tupi silt loam	26,340	4.97	Cacao, abaca, coconut, corn, fruit trees, coffee.
Taal sandy loam	10,440	1.97	Cacao, abaca, coconut, corn, fruit trees, coffee.
Guimbalaon gravelly loam	3,180	.60	Pasture
Guimbalaon gravelly loam	4,060	.77	Sugar cane, corn, rice.
Zamboanguita clay loam	14.060	2.66	Pasture.
Bolinao clay, steep phase	4,490	.84	Orchard, pasture.
Faraon clay, steep phase	63,730	11.95	Orchard, pasture.
La Castellana clay loam, steep	20,080	3.79	Orchard, pasture.
phise.			
Bydrosol	4,650	.88	Fish pond, woodland,
Heach sand	2,020	.38	Coconut, wildlife.
Biverwagh	400	.07	Wildlife.
Biverwash Rough mountainous land	284,860	53,53	Forest.
Total	531,640	100,00%	

¹ Area determined by use of planimeter. No deduction was made for bodies of water like rivers.

^{005888 4}

The original source of soil is the rock which has undergone decay or weathering through the ages. Since there are many kinds of rocks and different sets of climatic conditions, it follows that different kinds of soils will result. Even similar rocks weathered under different sets of conditions will produce different soils. This is the reason why there are many kinds of soils in Negros Oriental. To study many and different kinds of soils individually will be very difficult. So they are systematically classified into units called series and types. The soil series is an area of soil produced having similar relief, drainage, parent material, and soil profile characteristics. Some soils. like beach sand for example, are merely an accumulation of sand without having developed layers in the profile. Strictly speaking, they are therefore not soils, and as such are classified under miscellaneous land types. The soils of Negros Oriental are subdivided categorically into four groups, namely, soils of the lowland (secondary soils); soils of the uplands; soils of the steep uplands (all primary soils); and, the miscellaneous land types.

The different soil types identified in the province are as follows:

	Soil type
1. Lowland soils	Hamber
a. San Manuel fine sandy loam	95
b. San Manuel loam	190
c. San Manuel-Taal complex	414
d. Mandawe clay	240
e. Dauin sandy loam	416
f. Dauin clay	415
g. Siaton sandy loam	417
h. Isabela clay	256
2. Rolling upland soils	
a. Faraon clay	132
b. Bolinao clay	153
c. Lugo clay	156
d. Batuan clay	214
e. Tupi fine sandy loam	270 /
f. Tupi silt loam	271
g. Taal sandy loam	56
h. Guimbalaon gravelly loam	267
i. La Castellana clay	305
j. Zamboanguita clay loam	418
3. Steep upland soils	
a. Bolinao clay, steep phase	154
b. Faraon clay, steep phase	155
c. La Castellana clay loam, steep phase	708

Miscellaneous land types	
a. Hydrosol	1
b. Beach sand	118
c. Rough mountainous land	202
d. Riverwash	152

SOILS OF THE LOWLAND

The soils of the lowlands are all characterized as having level or nearly level relief and developed from transported materials washed down by rainfall and later deposited by water. It is to be expected therefore that in these soils one or several creeks or rivers traverse the soil type.

SAN MANUEL SERIES

San Manuel series represents soils of alluvial formation and as such they are mostly along courses of rivers. The series has a level topography like those of Isabela and Mandawe. But unlike Isabela and Mandawe, San Manuel soil has better drainage condition. The different soil materials deposited during its formation consist of loose and friable loam, silt loam and sandy loam which are brown to light brown in color. Neither stone nor rock is present. The soils in the different layers of the profile are non-calcareous and usually slightly to moderately acidic.

Native vegetation consists of some bamboo groves, talahib, and tambo along the banks of the creeks and rivers. The greater part of this soil has been cultivated to crops of various kinds.

San Manuel soils have deep water table. Depending upon the location, dug wells have water at depths from 2 to 4 meters from the surface. The water table also varies with the season, usually going down during the dry season.

There are two soil types identified in this province, namely, the sandy loam and loam. San Manuel fine sandy loam has a profile with the following characteristics:

San Manuel fine sandy loam

Depth em.	Characteristics .
0-25	Surface soil, fine sandy loam, brown to pale brown when wet,
	grayish brown when dry, strongly friable with a good, fine
	granular structure. Seldom cracks or hardens upon drying.
	Non-calcareous, with good root penetration and a pH of 5.5. It is fairly rich in organic matter.
B5=70	Subsoil, brownish gray when dry but light brown when wet;

silt loam, with strongly friable consistency and with an

excellent granular structure. The surface soil is separated from this layer by a smooth and gradual boundary. There is no stone or boulder present.

70-150 Yellowish brown, to light brown, fine

Yellowish brown, to light brown, fine sandy loam with strongly friable consistency and fine granular structure. Non-calcareous, no stone or boulder present. The boundary line separating this layer from the subsoil is smooth and gradual.

San Manuel fine sandy loam (95).—This soil type is found chiefly along the course of rivers such as the Bayawan River in Tolong. Drainage in general is good to almost excessive. The loose consistency of the soil in the different layers in the profile helps promote drainage. Areas of this soil type devoted to lowland rice, however, eventually become poorly drained internally due to constant puddling and wetting which clog up most of the pore spaces in the underlying layers. The soil is always being inundated by flood. In some places the soil becomes enriched due to deposition of whatever substances has been washed from the uplands. At times, however, the land becomes useless when the river changes its course and leaves a path of gravels, sand, and stones along its course.

The surface soil usually has a depth of from 25 to 35 centimeters and consists of fine sand to sandy loam. The latter usually predominates along the course of the creeks and rivers. This layer is friable and loose and can be plowed or harrowed at any time of the year. The soil color varies from dark gray to light brown. Under lowland rice culture the soil is gray but is brown under upland farming.

Lowland rice is widely grown in this soil type in Tolong. The varieties Lubang Pula, Elon-elon, and Raminad are planted. Lubang Pula can give a yield of up to 40 cavans per hectare. This is planted in May or June and harvested in October. Elon-elon and Raminad varieties give higher yield than the Lubang Pula. Most farmers, however, plant Lubang Pula because of water shortage. Lubang Pula is an earlier maturing rice than the other two varieties. The rice fields depend only upon rainfall as the source of water since there is no irrigation water for this purpose. After the rice harvest the field is usually fallowed until the next planting season. Some farmers plant corn in small sections of their fields. It will be far better to plant some legumes like mungo and beans instead.

Coconuts and bananas, are also grown but they are limited mostly along the coast and around dwellings where drainage condition is good. These are but minor crops in this soil type. San Manuel loam (190).—This soil type is found also along courses of most rivers, both in the southern and eastern sides of the province. It represents only a very narrow strip along the rivers or creeks and altogether covers 5,380 hectares.

The surface soil ranges from 30 to 40 centimeters in thickness and is fine granular with mellow or friable consistency. Soils close to the river banks are coarser in texture than those bordering the outer boundaries. The dashing down of finer soils from the upland accounts for the difference in texture. Soil color for this type is brown to light brown at the outer areas as a result of soil mixture from other types.

Drainage condition is fair to good. Internal drainage is somehow slow. This characteristic makes it a good soil for lowland rice. There is no stone or boulder to cause interference in any field operation.

The soil has a pH of from 5.0 to 6.0. This reaction is good for corn and sugar cane and to a little extent for rice. Rice needs more acidic reaction than corn or sugar cane. Coconut, however, is the most important crop in this soil type. Both small planters and regular big plantations of coconuts are found. Coconut in this type gives as much as 60 nuts a year per tree.

Corn is grown where coconut is not planted. Corn planted during the rainy season is not as productive as those planted during dry periods of the year. Aside from the adverse climatic effect on the yield, corn borer which is more destructive during the rainy season is further responsible for the low production. Generally the yield amounts from 7 to 12 cavans per hectare during the flood or rainy months, while an average yield of 15 cavans per hectare is obtained during the dry months.

San Manuel-Taal complex (414).—This soil unit is found in the vicinity of Dumaguete. It consists of two soil series, San Manuel and Taal which are found in small areas and quite close to each other making their separation impractical. Draining some sections in this area exposed an old mangrove soil which is characterized by the presence of a gleyed layer underneath the surface. Most likely this former hydrosol was covered by sand and silt that were washed down from the adjoining upland.

San Manuel-Taal complex is extensively cultivated to coconut, vegetables and a large portion is covered by the townsite. The soil is mostly sandy with good drainage. This is specially true to both San Manuel and Taal soils.

Taal soil is found in the interior part and is generally characterized by the presence of large boulders on the surface of the ground. These boulders are hazards to cultivation. For this reason, it is better that this kind of soils be used for permanent crops like fruit trees. San Manuel soils will be good for vegetables specially because they are near the city. The growth of corn is very poor, an indication that too much leaching of plant nutrients had taken place. In this case, therefore, incorporation of animal manure with the soil and liberal application of fertilizer are needed to produce good crops.

MANDAWE SERIES

The low and level alluvial plains found in the northeastern part of the mainland as well as those small portions in Siguijor Island are classified under Mandawe series. Unlike the Isabela series. Mandawe has yellowish brown surface soil. This series occupies but very small areas fringing from the sides of hills and mountains. Internal drainage is very poor due to the fact that all the horizons in the profile of this series are of the fine textured soils. This makes this series different from San Manuel series which has a sandy loam substratum. There is no stone or boulder on the surface. Some portions, however, in this series have been covered by eroded materials coming from the adjoining uplands. Where the materials deposited were fine there is likelihood that the soil improved in fertility but where the deposits were of inert materials like rocks and gravels, the land has become useless. Generally, the upland areas bordering this series belongs to Faraon series and due to erosion, the soil on this plain is slightly alkaline in reaction.

Mandawe series is represented by the clay type only, which has a profile of the following characteristics:

Mandawe clay

Characteristics

Depth em.	
0-20	Surface layer, light brown to dark brown clay; good coarse blocky structure; moderately friable when wet, hard when dry. Moderate amount of organic matter. Non-calcareous, slightly to moderately alkaline. No stone of any kind on surface or within layer.
20-50	Subsoil, dark brown to dark grayish brown clay loam; good coarse blocky structure; slightly compact when wet, very hard when dry. Poor in organic matter; non-calcareous;

pH of 7.96. Separated from the surface layer by a wavy and diffused boundary.

Yellowish brown clay loam; moderately coarse columnar structure; hard and compact when dry, slightly compact and soft when wet. Non-calcareous; pH of 7.84. No coarse skeleton present in this layer. Separated from the overlying layer by a wavy and diffused boundary.

Yellowish brown with mottlings of brown to dark brown, clay loam; medium, coarse granular in structure; hard and compact when dry, slightly compact and soft when wet. Non-calcareous and free from any coarse skeleton. This layer has a pH of 7.84. Separating this layer from the overlying layer is a wavy and diffused boundary. Sometimes it is very much deeper than 150 centimeters, in which case pebbles of riverwash origin may be found.

Mandawe clay (240).—This soil type is found in several small areas in Guihulngan and Vallehermoso in the mainland and in Lazi in Siquijor Island. Altogether this type has an area of 1,030 hectares. Mandawe clay is of recent alluvial deposit whose materials consist mostly of clay loam to clay. For this reason, internal drainage in this soil is poor. Since this soil type has a level topography, it makes external drainage rather difficult. Some farmers utilize this soil type for lowland rice fields.

The surface soil is yellowish brown to gray depending upon drainage condition. Where it is under lowland rice field the soil is gray, but under upland condition, the soil is yellowish brown. The surface layer ranges from 15 to 20 centimeters deep and is slightly plastic and sticky when wet. Under optimum moisture condition, the soil is of granular structure and can easily be plowed. There is not stone or boulder in this layer that may cause interference in tillage operations. Fine gravels of lime carbonates may be seen which are the result of erosion from the uplands.

The subsoil is of clayey texture, dark gray and also plastic and sticky like the surface. The difference between the two layers lies only in color. The subsoil is darker gray. When the soil is well drained, the subsoil is grayish brown and is plastic in consistency.

The soil type in Siquijor Island is used solely for lowland rice. There is no irrigation system and the farmers all depend upon the rainfall. The lack of sufficient water compels the farmer to plant early maturing rice like Apostol and Katorsa pula and puti. These varieties usually give about 35 cavans

to the hectare. Apostol is also being planted in a farm between Guihulngan and Vallehermoso and a yield of 45 cavans per hectare has been estimated. Upland crops grown in this soil type are corn, coconut, bananas, and different kinds of vegetables.

DAUIN SERIES

Dauin soil is but a small soil formation found in the south eastern end of the mainland. It is a low level alluvial deposit over a once marshland. Naturally it can be expected that drainage condition is rather poor. This alluvium which is water laid must have originated from the upland areas. It consists of black or dark gray clay laid over a meter in thickness. Below this alluvium is partially decayed organic matter which may be presumed to be a marsh before.

There is no stone or any other rock found in this series. In the same manner native vegetation has been entirely removed. Mangroves and nipa palms may be found at the extreme borders of the area but these are not the true plant cover of this series.

The water table is about a meter or less in depth from the surface. Although roots of plants can extend through the solum, seldom are they found in such depth because of the shallow water table.

This series has a profile with the following characteristics, as represented by the clay type:

an repr	
	Dauin clay
Depth em.	Characteristics
0-40	Surface soil, clay, black, poor, coarse granular, sticky and plastic when wet, hard and slightly compact when dry, non-calcareous, with no coarse skeleton present. It is fairly rich in organic matter.
40-70	Subsoil clay to clay loam, bluish black to dark grayish black poor coarse granular structure; soft, sticky and plastic when wet, hard when dry; non-calcareous; no coarse skeleton present. This layer is separated from the surface soil by a diffused and smooth boundary.
70–150	Substratum, clay, dark gray, soft when wet, might be friable when dry due to presence of great mixture of partly decayed plant tissues. There is no stone or gravel in this layer, and is separated from the subsoil by a smooth and

diffused boundary.

Dauin clay (415).—This soil type is found in two small patches with a total area of 800 hectares in Malway, a barrio north of Zamboanguita and in another area west of the town. The area is not very extensive and is used for lowland rice. The land is a level alluvial plain with poor drainage condition

The surface soil to a depth of from 30 to 40 centimeters is black clay. This color may become lighter upon drying. It is very sticky, soft, and plastic when wet and will tend to become hard upon drying. Although this soil is fairly rich in organic matter green manuring will enrich it farther and at the same time improve its physical condition. This will make it possible to farm this soil after the rice harvest for some crops like mungo and kadios. The improvement of the physical condition of the soil is not much for the lowland rice since lowland rice field is prepared when wet but rather for the dry season crop to follow after the rice. The rice grown are usually of the varieties falling under the group of Macan or late maturing rice. Some farmers plant Lubang Pula rice which can be harvested in October or early November. Lubang Pula gives a yield of from 30 to 50 cavans per hectare. Ordinarily this soil is not immediately utilized again after the rice harvest. In places where the drainage condition is slightly better, corn is planted only during the dry part of the year.

Davin sandy loam (416).—This soil type is found between Dumaguete and Bacong. It consists of small level land along the coast and has an approximately 80 hectares. Drainage condition is also poor and the water table is barely half a meter from the surface. Rocks as outcrops or under the surface are not present. The land has been extensively used for lowland rice and practically all forms of native vegetation have been removed.

The surface soil has a depth of 25 centimeters, which is dark gray, to almost black sandy loam. It is very loose either when wet or dry and is structureless. It is poor in organic matter content and the soil looks apparently poor. This soil could improve considerably if green manuring could be done. The subsoil to a depth of 60 centimeters is clay loam to almost clay. It is also as dark as the surface soil with indications of being bluish indicating poor drainage. There is no stone or gravel in this layer, and the boundary separating it from the surface is smooth and diffused. Water table is within this layer. The water table may go farther down during the dry

44

season. The layer below the subsoil is clay that is grayish black. Like in the other type of this series, partially decayed vegetable tissues are found below the 60-centimeter depth.

Dauin sandy loam is used for lowland rice. The growth of the rice indicate impoverished soil condition as shown by the fact that an average of 30 cavans only can be produced from such kind of soil. Coconuts are also grown and some corn during the dry part of the year.

SIATON SERIES

Siaton is one of the classes of alluvial soils in the province whose materials originated from the surrounding uplands. This series occupies but a narrow coastal area from Siaton to Sta. Catalina. Being deposited close to their place of origin. these soil materials cover only a relatively narrow strip with undulating slopes. It is slightly elevated inland and also forms high bluff from the shore lines. The land is not really flat like other plains of the Mandawe and San Manuel series but similar to the Taal. The surface soil is of medium texture. brown, good, medium to coarse granular and very friable. The subsoil is brown, clay loam to sandy clay that is slightly compact and sticky. The substratum, with a depth of about one meter, is sandy loam to sandy clay, structureless, slightly sticky, brown to light brown. In general appearance, this series may look like San Manuel. However, San Manuel soil horizons are loose and friable. The substratum especially is loose and sandy. The Siaton series, on the other hand, has sticky, slightly compact soils in all its layers. Their topography also differ. The Palo series is almost similar to the Siaton series except that the former has very poor drainage compared to the good drainage existing in the Siaton. Siaton soil is also different from the Umingan in topography and in the absence of stones in the profile. Siaton soil has no coarse skeleton whatsoever in any of the layers in its profile.

Siaton sandy loam is the only soil type under this series and has a typical profile as follows:

Siaton sandy loam

Characteristics

Depth cm. 0-30

Surface soil, sandy loam, brown to dark grayish brown and brownish black; good, medium to coarse granular structure:

very friable; fairly rich in organic matter; non-calcareous; and free from any rock outcrops or coarse skeleton.

Subsoil, sandy clay, light brown to grayish brown; poor coarse granular structure; slightly sticky to slightly compact; non-calcareous; poor in organic matter; no coarse skeleton present; boundary separating this layer from the surface layer is smooth and diffused.

Sandy loam, clay loam, light brown; slightly sticky and plastic; poor coarse granular structure; non-calcareous, with some weathered fragments of dark brown rocks, and separated from above layer by a smooth and diffused boundary.

Sandy clay loam to sandy loam; grayish brown to light brown; structureless, loose to slightly compact; no coarse skeleton; separated from the above layer by an abrupt but smooth boundary.

Siaton sandy loam (417).—This soil type is found along the coastal regions of the province from Siaton to Sta. Catalina and covers an area of 4,600 hectares. Siaton sandy loam has a nearly flat topography with the land being slightly higher in elevation along the edge of the bordering mountains than those close to the shore. The soil is well drained. External drainage is slightly faster than internal drainage. In places like lowland rice fields where the water is intentionally impounded, water remains longer for sometime before it can percolate completely.

The surface soil is from 20 to 35 centimeters in thickness, and consists of very friable and loose sandy loam, to silt loam. The greater part of this type is sandy loam, found in Dumanod and Telaptap. Reaching to a fair depth of 30 centimeters, the surface layer of the silt loam type is dark brown with rather good granular structure. There is no stone or rock outcrop in the surface layer and this condition makes the preparation of the land easier. This layer has a pH of 5.12.

The subsoil is of finer texture than the surface and usually lighter in color. There is no stone or any kind of rock in this layer. The lower horizon of the subsoil is sandy clay loam or a transition between the subsoil and the substratum. This transition horizon is slightly friable but tends to become plastic when wet. The substratum is sandy loam to sandy clay loam. It is structureless and is lighter in color than any layer in the profile.

Siaton sandy loam is grown extensively to corn, lowland rice, coconut, and banana. Corn fairly grows well when planted in

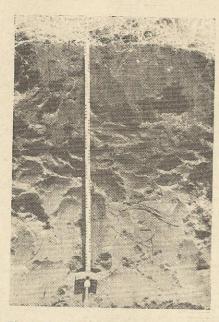


Figure 14. Profile of Siaton sandy loam.

The surface layer is much darker than the underlying layers.



Figure 15. Coconut is one of the leading crops grown on Siaton sandy loam. It thrives well on this soil type.

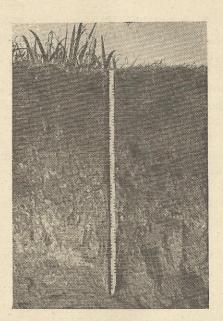


Figure 16. Profile of Isabela clay. The surface soil is characteristically black.

Note the fine texture of the soil in each of the different layers.



Figure 17. Sugar cane is the principal crop grown on Isabela clay in Negros
Oriental. Installation of a good drainage system is necessary for this crop on
this soil type.

May but a much better yield can be obtained if planted towards the approach of the dry period. An average of 10 cavans of corn can be realized from a hectare. The supply of irrigation water is a problem in rice culture. Irrigation water depends mostly upon rainfall and for this reason only early maturing rice varieties like Apostol and Lubang Pula are planted. Some fields close to creeks can be irrigated and the late maturing varieties such as Elon-elon and Wagwag are grown. A good growth of Apostol or Lubang Pula which is planted in June and harvested in the later part of October can produce up to 40 cavans per hectare. There are times, however, when rainfall is low and the yield of rice crop correspondingly decreases. After the harvest of lowland rice the fields are left idle.

SOIL SURVEY OF NEGROS ORIENTAL PROVINCE

Coconuts and bananas are some of the permanent crops planted. Being close to the sea, coconuts are fairly productive and vigorous. An average of 30 nuts can be obtained from a single tree every harvest. There are no regular banana plantations. Bananas are usually planted between rows of coconuts, as boundaries of fields and borders of other crops.

ISABELA SERIES

This series was first described and mapped in Negros Occidental. It is also found in Negros Oriental. Isabela soil is a product of alluvial deposition occuring on low level plains fringing the eastern sides of the mountain ranges. These plains are narrow and extensively used for sugar cane. The deep black clay soil laid over a yellowish brown clay is the principal characteristic of this series. This alluvial deposit is from 3 to 4 meters deep. Another characteristic of this series is the total absence of rocks or boulders as outcrops. These qualities make this soil highly desirable for farming. Being of fine clay, however, the drawback to this soil is its poor drainage. Both the internal and external forms are poor. Sugar cane fields have to resort to the use of drainage ditches to help drain the water. This series has a profile characteristic as follows:

em.	Characteristics								
0-30	Surface	soil,	grayish	black	to	black,	clay,	with	goo

Surface soil, grayish black to black, clay, with good, coarse granular structure, very sticky and strongly plastic when wet, moderately friable when dry, with fairly rich organic matter content, and no rock outcrops or coarse skeleton of any sort. Plant roots penetrate this layer. Non-calcareous, with a pH of 6.5.

- Subsoil, clay, grayish black to bluish black when wet, light grayish black when dry. Good coarse granular structure, strongly sticky and plastic when wet, hard to slightly compact when dry, non-calcareous, no coarse skeleton, with a pH of 7.0. This layer is separated from the surface soil by a wavy and diffused boundary.
- 10-100 Yellowish gray to yellowish brown clay when wet, light brown to yellowish brown when dry, with a good, coarse granular structure, strongly sticky when wet, but friable when dry, no coarse skeleton, non-calcareous, with a pH of 7.0. This layer is separated from the subsoil by a wavy and clear boundary.
- Substratum, yellowish brown clay to silty clay, massive, strongly sticky and plastic to slightly compact when wet.

 No coarse skeleton present, non-calcareous and has neutral reaction. This is separated from the upper layer by a wavy but diffused boundary.

Isabela clay (256).—This is one of the important soil types in this province. The soil occurs on small level coastal plains fringing from the inner mountain sides of the eastern side of the province. It has a wide formation around the District of Itals and is extensively used for sugar cane. This soil type has an aggregate area of 13,110 hectares. The plain is practically level except for the inner areas bordering the hills and mountains having slightly higher elevation. Some lower portions that collect water are grown to lowland rice instead of sugar cane.

The surface soil to a depth of from 30 to 50 centimeters is characteristically black. If used for upland crops when the soil is dry, it has a medium to coarse granular structure which appears powdery and loose. Seldom does it crack or shrink considerably unless used for lowland rice. When wet it is sticky and plastic like any other clay. It should not be worked when wet, otherwise the soil will puddle and harden upon drying and consequently lose its fine granular structure. It is friable and soft only when sufficiently moist. The surface soil has a reaction of from pH 6 to 7. It is very slightly acidic to almost neutral. This reaction is very favorable to sugar cane. Lowland rice, on the other hand, requires a pH of 5.5 to 6.1 for best growth. This reaction can be attained by the constant application of ammonium sulfate to the rice fields. This fer-

tilizer does not only supply nitrogen but also increases the acidity of the soil.

The subsoil is grayish black and at times bluish black and reaches a depth of one meter below the surface. The bluish black soil simply shows its lack of aeration. A well drained Isabela clay has almost a black subsoil. This layer is also of heavy clay. There is no stone or any sort of coarse skeleton in this layer. The soft clay permits easy root penetration through this horizon. The demarcation line separating the surface from the subsoil is highly diffused making it hard to separate one from the other. The only difference may lie in their consistency, wherein the subsoil is harder and slightly more compact.

The substratum is also clayey and at times silty clay. The principal characteristic of this layer is its yellowish brown soil. It is soft, plastic and sticky when wet but becomes friable when dry. There is a well marked demarcation between this layer and the subsoil on account of their contrasting colors. The substratum has no gravel or stone in it, and consists entirely of uniform layer of alluvial soil.

Isabela soil around the District of Bais is extensively used for sugar cane. The P.O.J. 2878 is the important variety used, and when fertilized with ammonium sulfate gives an average yield of 130 piculs per hectare. Yield as high as 200 piculs per hectare is common. Usually the ratooned canes give better production than newly planted canes by 5 piculs per hectare average.

Lowland rice is also planted near Bais using such varieties as Tigiglo and Elon-elon which are planted in July or August and harvested in January. Sometimes insufficiency of water delays planting up to September. Late transplanting tends to decrease the rate of production to a range of from 20 to 50 cavans per hectare.

Corn and coconut form the important crops in this soil type found in places outside of and far from Bais. Corn of the white variety known as "Visaya" is grown, giving an average yield of 20 cavans per hectare. Coconuts are not planted in regular plantation but usually in areas surrounding the corn fields and on places bordering the sea.

ROLLING UPLAND SOILS

Soils under this category have been previously termed as primary soils or soils developed in place. There are two general

groups based on the kind of the parent rocks, namely, sedimentary like the Faraon, Bolinao, and Lugo; and volcanic like the Tupi, Taal, Guimbalaon, La Castellana, and Zamboanguita.

FARAON SERIES

Faraon soils are derived from the decomposition of coralline limestone. This soil series is found on the hilly areas from Vallehermoso to as far as Dumaguete, and also from Siaton to as as far the boundary between Tolong and Cauayan. It is also found in the interior mountains along the boundary between Kabankalan and Ayungon. This series includes soils with rolling topography to hilly areas. External drainage is good under forest but becomes excessive in the open fields. Internal drainage is fair.

Soils under the Faraon series are black and usually clayey. When the land is highly eroded, the coral rocks become exposed showing a rocky appearance. In extreme cases of soil erosion, the land cannot be plowed because of the rocks. The limestone rocks in Faraon are comparatively soft, roughly angular and often times colored. This series is different from the Sibul or Binañgonan series in that the limestone rocks in the latter soils are hard, massive and white.

The Faraon series in the northern part of Oriental Negros is barren; its native vegetation has been completely replaced by cultivated crops. This soil in Tolong is still under forest where most hardwoods such as the molave type of forest are found. In some places, cleared lands that have been rendered unfit for cultivation were abandoned, and cogon grass sprang out. Faraon soil has a profile with the following characteristics:

Faraon clay

Depth em.	
0-30	Surface soil, black clay; medium granular structure; soft and
	very strongly plastic when wet, slightly hard and brittle
	when dry. Fair in organic matter. Sometimes limestone
	rocks are found on the surface. An abrupt and irregular
	boundary separates surface soil and subsoil.
86 48	g 1 - 1 1 - 1

30-45 Subsoil, dark yellowish gray; like the surface soil, very plastic when wet but hard when dry; moderate fine granular structure. Mixed in this layer are partially weathered limestone rocks. This layer is separated from underlying layer by a clear and smooth boundary.

005888==-5



Figure 18. Profile of Faraon clay. Note the shallow black surface layer above the coralline limestone.



Figure 19. Landscape of Faraon clay, steep phase. Steep slopes of this soil type, which should never be under cultivation, are planted to corn thereby promoting erosion.

45-60 Yellowish gray highly weathered limestone rocks; soft and weak; coarse granular structure.

Faraon clay (132).—This soil type is found in Canlaon, Guibulngan, in the interior of Sta. Catalina and Manjuyod. It has a total area of 22,880 hectares. The landscape has a rolling to indulating topography with slopes usually not exceeding 30 per cent. Some portions in the area may exceed the above grade but the slope is not long as to produce much runoff. Erosion produced by runoff does not depend much on the steepness of the slope but rather on the length of the slope. As an example, a land with 15 per cent slope and 100 meters long will suffer more erosion than the land with 30 per cent slope and 50 meters long. Internal and external drainage occur but the main bulk of water is drained externally.

Faraon clay is black. There are numerous limestone rocks as prosion pavements on the surface. The surface soil is very plastic and sticky when wet, and ranging from 10 to 15 centimeters in depth. When dry, it remains black. It seldom hardens or cracks. It has a poor coarse granular structure when wet, but becomes fine granular upon drying. Erosion pavements increase in number when the surface soil becomes proded. In some places outcrops of limestone rocks appear and these often cause great hindrance in tillage operations. The subsoil is bluish black to grayish black clay, plastic

The subsoil is bluish black to grayish black clay, plastic and sticky when wet which slightly hardens upon drying. Partly decomposed rocks of limestone may also be present in this horizon.

Sometimes the subsoil does not appear in well developed profiles, and in such a case the surface soil is immediately above the parent rock. The parent rock is white to gray coralline limestone. It is found in different degrees of decomposition. When wet, such material is sticky, but powdery when dry. This parent rock layer is of an undetermined depth. It is usually quarried and used for road surfacing. The rock is good source of agricultural lime. Some people use this material as a source of lime used in the manufacture of muscovado sugar. In this case, the lime carbonate is heated to produce the quick lime.

Faraon clay has a neutral to slightly acid reaction. Although it developed from limestone, yet it is not alkaline betause leaching process is always active draining out the

soluble calcium substances. The subsoil is neutral to slightly alkaline. Owing partly to this reaction, sugar cane, corn, and legumes have good growth on this soil. On the other hand rice which prefers a slightly acidic soil with pH of from 5.5 to pH 6.0 does not produce good crop.

This soil type is not much eroded except those found in the northern part of the Island of Negros and in Siquijor Island. There are, however, areas in Sibulan where almost all of the true soil has been eroded leaving only the grayish white and inert parent rock. These areas are very poor for crops. Those however, found in Manjuyod have not suffered a great deal from erosion.

Coconut is the principal crop grown in this soil type. Coconul produces good crop and helps protect the soil from erosion. Being a permanent crop which does not require cultivation and having great root system spreading from the tree, it helps keep the soil from washing away. Coconut trees usually average 15 nuts each harvest. Corn is another important crop grown Unlike coconuts, the planting of corn is conducive to soil erosion. Continuous planting readily decreases the productivity of the soil. In Siquijor, the soils in some areas are so eroded that corn is planted only in the crevices of the rocks where soils may still be held. The corn plants thrive so poorly realizing only from 3 to 4 cavans to a hectare.

Sugar cane is an important crop of this soil type in Manjuyod Here, the surface soil is still deep and the roots of sugar cane are afforded deeper penetration into the subsoil. Sugar cane is fertilized with 300 kilos of ammonium sulfate. An average of 150 piculs of sugar is realized under this condition and treatment. Aside from these crops, vegetables such as horse radish or malungay, bananas, maguey and fruit trees are also raised. Banana seems to be well adopted to this soil because the fruits are relatively bigger and more numerous than those planted in the adjacent soil types.

BOLINAO SERIES

Soils developed from limestone may either be red or black. The Faraon series consists of black soils; the red ones are classified under Bolinao series. Bolinao and Faraon soils are similar in all respects except in color. Generally, the limerocks in Bolinao series are harder and lighter in color than those in the Faraon series. Topography ranges from rolling, undulating

to hilly. This series occupies a very wide area along almost all of the coast of Siquijor Island and is also found in small patches in the mainland. Its elevation is generally just a few feet above sea level, but the hilly areas reach up to 700 feet. The land is well drained except the little valleys where there are inadequate outlets. Like the Faraon soils, Bolinao is very stony and oftentimes limerock outcrops are common. The surface layer is very stony where severe erosion has taken place.

The true soil is very thin immediately followed by the limestone bedrock thus limiting roots of most crops to the surface soil. Only roots of trees like coconut can penetrate through the little crevices in the rock. The principal characteristic of the soil is its being red. Oftentimes there is no subsoil, and still in other places the layer of parent material is missing. Weathering in limestone rocks takes place very fast so that transitions from the bedrock to true soil do not occur.

Ground water table is quite deep. Wells dug in the lower areas are from five to eight meters deep. Springs are often found in this series. The water obtained however is hard due to the dissolved carbonates.

This series is presented by Bolinao clay. The profile characteristics of this soil type are as follows:

Bolinao clay

Depth em.	Characteristics
0–20	Surface soil, clay; red to bright red; moderately friable and granular when dry, slightly sticky when wet, does not shrink or crack upon drying. It has an excellent granular to blocky structure; fairly rich in organic matter and probably high in iron content. Erosion pavements ranging from pebbles to boulders are present and rock outcrops appear occasionally.
20-40	Subsoil, dark reddish brown clay; slightly compact; good coarse granular structure. Relatively poor in organic matter. Lime pebbles and cobblestone are present in this layer. Subsoil and surface soil separated by a wavy to broken gradual boundary. Oftentimes this layer does not appear.
40-150	Bedrock, hard porous coralline limestone; white to yellowish white, sometimes with streaks of red. Boundary with over-

Bolinao clay (153).—This soil type is extensively found in Siquijor Island. Bolinao clay is also found in the northern part of Guihulngan, in Calusaulusayan and in Manjuyod, which

150 centimeters is usually white, hard limestone.

lying layer is an abrupt, wavy to broken. The layer below

altogether covers 18,740 hectares. The land is undulating to rolling and at times hilly. There are also wide undulating areas where cultivation is possible. Little valleys between steep slopes are likewise used for cropping to a great extent.

Bolinao clay has a very thin surface soil. Where erosion is not severe, this layer may be 10 to 20 centimeters deep Such soil which can be plowed or harrowed, can sustain crops. Where the land is severely eroded, practically the surface soil and sometimes all the layers above parent rock have been washed off leaving but a layer of gravel and stones of limerocks.

Bolinao clay is a dark red to reddish brown soil with fine granular structure. It is always friable unless puddled. When wet it is plastic and sticky. It hardens upon drying, and if left undisturbed it becomes friable again. Other clay soil definitely harden upon drying. Most roots of crops find easy penetration in this type of soil.

Subsoil does not always occur in this soil. This layer is present only when the solum is thick. In such case the subsoil is also reddish brown to red. But unlike the surface soil, the clay subsoil is slightly compact to moderately hard. It is not as friable as the surface layer.

Bolinao clay is extensively planted to corn, cassava, and coconut. Upland rice is not grown. Corn is planted in the same field three times a year without being fertilized. As a result the present crops are very poor and seldom profitable. The farmers are after minimal subsistence, not profit. Yield in most places in Siquijor ranges from 2 to 10 cavans to the hectare. At times, however, patani, cowpeas, and winged beans are planted in the field with stovers to support the vines. Cassava is also very commonly planted but the roots thus produced are very poor. The roots are utilized for food and some for starch. The residue after the extraction of starch is boiled as a substitute for corn or rice.

Next to corn, coconut is an important crop in this soil type. Practically, all fields along the coastal regions in Siquijor are planted to coconut. There is, however, no regular plantation of this crop as most landholdings are small. An average of 10 nuts a tree for every harvest can be obtained. Banana is also abundantly found in almost every field. This plant seems to have better adaptability in limestone soil. In spite of the poor soil, the plants appear vigorous and produce fairly large size fruits.

LUGO SERIES

Lugo series is an upland soil developed from calcareous shale. The topography is mostly hilly with narrow valleys. The land is well drained. External drainage is so excessive that soil erosion has been very serious. Lugo soil is black. With the excessive soil erosion, the greater part of the surface soil is gone leaving the white parent rock exposed. The parent rock is gray to grayish white shale which reacts violently with acids. Limestone outcrops are occasionally present. This series has been very extensively cultivated in spite of its slope, thus resulting to partial or complete denudation. Uncultivated areas are grasslands which are mostly cogonal. The land at present is poor that a great number of farms were abandoned. Water is scanty under this type. Most of the creeks are dry, or intermittent in nature. The absence of forest trees may partly be responsible for the dry river beds.

Lugo clay is the only type under the series and has a profile with the following characteristics:

Lugo clay

em.	Onaracteristics
0-15	Surface soil, clay; dark gray to black; medium to fine granular
	structure. Sticky and strongly plastic when wet, slightly
	friable when almost dry. There are no stones or rock out-
	crops. Fairly rich in organic matter.

15-30 Subsoil, dark brown to yellowish brown clay; good coarse granular structure; slightly friable when dry, strongly plastic when wet. Boundary separating subsoil from surface layer is smooth and diffused. There are no stones or rock outcrops in this layer.

30-150 Substratum, silty clay; brownish gray; weak coarse granular structure; gritty; sticky when wet. Boundary separating this layer from the subsoil is abrupt and smooth. This layer consists of limy consolidated shale.

Lugo clay (156).—The central region of Siquijor Island and a couple of small isolated areas north and west of Guihulngan, with an aggregate area of about 8,080 hectares, are classified under this soil type. Like those found in Cebu and Bohol, this soil is rolling to hilly. Some of the slopes are too steep for any practical method of cultivation. Very little portion of this soil type can be cultivated under careful system of soil management. The present system of clean culture cultivation



Figure 20. Profile of Lugo clay. The thin dark surface layer overlays a thick mass of soft calcareous shale.



Figure 21. Landscape of Lugo clay in central Siquijor Island. Most of the surface soil has been eroded due to improper use of the land. Building in foreground once housed the offices of a manganese mine.

did much, to enhance erosion in most areas in this soil type. Internal drainage is very slow on account of the clayey nature of the soil. Furthermore, external drainage is so fast that most of the water is lost by runoff.

The surface soil of Lugo clay is black or dark gray with a depth ranging from 10 to 20 centimeters. The soil is of heavy clay, very plastic or sticky when wet, slightly hard to moderately friable when dry. Such soil is difficult to work when wet, as hard clods usually form. Unlike the Faraon soils, there is no rock outcrop or any sort of coarse skeleton on this soil. Faraon clay distinctly exist within areas of Lugo clay but were not delineated on the soil map due to mapping scale limitation. Lugo clay has a coarse granular structure especially when dry but becomes massive with a soft consistency when wet.

A great portion of this soil type is severely eroded. The normal surface soil of Lugo clay is black. When viewed from a distance, however, various white and gray patches are apparent. These light colored areas are the exposed subsoil. Excessive cultivation of the steep slopes causes erosion. Farmers desiring to grow corn cleared the natural forest cover on steep slopes thereby promoting runoff.

The subsoil is clayey, yellowish brown or grayish brown, and varies in thickness from 50 to 80 centimeters. This layer is free from any kind of coarse skeleton. It is decidedly sticky and plastic when wet but becomes slightly hard to compact when dry. The surface is clearly separated from the subsoil by a more or less smooth boundary. The subsoil is slightly ralcareous. The substratum readily reacts with mild acids. This calcareous shale is white to grayish white, and very brittle. The rock is soft and can be crushed to a powdery mass. The substratum is of an undetermined thickness. A manganese mine was once in operation within this area.

Corn is the principal crop grown in this soil type. Present production is very low. The soil has lost its fertility due to continuous cropping and soil erosion. Loss of fertility through soil erosion is a total loss because of the impracticability of restoring the soil lost. Corn production ranges from one to four cavans per hectare. Corn is planted two or three times a year which is very detrimental to soil fertility. Sometimes tobacco is planted after corn is harvested in November or March. Under this system, only two crops are raised. Coconut,

to a minor extent, is also grown. Crop rotation, like planting of close-growing leguminous crops during the rainy season followed by corn, is strongly recommended.

BATUAN SERIES

Batuan clay (214).—The level land around the headwaters of the Namanyan River was classified under the Batuan series. The black soil was developed from calcareous sandstone. Sporadic patches of Faraon clay, which are not indicated on the soil map, occur in some areas. Batuan clay differs from Faraon clay as to relief, depth of soil, and absence of outcrops. Batuan clay is deeper and has a more level relief than Faraon clay. Its internal drainage is poor.

Batuan clay has the following characteristics:

Depth cm.	Characteristics
0-20	Surface soil, clay; dark brown to grayish brown when dry, turns black when wet; plastic when wet; coarse granular in structure.
20–40	Subsoil, clay, brown to light brown; columnar; plastic and sticky when wet; separated by abrupt boundary from the surface layer.
40 and below	Thick layer of hard calcareous sandstone.

A larger part of the area was found uncultivated. Thick stand of virgin forest characterizes the native vegetation. Underneath the big stand of timber are varied species of palms. Cultivated areas planted to corn give good harvest. Secondary forest and grass such as cogon cover once cultivated areas.

TUPI SERIES

This series, chiefly characterized by a black friable surface soil, occurs as undulating to rolling land with an elevation of from 800 to 1,600 feet above sea level. This series is found principally on the eastern slopes of Cuernos de Negros. Another characteristic of this series is the presence of big black boulder outcrops. Drainage is fair to good. In some places, external drainage is so excessive which cause both sheet and gully erosion.

Tupi soil is developed from the underlying residual materials of partially weathered andesitic rocks. The surface soil is loam, silt loam, or fine sandy loam; almost black and friable. Gravels and even boulders are present in the substratum.

While the coarse sandy or gravelly substratum is gray to grayish brown, the subsoil is light brown sandy loam.

Tupi soil in this province was once covered by a thick growth of rain forest. Most of it now is under cultivation.

The loose friable layers in the profile allow deep root penetration. These layers are not calcareous. Tupi soil is usually acidic. Depth of ground water cannot be ascertained. Rivers and creeks traverse this series, but most of them are intermittent.

The representative profile characteristics of Tupi soils are as follows:

Depth cm.	Characteristics
0-30	Surface soil, fine sandy loam, sandy loam to silt loam; black when wet, light gray when dry; excellent fine granular structure; very loose and friable; rich in organic matter;
	non-calcareous; boulder outcrops present. Has a pH value of 5.50. Root penetration is way down this layer.
80-70	Subsoil, yellowish brown to light yellowish brown fine sand; structureless; friable, slightly compact, non-calcareous; no coarse skeleton; poor in organic matter. Has a pH value of 5.50. Boundary separating this layer from the surface soil is smooth and clear.
70–150	Substratum, coarse sand to gravelly coarse sand; light gray to gray; structureless; slightly compact, friable; non-calca-

reous; stones and boulders present. Has a pH value of 5.50.

Separated from the subsoil by a smooth and abrupt boundary.

Tupi fine sandy loam (270).—This soil type, about 4,300 hectares, is found on the eastern slopes of Look Out Hill in the municipality of Luzuriaga. This area is part rolling and part undulating with some patches of level land. The topography is rough in the higher regions, but gradually becomes smooth as the lower part of Luzuriaga is reached. The elevation of Look Out Hill is 1,600 feet; Bongbong, 1,000 feet; and Luzuriaga, 600 feet. Drainage, in general is good. In the upper cultivated areas, external drainage is rather excessive causing considerable gully and sheet erosions. In the lower areas near Luzuriaga external and internal drainage are both good.

Tupi fine sandy loam has a surface soil ranging from 10 to 80 centimeters deep. The soil is characteristically black, very friable and loose. It is fine granular in structure to almost structureless. The surface soil is much thicker in the lower areas than in the upper regions due probably to deposition and erosion. This soil does not puddle or clod or shrink upon drying. Boulders of andesitic rocks are present in some places.

but not numerous enough to adversely affect tillage operations. Imaginative farmers collect and use them for fences or field boundaries.

The subsoil, sand to coarse sand which is brown to dark brown, is from 20 to 25 centimeters in thickness. It is slightly compact and friable. The separating line between the surface soil and subsoil is clear and smooth.

The substratum is coarse sand to almost gravelly, gray to light gray, very loose and structureless. This layer is separated from the subsoil by a fairly clear and smooth boundary.

In Luzuriaga this soil type is planted to vegetables such as pechay, cabbage, kadios, gabi, and a great variety of flowers. The favorable temperature of the locality together with the well drained coarse-textured soil are important in the culture of vegetables and flowers. Bananas, coconut and other fruit trees, as well as abaca are other important crops raised in Tupi fine sandy loam. There are several varieties of bananas grown, among which are the locally named "Tundan," "Boracho," "San Pablo," and "Bulangan." Under coconut groves are wild species of canas, called "Dulan" locally. Corn is also grown on limited scale.

Tupi silt loam (271).—This soil type is found in the Tablas Valley, a wide rolling area of grassland and timberland. Tablas Valley lies astride the Negros Oriental—Negros Occidental provincial boundary and a few miles inland from the southern shore of the Island of Negros. Internal drainage is fair Numerous creeks which are tributaries of the Tablas River help drain the area. This soil type has an area of about 26,340 hectares.

Tupi silt loam has a very friable and granular surface soil about 15 to 30 centimeters deep. It is light brown when dry but becomes black when wet. Although it is easy to till, the presence of numerous rock outcrops on this soil type makes cultivation by machinery difficult. The subsoil is brown to dark brown coarse to fine sand with some fragments of partially weathered rocks.

There is not much cultivation done on this soil type. The area is sparsely populated due to poor accessibility and the prevalence of malaria.

Tupi silt loam is very acidic having a pH value of 4.5. Only acid-tolerant plants grow well. To make this soil suitable for most crops, the application of a large quantity of agri-

cultural lime is necessary. When cultivating grassland for the first time, regular crops should not be planted. The land is cleared and then planted to legumes. Regular crops may then be grown afterwards.

TAAL SERIES

These are water laid volcanic soils which lie around the eastern slopes of Cuernos de Negros. The general topography is undulating to rolling. Taal and Tupi soils have some similarities. The same general landscape, sandy surface soil, and boulder outcrops occur in both series. Their main difference is in the color of the soils in their profiles. Light gray to gray soil occur in all the layers of the Taal series, while gray soil is found only in the substratum of the Tupi series.

Taal soil has good to almost excessive drainage. The loose and rather structureless soil favors rapid internal drainage to such an extent as to cause rapid leaching of bases. The land has long been devoid of its native vegetation. In Palinpinon the primary forest has been cut and only a second growth cover remains. This new vegetation consist of several species of low and soft-wood trees. Under coconut trees abound various kinds of herbs and ferns, wild canas or "Dulan."

Taal soils are not calcareous. The porous light soil enables roots to penetrate down to the subsoil for most crops, and down to the substratum for most trees.

Taal sandy loam (56).—This soil is part of the upland areas surrounding the eastern slopes of Cuernos de Negros. The land is gently rolling to undulating and has an elevation of from 20 feet at Bacong to 500 feet at Palinpinon. From the shore line where the land is slightly elevated, this soil type rises very gradually to the base of the mountains of central Negros Oriental. It covers an area of about 10,440 hectares.

The surface soil of Taal sandy loam is about 10 to 25 centimeters deep. At times the soil is mixed with some fine gravels which contribute further to the coarseness of the surface soil. This layer is gray to dark gray when wet, but becomes coarser when dry. It is very poor in organic matter. It is loose, porous, and very easily worked. However, the presence of some boulders obstruct the operation of agricultural machinery. This soil has a pH of 5.70.

The subsoil is light gray to light brownish gray sand which extends to a depth of about 60 centimeters from the surface.

It is structureless, loose, and porous. Stones and gravels are present in this layer. The surface soil and subsoil do not differ much in color so that transition from one layer to the other is very gradual and thus not very clear.

The substratum is likewise sandy to coarse sand, brownish gray, and extends down to an undertermined depth. Sometimes another layer of gravelly coarse sand exists within this layer. Boulders and stones are also present in this horizon.

Coconut is the principal crop grown on this soil type starting from Dumaguete City to Zamboanguita in the south. From Dauin to Zamboanguita, coconut trees are more or less confined only along the shores. Some inland fields are also planted to coconut trees but only in scattered rows, usually along the sides of corn fields. Coconut trees seem well suited to this soil type. A hectare produces an average harvest of 12,000 nuts a year. The meat from these nuts are sun dried into copra. Some trees are also tapped for tuba. Corn is the second important crop. Corn is not so productive probably because of soil exhaustion and loss of soil fertility through leaching. A hectare of corn yields only from five to six cavange of shelled corn, which is very low compared to 25 to 30 cavana a good soil can readily yield. Kadios and mungo are also grown in relatively large areas. These crops are at time interplanted with the corn. Mungo has very poor yield giving only four cavans per hectare as against 20 cavans that may possibly be realized from a good harvest.

This soil type is often flooded by the many rivers traversing it. Due to the deforestation of the surrounding mountain slopes water readily rush down to swell rivers and inundate plains. Many agricultural areas along the rivers have already been destroyed. Another adverse effect of deforestation is the drying up of rivers and streams after the rainy season.

GUIMBALAON SERIES

Guimbalaon soil was formed from older alluvium which consists of country rocks and washed out materials from Canlaon Volcano and from other volcanic vents in the island. The topography is undulating to rolling to even steep. The series is characterized by the presence of numerous deep gullies and ravines. The soil has a good internal drainage which partly account for its being red or brown.

Guimbalaon gravelly loam (267).—This soil type is found mear the Negros Occidental-Negros Oriental boundary along the proposed Kabankalan-Bais road. The area is not very extensive. The surface soil is usually shallow only about 10 to 15 centimeters deep. It is dark brown, friable, and granular loam. The presence of numerous gravels and concretions makes the soil loose. The gravels are reddish and angular.

The subsoil is clay, also dark brown, friable when dry. It well drained. Boulders are usually absent, but in some places partially weathered rock outcrops are found.

This soil type is rather poor. Aside from the rapid leaching of bases, it has a high fixative power for some of the elements like phosphorus and potash. These elements in the form of chemical fertilizers should therefore be supplied for plant growth. This soil is also subject to erosion. Soil conservation measures should always be observed whenever cultivating this soil type.

LA CASTELLANA SERIES

La Castellana series was first identified in Negros Occidental. It is also found and represented by most of the upland soils of Negros Oriental. This series is found between Vallehermoso, in the north, to the hilly regions west of Dumaguete City, in the south. The area is rolling to almost hilly. It is shiefly characterized by the dominance of large boulders on the surface. These stones impede the cultivation of this soil. Some of these rocks are utilized to fence or separate fields. For this reason, La Castellana soil is seldom cultivated or planted to seasonal crops. External and internal drainage are fair. Heavy-type soils belonging to this series, however, have slow internal drainage, but because of the rolling to undulating topography rain water readily drains downhill.

La Castellana soils were developed from andesite and other rocks of similar nature such as tuff, breccia and lime. Soils thus formed are in most cases gray to almost black especially those under grass cover. Those under forest are either light brown or dark brown. The grasses found are mostly cogon and some talahib. Open lands such as these are also often associated with binayoyo trees. Forest trees are of the dipterocarp type.

La Castellana soil closely resembles Guimbalaon soil. The subsoil and the substratum of Guimbalaon series are deep with highly weathered fragmental rocks and have less boulders unlike those of the La Castellana. This soil, in general, is grawhile Guimbalaon soil is dark brown. La Castellana soil may also resemble the Zamboanguita soil described in this report but each differ in moisture content and color. La Castellana soil, because of geographical location, receives abundant rainfall while the Zamboanguita soil is very dry during the dry season and could hardly support plant life.

There are two soil types under this series. The profile characteristics, represented by the La Castellana clay are as follows:

Depth Cm. 0 - 25Surface soil, clay, brown to almost black when wet, but gray to light brown when dry; good, fine granular structure sticky when moist; rich in organic matter; non-calcareous stony. Has a pH value of 5.50. Affords good root pene tration. 25 - 70Subsoil, clay, brown mottled reddish brown and gray; good, fine granular structure; slightly compact; stones and boulders present; non-calcareous; grass roots seldom penetrate this layer. Has a pH value of 5.50. Surface soil separated from subsoil by an irregular and clear boundary. Substratum, clay, gray to reddish brown; compact and hand 70 - 150due to presence of stones and boulders; non-calcareous Acidic, with a pH value of 5.50. This layer is separated from the subsoil by an irregular and broken boundary.

La Castellana clay (305).—This soil is gray to dark gray and appears darker when wet. Big boulders scattered all over the surface is a typical characteristic of the series. These rocks are dark with rough angular faces. Their origin may be attributed to volcanic actions. The land is rolling and at times hilly. Deep ravines bisect the land giving it a rough-broken appearance. This soil type has an area of about 4,060 hectares.

The surface soil is from 15 to 30 centimeters deep. The surface soil on the lower slopes is generally thicker than those in the upper areas. Soil erosion is not very serious in this soil type. Some farmers prefer this stony soil. They believe that soil erosion is more prevalent in soil types without boulders than in those with outcrops on their surface. La Castellana clay is fairly friable and granular in structure. Were it not for the presence of some rock outcrops, this soil is easily tillable.

The subsoil is clay loam about 40 to 50 centimeters thick. It is brown to dark brown with dark red mottlings. In this

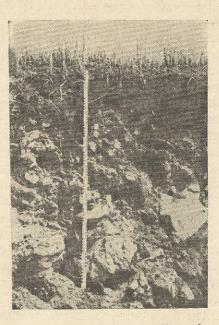


Figure 22. Profile of La Castellana clay.

The solum is shallow underlain by unconsolidated rock materials imbedded in clay soil.



Figure 23. Landscape of La Castellana clay. Rolling to hilly, it is usually under grass. Houlders scattered over the surface is a typical characteristic of the series.

PLATE 9

layer some stones and boulders are present. Some imbedded boulders in this layer are of such size as to protrude to the surface. The surface soil and subsoil are separated rather gradually by a more or less horizontal smooth boundary. The subsoil is extremely acidic and so is the substratum. Boulders are found in all these layers. La Castellana clay in Canlaon (elevation-1,600 feet) is almost black and fairly friable Corn on this soil, yields an average of 15 cavans of shelled corn per hectare. Upland and lowland rice are also grown. Water for irrigation is abundant and if properly controlled the land can be irrigated throughout the year. La Castellana clay delineated from Dumaguete to Tanjay (elevation-400 to 500 feet) is mostly planted to coconut. Coconut trees yield poorly giving only about 5 to 10 nuts per tree each season. Inbetween coconut trees corn is planted. The land is probably too exhausted that corn yield ranges from 4 to 6 cavans of shelled corn per hectare.

Aside from these crops, different kinds of fruit trees are also grown such as jackfruits, bananas, mangoes, and a few citrus. These are not grown on a commercial scale. Bananas are the most common.

ZAMBOANGUITA SERIES

This series is found in the southern part of the province and covers most of the elevated rolling areas between Zamboanguita and Siaton. Some portions are good for farming while the rest are broken and steep to warrant cultivation. An important characteristic of this soil is the wide open grassland found in it. Binayuyo trees are scattered all over the grassland. Vegetation is green only during the rainy season.

Another factor which makes this soil series not adaptable for farming operations is the presence of many rock outcrops all over the area. The rocks are from 30 centimeters to a meter in diameter. These dark colored rocks are either outcrops or lie buried several centimeters below the surface.

The soil has been developed from basaltic rocks. The dark surface layer is followed by several layers of dark reddish brown soil. Included within the area covered by this series are minor areas of the La Castellana and Taal series.

Zamboanguita soil is described and delineated as a separate series in view of several distinguishing features noticed. This soil closely resembles the Guimbalaon clay loam, stony phase. described in Negros Occidental. Climatic conditions where the latter soil is found permit farming operations throughout the year. In Negros Occidental, as well as in Leyte where this soil is also found, the principal crop is sugar cane.

Zamboanguita soil, on the other hand, could not be cultivated throughout the year. This series was once used for pasture, but the grasses dried out at the advent of the dry season. Boulders are less frequently imbedded in the profile of the Guimbalaon, while in the Zamboanguita series boulders are usual and common.

Rocks present in the Zamboanguita and La Castellana series are identical. However, their soil colors differ. The subsoil of the La Castellana is dull brown to gray while Zamboanguita soil has a reddish brown subsoil and substratum. Some areas of Zamboanguita series may, however, be included within the La Castellana series.

Zamboanguita clay loam

Depth	Characteristics
Cm.	Surface soil, clay loam, grayish black; fine granular; moder-
0-25	ately friable but slightly hard when dry; rich in organic
	ately friable but slightly hard when all,
	matter; non-calcareous; boulders present as outcrops.
25-50	Subsoil, clay loam, reddish brown; good medium granular;
	moderately friable, slightly hard and compact when dry.
	Some fine gravels and concretions present. Boundary with
	unner layer clear and smooth.
50-100	Class woodish brown: massive: slightly compact but otherwise
90-100	soft; weathered rocks present; boundary with upper layer
	smooth but diffused.
100 150	Cabatratum clay vellowish red; compact and massive; bound-
100-150	ary with overlying layer clear and smooth; boulders present
	in some profiles.

Zamboanguita clay loam (418).—This soil type was established in Zamboanguita. It extends to Siaton in the southern end of the province and has an area of about 14,060 hectares. It occupies the rolling uplands and foothills south of Cuernos de Negros with an elevation of about 300 to 500 feet. The slopes of some places are good for cultivation. The rest are broken terrain with steep slopes. The southern end along the coast is bisected by many deep ravines. Rapid runoff is checked by grass cover of various kinds. Steep slopes and absence of forest cover afford very little chance for water to percolate, thus little moisture is stored underneath. Con-

sequently, this soil type is easily dried up during summer Silibon, the grass that characterizes soils of dry areas, is the most common. Talahib and binayuyo trees are found growing all over this soil type.

The surface soil, about 20 to 30 centimeters deep, is dark gray when dry and almost black when wet. The black soil is confined to the surface layer. Soil under grassland is commonly black and this is attributed to the rapid deposition of organic matter in the form of grass leaves and roots. The surface soil for this matter becomes friable and easy to work. This favorable characteristic is, however, offset by the presence of rocks, exposed and buried. Rocks make plowing difficult coupled with the probable damage they may cause to farm equipment. Being rich in organic matter, the soil is mellow and friable which in turn induce good root development for crops

The subsoil is dark reddish brown which is very much in contrast with the surface soil. This layer does not contain as much organic matter as the surface layer and being clayer it is much harder than the surface soil. At times rocks are also found within this horizon. Some of these rocks can be removed although some are so huge that they cannot be moved manually. The lower layers in the profile are also reddish brown and contain concretions and weathered rock fragments

Zamboanguita clay loam is not much cultivated. In general the area is uninhabited. The little patches of farms are small fields of corn, upland rice, and kadios. Plantings are done only during the rainy season after which the farmers leave the place. The area was used for cattle pasture before the war Grass and water are abundant during the rainy season, but with the approach of the dry season, the cattle move down to feed along the gullies and ravines where the grasses are still green and lush. Green feed and water shortage are the problems which confront cattle men during the dry season.

STEEP UPLAND SOILS

Running along the eastern coastal side of Oriental Negros is a range of hills and mountains. The formation includes from those of limestone to shale, and volcanic. While the land in this part is not very suitable to cultivation, it is very lamentable to see that same has been very intensively cultivated to seasonal crops, principally corn. So intensively cultivated that very severe soil erosion had occurred as a result. Floods re-

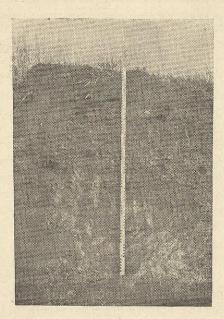


Figure 24. Profile of Zamboanguita clay loam. The soil is dark, deep and fairly friable with fine granular structure.



Figure 25. Landscape of Zamboanguita clay loam. The rolling, grass covered slopes of this soil type is suitable for pasture.

sulting to damages in the lowlands are very common. It would have been better if the areas were left to forest, or reforested to correct all such destruction to soil.

Bolinao clay, steep phase (154).—This soil type is located in Siquijor Island, and includes all the red limestone soils that have very steep slopes. This phase has an approximate area of 4,490 hectares. The elevation of the area under this soil reaches up to 1,000 feet above sea level. The land is partly covered by a second growth forest and partly cultivated to crops. Very common in this growth are young molave trees. Drainage condition is good to excessive. Places, where clearings have been made, showed rather excessive runoff causing severe soil erosion.

The surface soil in this phase is not as red as those in the other types. The reason lies in the presence of much organic matter which causes the soil to be grayish red or grayish brown. It is more friable though than those in the lower areas outside of the forest. In the virgin stage, the soil is deep and seldom do stones or boulders of limerocks appear. But wherever and whenever man clears this soil, the surface soil easily washes away thus exposing the rocks.

As much as possible this type should not be put under cultivation. Steps must be taken to put to permanent crops or forest trees those areas that were "Kaingined". A farmer will not profit much from cultivating this land type. He may get good production during the first few years but sooner he will realize his mistake and feel the effect of accelerated erosion. Finally, the whole community will bear the consequences of his own folly.

Faraon clay, steep phase (155).—Faraon clay as a soil type has a rolling relief. The soil with internal and external characteristics as Faraon clay but differing only in the slope is classified under the Faraon clay, steep phase. This type as the phase indicates has a slope ranging from 30 to almost 100 per cent. Under this kind of slope, cultivation to clean culture crops is not advisable because the soil will be eroded or washed away with the rain. This phase is found principally in the greater part of northeastern Oriental Negros from Jimalalud to Vallehermoso, and partly in the southwestern part of the province covering the forested areas in Tabong. This type has an area of 63,730 hectares. In cultivated areas, the ex-

ternal drainage is quite excessive. Drainage condition in forested areas is fair to good.

The bedrocks in the phase are also coralline limestone. These rocks are conspicuously seen as outcrops under virgin forest and almost completely exposed in highly eroded areas. Under native vegetation, the molave type of forest covers this type of soil. This hardwood should be conserved by not allowing "kaingins" in this area. For denuded areas like those in northern Negros Oriental, efforts should be made to reforest them. Ipil-ipil is one kind of tree that will be suited for this purpose. In spite of the seriousness of erosion on this area farmers still plant corn, cassava, bananas and some upland rice. The stand of the crops would clearly reveal the great unproductiveness of the soil. Most of the crops have chlorotic leaves. The cause of such chlorosis may be due to the rendering of the iron into an unavailable form by the "Ca" ions, or that iron in the soil is absent due to erosion. In most cases, the surface soil and the subsoil have already been washed off leaving only the inert bedrocks. Planting crops on such areas does not pay, instead, such a practice leads to considerable losses. As a result, soils on the lowland are rendered unfit for cropping because amount of gravels and erosion pavements that have been washed down from the uplands were deposited on them.

The forested areas which still exist in the southern portions of the province should be properly conserved. Selective system of logging should be practiced so as not to destroy other parts of the forest. Efforts should be done to reforest cut-over areas which should not be disposed for agricultural purposes.

La Castellana clay loam, steep phase (708).—This soil type is found mostly in Bais and has an area of about 20,080 hectares. It comprises most of the rolling uplands which are cultivated to some crops. External drainage is good whereas internal drainage is rather slow. Conditions of water-logging do not occur as excess water readily flow as runoff.

Boulders, although probably not so numerous and so big as in the other type of this series, are also found scattered all over the surface: Plowing such a land is not at all hindered by these rocks as they are just shoved off by the plow. The difficulty in plowing in this lies on the texture of the soil. The surface soil to a depth of from 15 to 20 centimeters which is dark gray clay loam, is very sticky and plastic when wet and has a tendency to become hard when dry. The coarse granular

structure becomes massive at times making it hard to work with. The subsoil is likewise clay and is dark gray. Its color, however, is only lighter than that of the surface soil.

Some level portions of this soil unit are used extensively to the growing of sugar cane. Rows upon rows of canes are laid over this rolling areas in such a way that the furrows run up and down the slopes. It is but natural to see some badly eroded lands under this type which condition causes the decrease in yield of canes. The variety of the cane planted is P.O.J. 2878 which is planted in November to February and may be ready for harvest 12 to 14 months after. The canes are fertilized with ammonium sulfate, mostly at the rate of from 300 to 400 kilos per hectare. Under this condition 100 to 130 piculs of sugar can be realized from a hectare.

This soil type is almost fully devoted to the production of sugar cane. No other important crop is planted.

NON-AGRICULTURAL SOILS

Strictly speaking, soils under this classification are not true soils in the sense that they are not products of weathering or that their soil horizons are not generally related to one another. In the loose method of classification, though where we refer to soil as a medium for plant growth, they may be considered soils. Non-agricultural soils also include areas wherein physical and chemical factors like slope, stones, chemical composition, etc. do not warrant cultivation and other farming operations.

Areas classified under the miscellaneous land type are hydrosols or tidal marshes, beach sands, and rough mountainous lands.

Hydrosol (1).—Salt marshes along the coastal regions fall under this classification. Such areas are usually flat and invariably almost at sea level; drainage is very poor and ordinarily there is always standing brackish water. At high tide the land is completely under sea water. Rosell and Arguelles (1928) have studied this kind of soil and have classified the different layers of the profile into three, namely: the acqueous, or the layer of the brackish water above the soil; the subacqueous which is the layer of deposited debris or undecomposed organic matter; and the basal horizon or the layer of slimy clay.

Hydrosol areas in the province which cover approximately 4,650 hectares were delineated along the coasts of Tanjay and

Hais. Hydrosols are usually covered by halophytic plants such as mangrove and nipa palms. Bakawan, bungalon, pagat-pat, ungarai, and api-api are the common trees found. Vines and low growing shrubs such as rigoriw and ferns are found mostly along edges of hydrosols but these seldom grow in the deeper parts. Big trees are cut for fuel while nipa palm fronds are utilized to thatch native houses. Fair sized nipa swamps are found in Tanjay and Tolong.

Areas under hydrosol are converted into fish ponds wherein milkfish are reared. Some fish ponds are found in Tanjay. The system of culture in Negros Oriental is not as intensive as those around Manila. Fish ponds and salt beds are often constructed side by side as in Manjuyod.

Beach sand (118).—These are low and level areas along the coast. Unlike the hydrosol, beach sands are well drained and to a certain extent crops are grown. The sands in this type were accumulated by wave action and consist of quartz, imestones and marine shell which are finely triturated from the constant pounding of waves. Beach sands are usually planted to coconuts. Depending upon the coarseness of the and and the availability of irrigation water, this land type can be grown to vegetables and some fruit trees.

Riverwash (152).—Some areas between Dumaguete City and Zamboanguita are often damaged by floods or else most become useless when rivers traversing them altogether change their courses. These areas which were once productive have either become river beds or covered by stones and inert gravels transported from the mountains. These areas are classified under riverwash.

Further destruction of productive land by floods and the like can be minimized. Indiscriminate cutting of timber, "kaingin", over grazing of slopes and planting of steep slopes to clean-cultured crops are some of the few evil practices to avoid. Instead, reforestation, conservation farming, and altogether wise use of forest, grassland and soil resources are imperative.

Rough mountainous land (202).—The mountain range which centrally runs along the length of the province is classified under this category. Most part of the land is non-agricultural mainly because slopes are very steep. There are, however, small patches of relatively level areas found throughout this

unit. Such areas when properly cultivated may produce substantially. At present numerous "kaingins" exist and as result good forest cover gave way to second growth trees a cogon. Soil erosion is now a grave problem. Runoff became very excessive and thus floods on the lowlands are communoccurrences. There were many occasions when very destructive floods inundated the lowlands between Dumaguete City and Zamboanguita. These floods destroyed once arable land becovering it with rocks and sand, aside from destroying home crops and livestock.

This kind of land is better utilized solely for forest purpose. To cultivate it for clean culture or annual crops is not advisable and never shall it be attempted. Areas already cleared should be allowed to return to forest or better be reforested. Lumber concessioners in this area should practice selective method accutting timber in order to avoid denundation of the forest Once areas like these are reforested, soil erosion and excessive runoff will be reduced to a minimum and the streams, which water as well as drain these areas, may again flow continuous throughout the year.

MORPHOLOGY AND GENESIS OF NEGROS ORIENTAL SOILS

The soils of Negros Oriental were divided into primary residual soils, and secondary or transported soils. The primar soils, found in upland regions, are represented by Farana Bolinao, Lugo, Batuan, Tupi, Guimbalaon, La Castellana, and Zamboanguita series; the secondary soils, found in lowland areas, are represented by San Manuel, Mandawe, Dauin, Siaton and Isabela series.

Soil profiles have varied degrees of development. The factorwhich affect the degree of soil development are relief, vegetation, and time. The following are the groups of soils classified according to the degree of profile development.

PROFILE GROUP II.—Soils of young alluvial fans, flood planehaving slightly developed profiles underlain by unconsolidated material. The profile has slightly compact subsoil horizon Only the San Manuel series falls under this group. The different layers in the profile are made up of loose soil. Drainage is good to almost rapid. These are among the productive soil in the Philippines. Many kinds of crops can be planted on these soils.

PROFILE GROUP IV.—Soils of older plains or terraces having strongly developed profiles (dense clay subsoils) underlain by unconsolidated material. The Mandawe, Siaton, and Isabela soils are typical examples of this group. All of these soils have compact underlying layers, typical characteristic of their profiles. Internal drainage or permeability is slow. The layers in the profile are distinct from each other. The Mandawe and Isabela soils are high in calcium. Siaton soils are low in this element.

Profile Group VII.—Upland soils developed from hard igneous bedrock and having a rolling to steep topography belong to this group. Tupi, Taal, Guimbalaon, La Castellana and Zamboanguita are the soils under this group. All of these soils are of volcanic origin. Tupi and Taal are both products of volcanic ejecta producing sandy soils that are gray to dark gray or even black. Guimbalaon and Zamboanguita soils produce fairly weathered red soils or latosols. They have good internal drainage in spite of the clay texture of all the layers in the profile. The red color of the soil signifies good aeration and the presence of plenty of iron. These soils, however, have high phosphorus and potash fixation. The Castellana soil is almost similar to Guimbalaon except for the presence of numerous boulders, the dark gray color and rather shallow soils of the former.

PROFILE GROUP VIII.—These are upland soils developed from consolidated sedimentary materials or stratified rocks like limestone, sandstone, and shale. The topography is generally rolling to steep. Faraon, Bolinao, Lugo and Batuan soils are under this group. Faraon soil had been previously classed under another profile group. The classification, however, has been modified lately. Faraon, Bolinao and Batuan soils are all developed from limestone and calcareous sandstone. Faraon and Batuan soils are both black clay. The latter, however, has an almost level relief with fairly deep soil that is not much subjected to erosion. Bolinao, on the other hand, has a red clay soil. Except for the color, Bolinao and Faraon are similar in profile development. The soil is shallow and marked by numerous rock outcrops. The soil profiles show usually the "A" and "C" horizons. The "B" horizon is not present which is due to the rapid formation of the soil. The depth of the solum does not increase much due to excessive soil erosion.

PRODUCTIVITY RATINGS OF NEGROS ORIENTAL SOILS

Productivity refers to the ability of the soil to produce crops or a sequence of crops under a specified type of management. It represents combined effects of many soil characteristics. For a given soil type, it summarizes the effect on yield by depth and texture of both surface and subsoil, nature of the parent material, fertility, reaction, relief, and drainage.

The method followed for soils in Negros Oriental is known as the Deductive Method. In this method, standard yields of different crops were set. The yields were obtained from well known productive soils, and produced under a given set of soil management. The yield of the soil under consideration is compared to the standard yield, and the percentage of comparison is obtained as the productivity rating. A rating which is equal to the standard means the soil is just as good as the standard soil which is rated 100 per cent. A rating of 50 percent therefore will mean that the soil in question produces only half as much as the standard soil.

The yield of crops was obtained directly from farmers, from fieldmen of the Bureau of Agricultural Extension, Bureau of Plant Industry and other sources. It is possible that not all crops are grown in a single soil type. In some instances, in the absence of records, yield of crops was obtained by estimates based upon the knowledge of the characteristics of the soil and cropping management.

The following are the average yields per hectare of crops established as standards of 100 per cent. The yields are based on normal soil managements—that is without the use of fertilizers:

Sugar cane	80 piculs sugar per hectar	
Upland rice	30 cavans per hectare	
Lowland rice	60 cavans per hectare	
Corn	17 cavans per hectare	
Coconut	3,750 nuts per hectare	
Tobacco	1,475 kilos per hectare	

The productivity ratings for the soils of Negros Oriental are shown in Table 8. In the determination of these ratings it should be stated that such factors as distance to markets, kind of roads, prices of crops, cost of production and other economic factors were not taken into consideration. The productivity rating should not be interpreted entirely as a basic criterion for land valuation.

The data for productivity ratings are based from yields per hectare of crops grown in each soil type. If no crop is grown in a soil type, an estimate of the yield of the crop that could be grown is considered, having as basis the characteristics of the soil and cropping management. The authors wish to acknowledge the information furnished by the Office of Bureau of Agricultural Extension in Dumaguete City. Since most of the data were obtained from field observations and from farmers who seldom keep written records of crop yields, the authors found it very difficult to get accurate data of crop yields. The data hereto furnished represent the customary methods of farming which do not usually consist of the application of commercial fertilizer except for sugar cane.

Table 8.—Productivity ratings of the soils of Negros Oriental.

	Crop productivity index for						
Soil Types	Sugar	Upland rice	Lowland	Corn	Coconut	Tobacco	
an Manuel fine sandy loam an Manuel loam Mandawe clay Dauin sandy loam	200 75	75 75 75	66 70 30 70	175 175 60	100 100 80 50	90 90 70	
Dauin clay lat on sandy loam mbela clay latuan clay	80 185	70 100 50	70 70 100 100	70 65 115 100	50 100 90 80	80	
araon clay olinao clay ugo clay	150 150 75 135	50 50 75	50	145 145 45 115	80 80 60 80	90 90 100	
upi fine sandy loamupi silt loam nal sandy loamumbalaon gravelly loam	125 70	75 80 75	50	115 70 100	80 150 70	80	
π Castellana clay amboanguita clay loam	100	75 80		100 35	80 80		

It will be noted that the ratings for sugar cane in most of the soil types are very high. It is a general practice in Negros Oriental specially near the vicinities of the Bais Sugar Central for planters to fertilize their sugar cane plants with Ammophos, or complete fertilizers. Crops other than sugar cane are seldom fertilized.

On the other hand, the apparent low ratings for crops in all of the soil types in the province should not be used as a basis evaluating the soil type. Many of the soils in the province have been farmed for many years now and the soil fertility has been almost exhausted. Simple soil conservation practices like green manuring, application of soil erosion practices and fertilizer application will readily build up the fertility of most of the soils.

Economic considerations do not play any part in the determination of the productivity of the soils as listed above. The ratings do not also show in any way, land valuation or assessment of the land for taxation or other economic considerations.

MECHANICAL ANALYSIS OF NEGROS ORIENTAL SOILS

SOIL SURVEY OF NEGROS ORIENTAL PROVINCE

One way to classify soil is by its texture—meaning the coarseness or fineness of the mineral particles of the soil. The three physical components of mineral soils are sand, silt, and clay. Generally all soils consist of these three parts. Some however may be pure such as beach sand which may not contain clay. The relative amounts of these three parts namely sand, silt and clay present in a soil will determine the texture of such soil. A soil containing dominantly of clay will be clayey and of silt will be silty. A well proportioned amount of the three parts will be loam. Other combinations will be sandy loam, silt loam, clay loam, sandy clay loam, etc.

Soil texture implies only size particles. This is usually determined in the field by feeling moist soil with the fingers and noting the degree of coarseness or fineness of the soil particles. The sizes of the different soil particles called separates are as follows:

Separates	Diameter in millimeter
Very coarse sand	2.00-1.00
Coarse sand	1.00-0.50
Medium sand	0.50-0.25
Fine sand	0.25-0.10
Very fine sand	0.10-0.05
Silt	0.05-0.002
Clay	pelow 0.002

Mechanical analysis of soils may be done rapidly using the Bouyoucos method. Representative samples of all the soil types of Negros Oriental were analyzed using the aforementioned method. The results are shown in Table 9.

Table 9.—Mechanical Analysis of Negros Oriental Soils 1.

Soil Type Nos.	Soil Type	% Sand 2.005 mm.	% Silt .05002 mm.	% Clay Below .002 mm.	Total Colloids
153 415 416 132 155 256 305 156 240 95 190 417 56 270 271 418	Bolinao clay Dauin clay Dauin sandy loam Faraon clay, steep phase Isabela clay La Castellana clay Lugo clay Mandawe clay San Manuel fine sandy loam San Manuel sandy loam Taal sandy loam Tupi fine sandy loam Tupi site loam Zamboanguita clay loam	78.4	19.6 28.6 5.6 24.2 27.8 27.8 27.8 28.8 22.8 34.8 10.4 20.4 18.4 19.4	56.8 51.0 16.0 58.2 39.6 52.4 37.6 71.6 45.8 12.6 20.6 20.6 10.6 10.6	65, 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8

Data for surface soil only. The modified Boysbucos method of analysis was followed

FIELD DETERMINATION OF SOIL TEXTURAL CLASS

The determination of the soil class is still 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 elentist frequently checks it against laboratory results.

The following are the definitions of the basic soil textural lasses in terms of field experience and feel:

Sand: Sand is loose and single-grained. The individual rains can readily be seen or felt. Squeezed in the hand when try, it will fall apart when the pressure is released. Squeezed when moist, it will form a cast, but will crumble when touched. Sandy loam: A sandy loam is a soil containing 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, it will form a cast which readily fall apart, but if queezed when moist, a cast can be formed that will bear areful handling without breaking.

Loam: A loam is a soil having a relatively even mixture of different grades of sand and of silt and clay. It is mellow with a somewhat gritty feel, yet fairly smooth and slightly plastic. Squeezed when dry, it will form a cast that will bear areful handling, while the cast formed by squeezing the moist soil can be handled quite freely without breaking.

Silt loam: A silt loam is a soil having a moderate amount of the fine grades of sand and only a small amount of clay, over half of the particles being of the size 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, it will form casts that can be freely handled without breaking, but when moistened and squeezed between the fingers, it will not "ribbon" but will give a broken appearance.

Clay loam: A 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 will break readily, barely sustaining its own weight. The moist soil is plastic and will form a cast that will bear much handling. When kneaded in the hand it does not crumble readily but tends to work into a heavy compact mass.

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

Such definitions are suggestive only. None could be made these or similar terms that would apply adequately to all soft The dependable definitions, the standards, are those developed from mechanical analyses.

LAND CAPABILITY CLASSIFICATION OF NEGROS ORIENTAL SOILS

A certain piece of land should be used only for what it good for. Using land more than what it is good for will result in deterioration. The saying goes—use every piece of land according to its capability and treat it according to its needs

The different soil types in Negros Oriental were groupe into classes according to their capabilities to show the necessary treatment for each class. In general the different land capability classes recognized are as follows:

- CLASS A—This is a very good land that can be cultivated safely and extensively to crops with ordinary good farming practices.
- CLASS B—This is a good land that can be cultivated safety using easily applied conservation practices.
- CLASS C—Moderately good land that can be used regularly for cultivated crops in a good rotation but needs intensive conservation treatments.
- CLASS D—This is a fairly good land that is best suited for pasture but can be cultivated to crops in a good rotation but needs intensive conservation treatments.
- CLASS L—This land is flat but is too wet or stony and is suffer for pasture or forestry.
- CLASS M—This land is too steep, eroded, or shallow, for cultivation but is suited for grazing or forestry if well managed.
- CLASS N—Land is very steep, eroded, rough, shallow, or degree Good only for forestry or grazing if handled with great care.
- CLASS X—Land is level but wet most of the time and cannot be economically drained. Can be used for farm pond or recreation.

CLASS Y—This land is too steep, eroded, barren, and rugged, and should be reserved only for wildlife or recreation.

The factors used in land capability classification are (1) the oil type, (2) slope of the land, and (3) the degree of soil prosion. These three factors taken as a whole will determine the capability class. The land capability class of a certain oil type will vary depending on the classes of slopes and legree of erosion it may have.

The soils in the plains neither have slopes nor erosion lasses. So, these soil types have fixed classification. However, the soils of the uplands exist under different slopes and erosion classes. In order to facilitate their classification, the possible slope-erosion classes are listed in Table 10, with their corresponding capability classes. Any other slope-erosion class that may be found in the field with an erosion class more severe than the one specified above will be classed under the next lower

ABLE 10.—Land capability classification of the different soil types in Negros Oriental.

Boil Type Nos.	Soil Type	Possible Soil Unit ¹ (slope- erosion)	Land Capability Class
95 190 414 417	San Manuel fine sandy loam San Manuel loam San Manuel-Taal complex Siaton sandy loam	a-0	A
240 256 415 416	Mandawe clay Isabela clay Dauin clay Dauin sandy loam	a-0	B w
214 182 153 156	Batuan clay Faraon clay Bolinao clay Lugo clay	$\left\{\begin{array}{c} b-0 \\ b-1 \\ c-1 \\ d-1 \end{array}\right.$	B e C e D e M
270 271	Tupi fine sandy loam Tupi silt loam	a-0 b-2	A B e
56	Taal sandy loam	∫ c-2 d-2	C e D e
267 805	Guimbalaon gravelly loam La Castellana clay	b-0 b-2	Ве
418	Zamboanguita clay loam	$\left\{\begin{array}{c} c-2 \\ d-2 \end{array}\right.$	C e D e
154 155 708	Bolinao clay, steep hase Faraon clay, steep phase La Castellana clay loam, steep phase	e-2	M N
1 118 152 202	Hydrosol Beach sand Riverwash Rough mountainous land		Y

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 specified above will be classed under the next capability class. Thus, Lugo clay with a b-2 classification will be classed as De.

000999

capability class. As an example, Zamboanguita clay loam was found with a d-2 (slope-erosion) unit. Since this classification is more than c-2 mentioned in Table 11, the land capability classification will be Class De.

The guide for each of the land capability class is included in order to give the reader an idea on how to utilize the sald land.

LAND CAPABILITY CLASS AND CONSERVATION GUIDE-CLASS A

Soil types: San Manuel fine sandy loam
San Manuel loam
San Manuel-Taal complex
Siaton sandy loam
Tupi fine sandy loam

Deep, level, well drained easily worked soil.

Class A land is nearly level. The soils are deep, dark, and usually fertile or can be made fertile under good management. They are usually deep alluvial soils which vary from silty to sandy and erosion is not a problem. They do not need drainage or other special practices. The land is rarely flooded. It is very easy to work and can be cultivated safely with ordinary good farming methods.

It is suited for intensive cropping. All crops common to the area can be grown on this land. Since soils of this class have good permeability, they are better adapted for crops other than rice. When used for lowland rice, puddling of the soil is usually necessary to prevent excess seepage.

Conservation farming requires such practices as liming (agricultural lime) when needed, the use of the correct kind and quantity of fertilizers and rotation of crops, which includes a legume or a soil improving crop for sustained production.

For better efficiency in the use of lime and fertilizers, a regular practice of green manuring or the plowing under of any young green plants such as legume crop or any farm manure or compost material is advisable. Waterways through or adjacent to this class of land should be well vegetated with adapted grass, shrubs, or trees.

LAND CAPABILITY CLASS AND CONSERVATION GUIDE-CLASS BW

Soil types: Mandawe clay
Dauin clay
Dauin sandy loam
Isabela clay

Land that can be cultivated safely but needs drainage in addition to good farm management practices to maintain productivity. Class Bw is good land but because of poor drainage conditions some effort to drain the excess water is needed. Included in this class are wet lands that can be easily drained. They usually occur on low bottoms near large streams. The soils are deep but the subsoils are heavy or the water table is very shallow and restrict water movement. Small ditches should be constructed to prevent damage from runoff from adjoining uplands. Protection from occasional overflow may be needed.

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

Lime and fertilizers of the proper kinds and quantities, soil-improving crops, farm manure and compost are needed to maintain the productive capacity of this land class.

LAND CAPABILITY CLASS AND CONSERVATION GUIDE-CLASS Be

Soil types:

Batuan clay
La Castellana clay
Tupi silt loam
Guimbalaon gravelly
loam

Faraon clay Bolinao clay Lugo clay

Good land that can be cultivated safely but needs certain erosion control measures in addition to good farm management practices to maintain productivity.

Class Be land in good from every standpoint but certain physical characteristics make it susceptible to moderate erosion damage since it usually occurs on smooth, gently sloping upland areas. The soils are deep but the subsoils are rather heavy. The slope is not more than 8 per cent and the soil is susceptible to moderate erosion when unprotected. This land therefore needs protection against erosion with control measures such as contour farming, terracing, and strip cropping. Excess water must flow into safe or grassed channels. Diversion ditches should be constructed to prevent damage from runoff from any adjoining uplands.

All crops common to the area can be grown. Liming and fertilizing, following recommended quantities and kinds, should be done. You will need a good crop rotation that has a legume or soil-improving crop such as mungo or soybean at least once in 3 or 4 years. For all legumes, the soil should be well supplied with lime and phosphate carrying fertilizer. The

use of farm manure or compost is recommended. If the soil does not contain the right kind of bacteria inoculation should be done.

LAND CAPABILITY CLASS AND CONSERVATION GUIDE—Ce

Soil types:

Faraon clay
Taal sandy loam
Zamboanguita clay
loam

Batuan clay Bolinao clay Lugo clay

Moderately good upland than can be cultivated safely if a carefully planned combination of conservation practices is applied.

Class Ce is moderately good land suitable for cultivation but needs the most careful use of the best soil conservation practices to prevent erosion. Soils are good, deep to moderately deep, with slopes that would range from 8 to 15 per cent. It has a moderate to severe erosion or is subject to moderate to severe erosion if unprotected.

To farm this land safely you will have to protect the land against erosion damage by installing a system of terraces, and supported by contour farming, and strip cropping. Terraces should empty into well grassed waterways or natural drainage

After establishing the needed conservation measures, a good soil management program should be adapted. This will include a good crop rotation using a legume as a green manure crop, judicious use of lime and fertilizers, farm manure, and compost to build up the soil.

Many crops common in the area can be grown but they all should be planted on contours. Fruit trees should be planted on the contours and a leguminous cover crop should be maintained to protect the soil from erosion.

LAND CAPABILITY CLASS AND CONSERVATION GUIDE—CLASS De

Soil types:

Bolinao clay Taal sandy loam Zamboanguita clay loam Batuan clay Faraon clay Lugo clay

Land good enough for occasional cultivation if handled with care but best suited to pasture and forest.

Class De land has slopes which run up to 25 per cent with moderate to severe erosion or is subject to moderate to severe erosion if left unprotected. The topsoil is generally thin with heavy, slowly permeable subsoil. It is fairly good land that can be cultivated occasionally with proper safeguards.

To farm the land a system of terraces has to be installed with properly laid out terrace outlets in the absence of natural outlets if erosion damage or gullying has made the natural drainageways impracticable. Terrace outlets must be covered at all times with a thick vegetative growth, preferably grass. Reseed and fertilize if the grass is not well established.

Plowing as well as other farm operations must be done on the contour. Crop rotation on this class should be a long one. Planting to row crops is not advisable. Close growing crops like grains or legumes are preferable. This land when used for orchards, the trees should be planted on the contour and a good stand of leguminous cover crop should be maintained.

Where erosion on a moderately deep soil has not been so severe, gullies can be smoothened and then seeded either to grass or legumes. The soil thus scraped should be limed and fertilized to give a good start for the grass or legume. The legume seeds will need inoculation.

LAND CAPABILITY CLASS AND CONSERVATION GUIDE—CLASS Ds

Soil types: Beach sand

Land good enough for occasional cultivation if handled with care but best suited to pasture and forest.

Class Ds land is nearly level to sloping with deep soil but thin topsoil and light, very rapidly permeable subsoil with a low available moisture. Included in this class are level or nearly level lands with deep soils but because of climatic conditions not enough moisture is available for good crop growth. In such cases lands under this class need artificial irrigation.

This class of land is also subject to some degree of soil erosion during those sporadic periods of heavy rainfall or after excess application of irrigation water.

This land is best suited if planted to vegetables or for truck farming. Root crops will do well too if planted at such times of the year when rainfall is abundant.

Increasing the organic matter content of the soil is recommended in order to increase the water holding capacity of the soil. This can be done by the application of animal manures.

It is not likely that this soil will need any lime but should it be desired, lime may be added only after an analysis of the soil is done. Fertilizers needed would be more of nitrogenous fertilizer for the leafy vegetables and ammonium phosphate or complete fertilizers as soil analysis may show for the fruiting vegetables. LAND CAPABILITY CLASS AND CONSERVATION GUIDE-CLASS M Soil types:

Lugo clay Zamboanguita clay loam Batuan clay Faraon clay Bolinao clay

Land not suited for cultivation but good for grazing or forestry if handled with care.

Class M lands are usually on steep slopes up to 40 per cent The soil is generally shallow or highly eroded making it not fitted for seasonal cultivation. Stones or gravels may be present or so numerous that they interfere with tillage operations. The land may be used for pasture or trees but needs to be carefully handled. In order to grow good legume or grass for pasture the land should be well prepared using lime and fertilizers as recommended in order to give the young plants a good start. You may need to build some diversion terraces around the heads of active gullies if any are present on the farm. Gullies that start to develop should be smoothened and sodded. Newly developed pastures should not be grazed severely. On well established pastures grazing should be well controlled and rotated. Whenever possible, stock ponds should be constructed to supply water to the animals.

Where climatic conditions permit, this land can be devoted to orchards for such crops as citrus, coffee, mango, or other similar crops but in all cases, the trees should be planted along the contours and good cover crop to protect the soil from washing should be provided.

As for forest, native trees should be protected from fires or Kaingins and bare spaces planted to wood trees like ipil-ipil.

LAND CAPABILITY CLASS AND CONSERVATION GUIDE-CLASS N

Soil types: Bolinao clay, steep phase Faraon clay, steep phase La Castellana clay loam, steep phase Rough mountainous land

Very steep land, eroded, rough with shallow soils that can be used for grazing or for forestry if handled with great care.

This kind of land is not suitable for any tillage except that which is needed to establish permanent vegetations such as for permanent pasture land or woodland. This class consists of lands that are with slopes up to or more than 40 per cent. The land is rugged broken by many large gullies. The soil is badly

eroded or very shallow. Stones may also be very abundant making it very impracticable to cultivate.

This land has very limited use. Where grass is growing some grazing to cattle may be allowed but must be managed very carefully to prevent erosion. The pasture land will need very liberal fertilization and liming and reseeding.

Gullied lands are best used for trees and only trees growing well in the locality should be used. Ipil-ipil is especially recommended. Where trees are already growing, they should be left and protected from fire and "kaingin".

LAND CAPABILITY CLASS AND CONSERVATION GUIDE-CLASS X Soil type: Hydrosol

Land suited only for wildlife or recreation.

Land in this class is usually level or is slightly depressed wherein water, either sea or fresh, stays most of the time making it impossible to utilize the land either for crops or pasture and trees. This land type is termed as hydrosol.

This land class may be used as site either for salt bed or for fish pond. Ordinarily this land is covered by mangroves or nipa palms or grasses as in the case of fresh water ponds. When the site is made for either fish ponds or salt beds, the trees or palms may be disposed of but a good wide strip should be left along the outer borders of the shore line to protect the land from the scouring effect of the waves.

For fish ponds the site should be dug to not less than a meter in depth. To produce a good growth of algae which is the feed for most fishes, the water in the pond should be fertilized.

> LAND CAPABILITY CLASS AND CONSERVATION GUIDE—CLASS Y Soil type: Riverwash Land suited only for wildlife and recreation.

Land in this class is in extremely arid regions where no sufficient grass for grazing can grow; or is very steep; rough or stony with very little or no soil at all. It also includes the rocky foothills, rough mountain lands, large areas of bare rock outcrops, and land that is very extremely eroded.

This kind of land therefore is not suitable for cultivation nor for grazing. However, trees should as much as possible be allowed to grow. The trees should be protected against "kaingins". Since this kind of land is good as habitat for game animals, protection against wanton killing should be instituted.

KEY TO THE SOILS OF NEGROS ORIENTAL

conservation practices recommended Negros Oriental fo soils the to

Conservation Practices	Green manuring, fertilization, liming.	Green manuring, fertilization, drainage.	Fertilization. Suitable for low- land rice only.	Erosion control, green manur- ing, fertilization.	Green manuring, fertilization, liming, erosion control.	Erosion control, fertilization, liming.	No row crops. Sujtable for pasture and tree farm.
Suitability	Corn, coconut, veg- etables, sugar cane, fruit trees.	Sugar cane, corn, rice	Rice	Corn, coconut, sugar cane, legumes, cas- sava.	Corn, coconut, veg- etables, fruit trees, coffee, cacao.	Sugar cane, coconut, corn, pasture.	Pasture, tree farm, cacao.
. Permeability	Rapid	Slow.	Slow.	Moderate	Rapid	Moderate	Moderate
Drainage	Good to excessive	Poor	Poor	Good	Good	External - excessive Internal-slow.	External – excessive Internal—slow.
Relief	Flat	Flat	Flat	Undulating to rolling; hilly.	Undulating to rolling.	Rolling to undulating.	Hilly to mountainous
Soil Type	San Manuel fine sandy loam San Manuel loam San Manuel-Taal complex	Mandawe clayIsabela clay	Dauin sandy loam	Batuan clay. Faraon clay. Colonao clay. Lugo clay.	Tupi fine sandy loam	Gumbalaon gravelly loam	Entrac clay, steep phase
Soil Type No.	95 190 414 417	042	416	TARES			MIN

SUMMARY

Negros Oriental lies on the eastern side of the Island of Negros. The province has an area of 531,640 hectares composed of the mainland of Negros Oriental and the subprovince of Siquijor Island. Dumaguete City, the seat of the provincial government, is 393 air miles from Manila and 335 kilometers from Bacolod City, Negros Occidental. Larena, the capital of Siquijor, is 20 air miles from Dumaguete.

The relief of the province is characterized by low, rugged, and serrated chain of mountains. The highest mountain peak is Canlaon, 2,465 meters high. Cuernos de Negros, another peak, has an elevation of 2,000 meters. Siquijor, like the mainland, has a rugged topography.

Drainage, in general, is adequate. Many rivers and creeks traverse the province. Most of these rivers and creeks drain to the eastern and southern coastal regions. Water supply for home consumption is adequate. Gravity or pump type of water system serves most towns.

The vegetation of the province in the upland mountainous areas is generally primary forest. Secondary forests are the result of careless and wasteful lumbering and *kaingin*. The narrow coastal plains are intensively cultivated. There are patches of open and cogon lands in the interior upland areas. Along the swamps are some discontinuous growths of nipa palms and mangroves. Similar conditions are found in the subprovince of Siquijor.

In most parts of the province, Tertiary sedimentary rocks predominate. Coralline formation runs as a narrow belt along the coast from the northern part of Vallehermoso to Dumaguete City. Another portion is found at Tolong in the south. Siquifor Island is of coralline formation except at its center between Lazi and Larena which is calcareous shale. The interior of Bagtic is also coralline limestone. The southern peninsula is andesitic to basaltic lava flow of late Tertiary and Quartenary age.

Coastal shores and rivers are flood plains of recent alluvium. Igneous rocks came about during the time of mountain-making movements. According to Smith, there might have been previous land connections between the Island of Negros and Cebu which was later encroached upon by the sea and now is the sunken area known as Tañon Strait.

The civil government of Negros Oriental was established on May 1, 1901 together with the subprovince of Siquijor. The sugar industry was introduced in 1850 when the ports of Cebu and Iloilo were opened. The Silliman University was founded in 1900 by Dr. Horace B. Silliman.

Dumaguete City is the center of transportation and business. Inter-island boats and ocean-going vessels call at the port to load agricultural products and unload merchandise. Bais, the second important port, loads sugar. Overland transportation companies maintain regular runs between Dumaguete City and Bacolod City and to other points of Negros Oriental.

The Philippine Air Lines maintains air transportation facilities in Dumaguete City connecting it with Cebu and other important airports in the Visayas and Mindanao as well as with Manila.

A general high school, a vocational school, and courses in home economics maintained by the government as well as private schools are found in the provincial capital. Municipalities have also government schools and in a few private institutions are also found.

Radio and telegraphic communication of the Bureau of Postare located in Dumaguete City, Larena and other important towns.

The chief industry of the province is agriculture. The most important products are sugar cane, copra, corn, cacao, coffee kapok, hemp, banana, fruits, vegetables and root crops. Other industries are pottery, salt making, manganese mining, cattle raising and lumbering. By-products of sugar cane like alcohol and paper are manufactured in Bais.

Two types of rainfall prevail in the province. The dry months are January through April. The rainy season is from May to December.

Tenancy is served on short season annual crops. Coconutabaca, sugar cane, and other perenial crops are usually run by administration. Carabaos, native plows and harrows are used for farm cultivation.

In 1948 the total farm area of the province was 125,529.33 hectares, of which 55.2 per cent was operated by owners; 6.80 per cent by part-owners; 21.30 per cent by share tenants; 0.10 per cent by share-cash tenants; 0.90 per cent by cash tenants;

150 per cent by other tenants; and, 7.20 per cent by farm managers.

The soils of the province are subdivided categorically as mils of the lowland, soils of the rolling upland, soils of the steep upland, and miscellaneous land types.

Soils of the lowland with 33,830 hectares are level to nearly evel. There are eight soil types under this subdivision. In the largest in area, followed by San Manuel fine andy loam, San Manuel loam, San Manuel-Taal complex, Manhawe clay, Dauin sandy loam, Dauin clay, and Siaton sandy nam. These soil types are planted to corn, coconut, vegetables, abacco, fruit trees, and sugar cane.

Rolling upland soils with 205,880 hectares are subdivided into oils derived from sedimentary rocks such as Faraon, Bolinao, ango, and Batuan series; and volcanic soils such as Tupi, Taal, luimbalaon, La Castellana, and Zamboanguita series. Other teep upland soils are Bolinao clay, steep phase; and La Castellana clay loam, steep phase. These steep upland soils of mestone, shale, and volcanic origin are planted to corn. Severe oil erosion occurs. Floods damage lowland areas.

The hydrosol, beach sand, and riverwash are classified under miscellaneous land types with a total of 7,070 hectares. Hydrosols are covered by mangroves and nipa palms. Other areas we used for fishpond sites. Beach sand are usually planted to oconuts. Areas classified as riverwash are those covered by ravels and stones, or stone covered old courses of meandering overs.

Non-agricultural rough mountainous lands, with 284,860 lectares, run the whole length of the province. Their slopes are steep and covered by primary or secondary forests.

The Bouyoucos method of mechanical analysis for soils was blowed. The relative amounts of sand, silt and clay present the soil determine the texture of the soil.

Productivity ratings shown in Table 8 indicate the compaison between the productivity of the soils found in the province with adopted standards for the Philippines based on the Deluctive Method. In this method, standard yields of different rops were set.

The different soil types of Negros Oriental tabulated in Table 0 were grouped according to their capability classes. The

possible land capability class to which each soil type belong is given for reference and guidance.

for the different soil types found in the province.

The morphology and genesis of soil types were classified into four groups, namely, Profile Group II, IV, VII, and VIII based on the origin, parent material, degree of profile devel opment, and general relief.

Table 11 shows the soil conservation practices recommended GLOSSARY OF COMMON ECONOMIC PLANTS FOUND

10000000000	Scientific name	Family name
Common name		Musaceae
Abaca	Marga tamtalao NPP	Cucurbitaceae
	Mamandied Character Little	Verbenaceae
	A are a command office will the Little	Dipterocarpaceae
Apitong	Tientemorarmis diduction to	Rhizophoraceae
Hakauan	Dhagonhorn, will of the to	Gramineae
Ramboo	Bambusa spinosa Roxb.	Musaceae
Banana	Musa sapientum Linn. Dolichos lablab Linn.	Leguminosae
Natao	Dolichos lablad Lilli.	Euphorbiaceae
Binayuyo	Antidesma ghaesembilla Gaertn	Moraceae
		Bombacaeae
Hammalone.	Cumingia philippinensis	
Cabbage	Brassica oleracea Linn. var. capitata Linn.	Cruciferae
	- I I I I I I I I I I I I I I I I I I I	Sterculiaceae
Cacao	· ' Tinn	Cannaceae
Canas	Cuenty	Euphorbiaceae
Cassava		Sapotaceae
Chico	"form Tinn	
Coconut		Lubiaccae
Coffee (Arabica)		Grammed
Cogon		ar arrange
Corn	Consuminam on Macf.	Marvaccae
Cotton	Triang einengis (Linn.) Savi	Degammo
Cowpea	Solanum melongena Linn.	Solanaceae
Eggplant	Colocasia esculenta (Linn.)	
	Schott and Filli.	Araceae
	Allium sativum Linn.	Linaceae
Garlic	T categoria alanca (Lilling) Deliving	
Ipil-ipil	A wto commis heler opicy toos Little	
Jackfruit	Cajanus cajan (Linn.) Millsp	. Legummosac
Kadios Kalamansi	Citmia microcarpa Bunge	. Itutaccac
Kapok	Coiha mentandra (Linn.) Gaerth	Dombacaccas
Lanzones	Laneium domesticum Correa	Menaccae
Langarai	Bruguiera parviflora (Roxb.) W. & A	. Rhizophoraecae
Maguey	Agave cantala Roxb	Amarymadecar
Malungay	Moringa oleifera Lam.	Willingaceae
Mango	Manaifera indica Linn.	Anacardiaceae
Molave	Witer narviflora Juss	Verbenaceae
Mungo	Phaseolus aureus Roxb	Leguinnosae
Nipa	Mana fruticans Wurmb	I alliao
i Onion	Allium cena Linn.	Lillaceae
Oranges	Times	Rutaceae
CHAIRES		95

Patani Patolang bilog Peanut Pechay Potato Radish Rattan Rice	Sonneratia caseolaris (Linn.) Engl. Carica papaya Linn. Phaseolus lunatus Linn. Luffa cylindrica (Linn.) M. Roem. Arachis hypogaea Linn. Brassica chinensis Linn. Solanum tuberosum Linn. Raphanus sativus Linn. Calamus spp. Oryza sativa Linn.	Caricaceae Leguminosae Cucurbitaceae Leguminosae Cruciferae Solanaceae Cruciferae Palmae
Sitao	Acanthus ilicifolius Linn. Panicum maximum Jacq. Vigna sesquipedalis Fruw. Glycine max (Linn.) Merr.	Gramineae Leguminosae
Sugar cane	Saccharum officinarum Linn. Ipomoea batatas Linn. Saccharum spontaneum Linn	Cucurbitaceae Gramineae Convolvulaceae
Tobacco	Nicotiana tabacum Linn. Lycopersicum esculentum Mill. Dioscorea esculenta (Loun) Burkill I	Gramineae Solanaceae Solanaceae
	Dioscorea alata Linn	

LITERATURE CITED

- ALICANTE, M. M. and others. Soil survey of Negros Occidental Province Philippines; Department of Agriculture and Natural Resources and report 14. Bureau of Printing, Manila, 1951
- BARRERA, ALFREDO and others. Soil survey of Cebu Province, Philippiness Department of Agriculture and Natural Resources soil report No. 17 Bureau of Printing, Manila, 1954
- Bouyoucos, G. T. A comparison of the hydrometer method and pipelle method for making mechanical analysis of soils with new directions Journal of the American Society of Agronomy, No. 8, V. 22, August 1930: 747-751. American Society of Agronomy, N. Y., 1930
- Brown, William H. Useful plants of the Philippines; Dept. of Agriculture and Commerce technical bulletin 10, 3 vols. Bureau of Printing Manila, 1941 & 1946
- BUREAU OF CENSUS AND STATISTICS. Summary and general report the 1948 census of population and agriculture; vol. III. Bureau of Printing, Manila, 1954
- . Yearbook of Philippine statistics, 1946. Bureau of Printing, Manila, 1947
- CENSUS OFFICE OF THE PHILIPPINE ISLANDS. Census of the Philippine Islands, 1918; geography, history, and climatology, Vol. I. Bureau of Printing, Manila, 1920

MERRILL, ELMER D. An enumeration of Philippine flowering plants, 4 volumes. Bureau of Printing, Manila, 1923-1926

SMITH, WARREN D. Geology and mineral resources of the Philippine Islands. Bureau of Printing, Manila, 1924

Soil Survey Staff, U. S. Department of Agriculture. Soil survey manual; U. S. Department of Agriculture handbook No. 18. Government Printing Office, Washington, D. C., (August, 1951)

WEATHER BUREAU. Annual climatological review, 1954. Weather Bureau, Manila, 1956

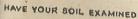
. Monthly average rainfall and rainy days in the Philippines. Weather Bureau, Manila, 1956



THE BUREAU OF SOIL CONSERVATION BUILDING AT FLORIDA STREET, ERMITA, MANILA

0







ANALYZE YOUR SOIL FOR BIGGER CROPS