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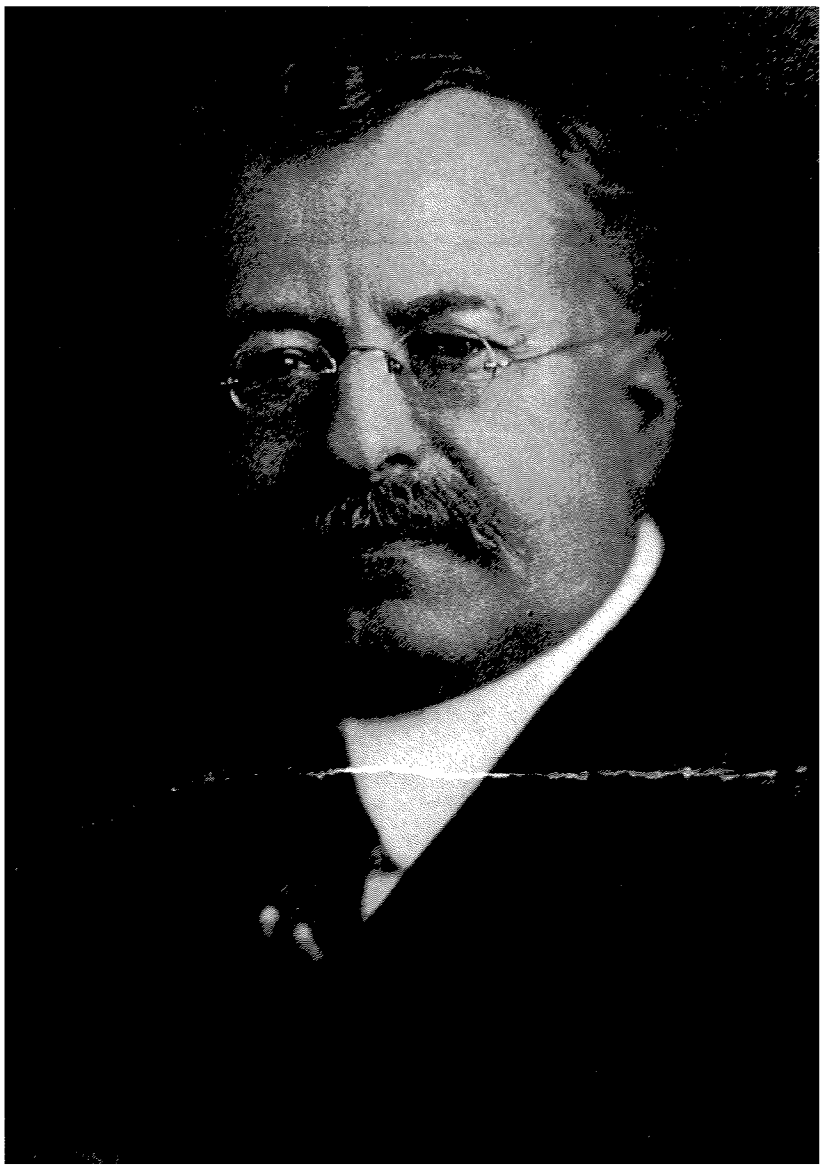

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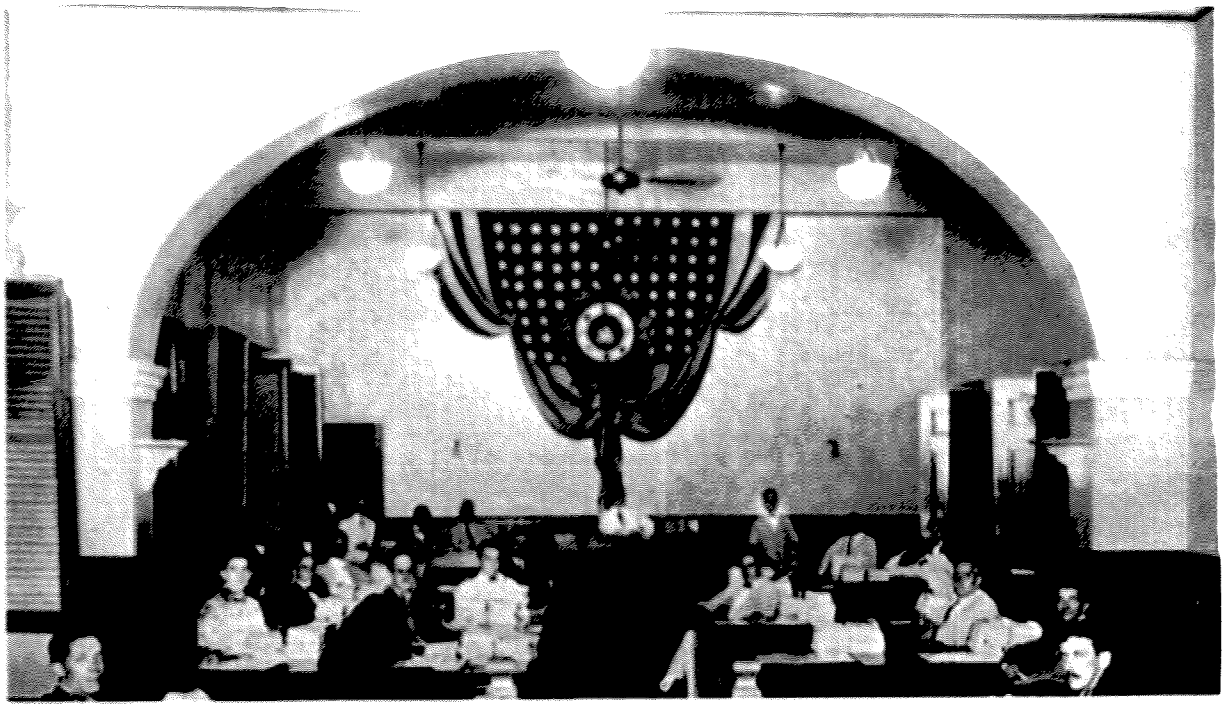

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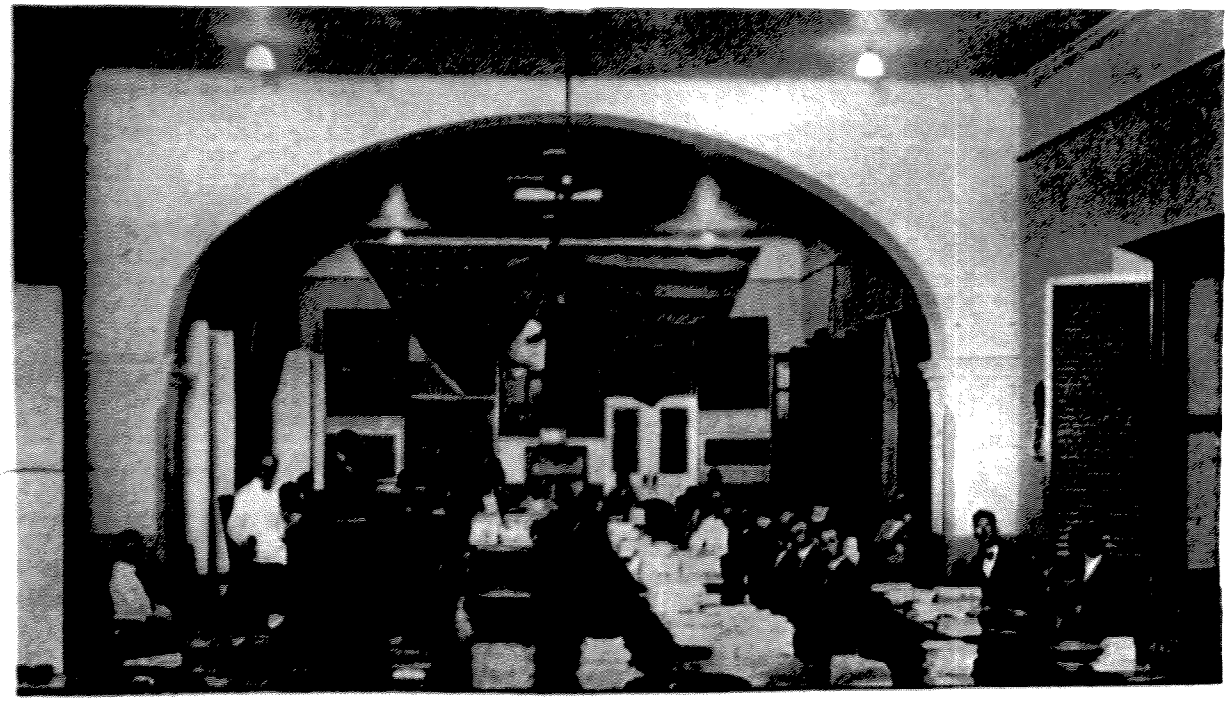

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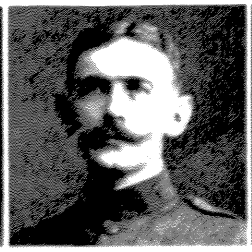

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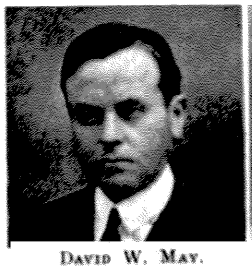

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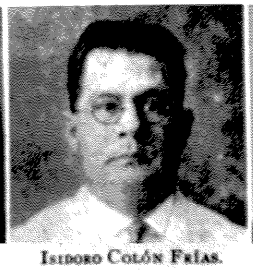

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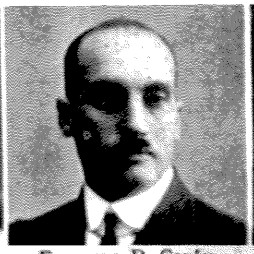

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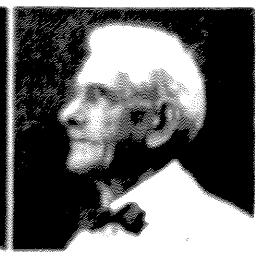
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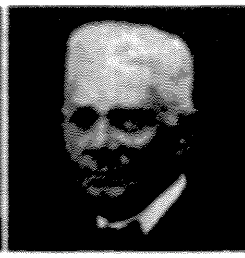
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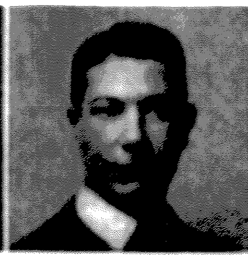
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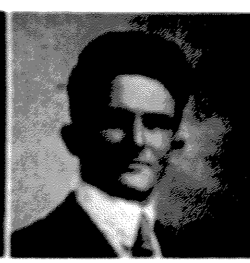
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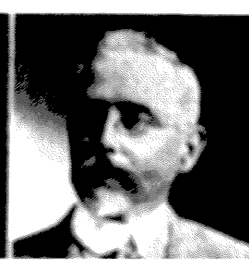
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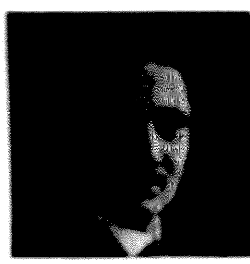
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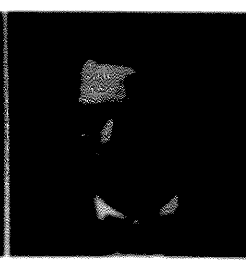
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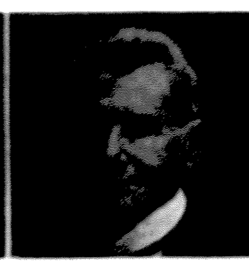
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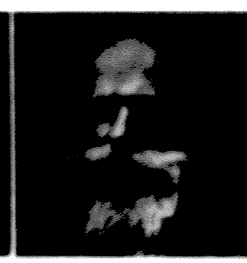
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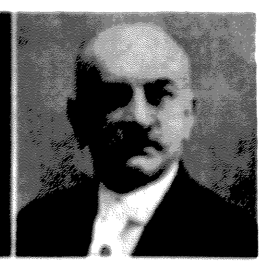
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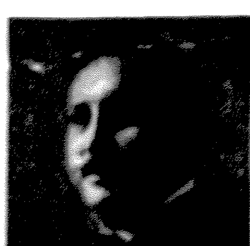
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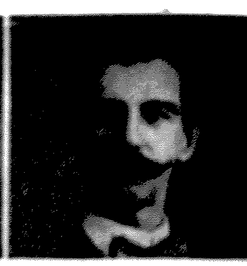
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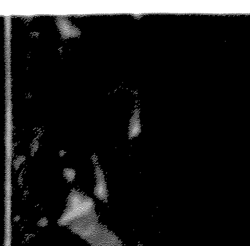
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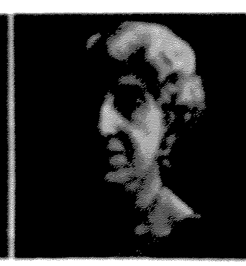
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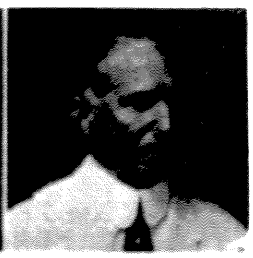

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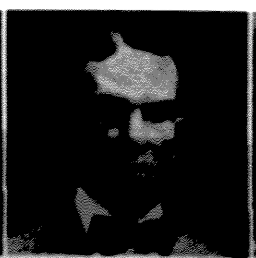

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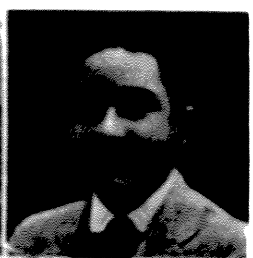

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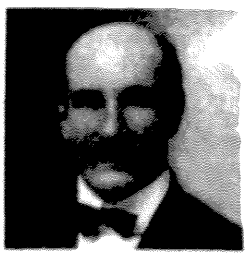

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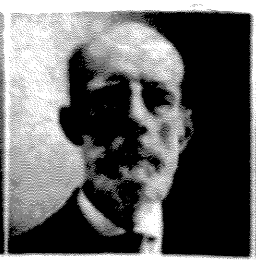

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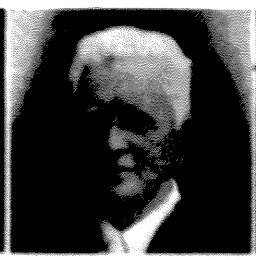

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A LOS HOMBRES DEL PASADO, CUYA VISIÓN Y ARROJO IMPLANTARON LA CIVILIZACIÓN CRISTIANA EN PUERTO RICO; A LOS HOMBRES DEL PRESENTE, A CUYA LABOR, INTELIGENCIA Y PERSEVERANCIA SE DEBE LO QUE ES BORINQUEN HOY; A LOS HOMBRES DEL FUTURO, DESTINADOS A PLASMAR UNA PATRIA SUPERIOR AL MAS DORADO ENSUEÑO; A TODO EL QUE HA PISADO EL LAR QUERIDO Y LABORADO EN PRO DE LA PERLA DEL CARIBE, ESTA OBRA SE DEDICA REVERENTEMENTE.

TO THE MEN OF THE PAST WHOSE VISION, DARING AND PLUCK GAVE PORTO RICO TO THE WORLD; THE MEN OF THE PRESENT WHOSE PERSEVERANCE, WORK AND SKILL HAVE MADE HER WHAT SHE IS TODAY; AND THE MEN OF THE FUTURE, DESTINED TO VIEW A PORTO RICO SUCH AS THE MEN OF THE PAST AND PRESENT NEVER DREAMED OF, THIS, "THE BOOK OF PORTO RICO," IS DEDICATED.

PREFACIO—PREFACE

Because of the lack of an appropriate institution—a Pan-American University, for instance—which would carefully study and propel the realization and transformation of the different ideals naturally springing from this gigantic experiment, and conscious of our high duty to the United States and Porto Rico, to Spain and Latin America and to Humanity at large, we have self-imposed the delicate task of insinuating a program, to the utmost limit of our relatively small power, in order to prepare for this young shoot of Latin-Anglo-Saxon civilization, the best possible surroundings for its highest development.

Keenly conscious of the great responsibility which we thus assume, and desiring to present the facts as they actually are, leaving everyone at perfect liberty to draw his own conclusions, and convinced that this task was impossible for any one man to shoulder, we resolved that all the main human activities of the island should be presented, and determined that each particular subject treated should be entrusted to the very person who, through careful examination, should prove himself best posted by first-hand knowledge to represent Porto Rico on his specific subject before the Congress of Public Opinion, and at the same time urging each contributor to make himself fully aware of the great responsibility that he shared with us, and to realize that because it was honorary it was all the more binding.

Having then in view that The Book of Porto Rico should be a reliable review of the past, a careful survey of the present and an intelligent guide to the future—a true reflection to ourselves and to all others of what we were, what we are, and what we should be—with our minds firmly set on the highest interest of our country, we started on our difficult task with great enthusiasm and determination.

The generous labor of our contributors and our humble tribute stamped on these pages, cause us to hope to receive as hearty a welcome from our readers as strong as was the high motive which impelled us to take up this task of almost impossible realization.

E. F. G.

For his valuable co-operation and suggestions during the manufacture of this book the Board of Editors desire to express their hearty appreciation to Mr. Duncan Robertson of New York.

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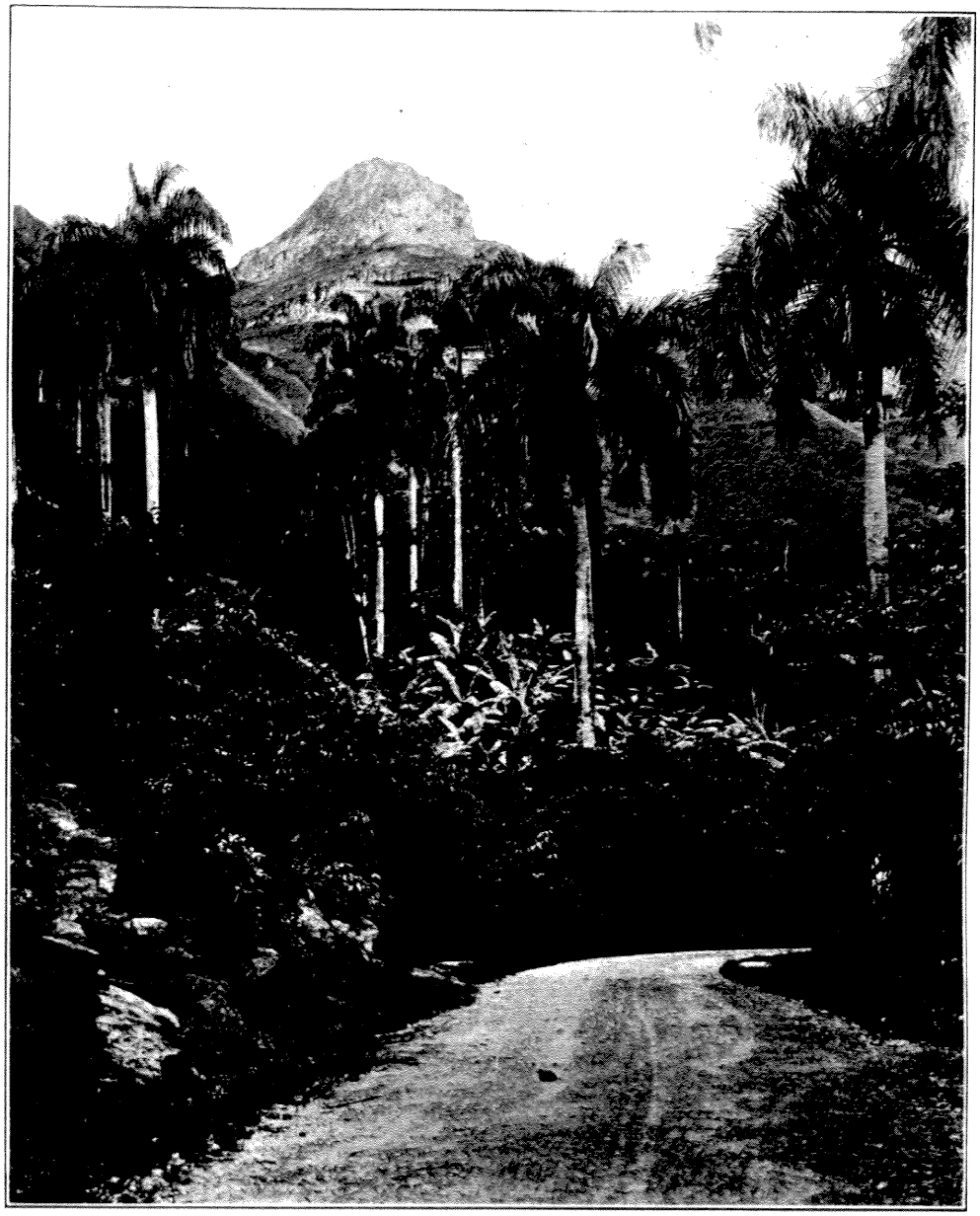


EL MONTE BLANCO PUERTORRIQUEÑO EN PLENO VERANO.
PORTO RICO'S MONT BLANC IN MID-SUMMER.

I

NATURAL HISTORY

GEOLOGY AND MINERALOGY—PHYSICAL AND POLITICAL GEOGRAPHY—CLIMATE—FLORA—INSECTS, FISH AND OTHER FAUNA—BIRDS—THE PORTO RICAN SKY.

Synopsis of the Geology and Mineralogy

By D. W. Noble, B.Sc.,

Geologist and Business Man.

Porto Rico is situated in the Atlantic Ocean, about 1,400 miles S. E. of New York, between Latitude 17° 54′ and 18° 31′ North, and between Longitude 65° 50′ and 67° 15′ West, with an area of 3,435 square miles. Population in 1910: 1,118,000. In 1922: 1,300,000.

The Summit of a Large Mountain Range: Bearing in mind that Porto Rico is the summit of a large range of mountains with its northern base in Latitude 19° 36′ and Longitude 67° 25′ (27,366 feet below sea level — Cook's soundings), the deepest place in the Atlantic Ocean, and the southern base 15,800 feet below sea level, Latitude 16° 90′ and Longitude 67° 25′, the author ventures to write the following:

GEOLOGY

Many distinguished Geologists have visited this beautiful little island since the celebrated Humboldt did so in 1801, but since it is so mountainous, and there were no roads, it was difficult to verify positively the geological Era to which it belonged, until more recent investigations facilitated by the 1,800 miles of new road, that have been constructed on this island during the last twenty-five years, all round and through the several divides, enabled us to approach by degrees the ultimate determination of its formation.

Once a Group of Small Islands: During the early part of the Mesozoic Era it seems this island was a conglomerate of small islands. From Río Piedras, due southeast to Gurabo, Juncos, Naguabo, and on the east of Fajardo, Luquillo, Río Grande and Carolina on the North, with the lofty hill called Luquillo, over 4000 feet high, form one island to the Northeast.

Another island to the Northwest from Río Pideras, due West passing through the south of Bayamón and Toa Alta, Corozal, Ciales, Florida, Lares, San Sebastián, Moca and Aguadilla.

The larger Main Island in the center, from Cape La Pandura and Mala Pascua, on the southeast of the town of Yabucoa to Cape Rincón on the west; and two small islands on the southwestern end of the island.

These Islands Unite: During the cretaceous period, these five islands united, forming the island of Porto Rico; the entire island dipping a little from northeast to southwest, forming several lakes.

Through the Period of Physical Unrest and Upheaval: During the Oligocene period, the island suffered a great deal of folding and unfolding; part of its Northwestern end, from San Juan to Aguadilla, of a cretaceous formation, saddled on the older Mesozoic, towards the center main island, as can be seen very plainly at the "Paso de Aguadilla" near Arecibo.

During this period of great unrest and upheaval, volcanoes existed and we can today notice three extinct ones—one near Coamo, one near Lares, between Arecibo and Utuado to the south, and one near Corozal and Vega Baja. The northern part of the island is characterized by the abundance of igneous primitive rocks, the complete absence of fossils and the metamorphosism of the sedimentary rocks which are chiefly stratified, clays and metamorphic limestone. The igneous rocks, that have given rise to the metamorphic rocks, diorites and diabeses are very abundant. Many of these rocks are of a fine grain and of different colors, and some of them present the tendency to

of the continents but are later in age. Other volcanic outbreaks may have extended into the Tertiary period, but none continue into the Quaternary.

No Volcanoes: So that the volcano, the volcanic apparatus, in its present form, does not exist in Porto Rico, there having been no proof that the emission of lavas and ashes may have occurred in the island after the Pliocene period.

Once a Part of the American Continent: It is evident that these widespread phenomena of mountain formation, these great orogenic movements, have taken place over extensive areas, and cannot have been limited to such a restricted area as Porto Rico now occupies. Thus by comparing these with other similar phenomena which have occurred in the present existing continental land masses, and which have already been carefully studied, we are able to deduce, that, during the orogenic movements which have raised these mountain ranges, the island was part of a continent of which the other Antilles also must have formed a part, and which was united at different periods of historical geology to that which is now the American Continent.

Once Part of a Continent Comprising All the Antilles: By the beginning of the Primary era in which the Paleozoic deposits were formed, it must have already emerged in as much as the terranes corresponding to the Cambrian, Silurian, Devonian and Carboniferous periods are not found here; and it probably formed part of a continent of historical geology to that which is now the American Continent.

Submerged During the Period of Soft Coal Deposits: During the period of the soft coal deposits the island was submerged. It is known that during that period the continents, in both the Northern and Southern Hemispheres, were limited by parallel 40, and as Porto Rico is situated between 17° 30′ north latitude it is evident that it was submerged at that time. This fact is confirmed by the absence of soft coal deposits in Porto Rico and in all the other Antilles, the same as it is now found in either the Northern or Southern continents between the equator and parallel 40 of each hemisphere.

And Then It Emerged Again: The island emerged perhaps at the end of the Primary era, since up to the present time the terranes corresponding to the Triassic and Jurassic periods have not been found.

Courtesy of the American Museum of Natural History.

ELASMODONTOMYS OBLIQUUS—ENCONTRADO SÓLO EN PUERTO RICO.

PALATAL VIEW OF ELASMODONTOMYS OBLIQUUS FOUND ONLY IN PORTO RICO.

And Then Submerged: Probably it submerged again about the beginning of the Cretaceous to rise again after the close of the same period, remaining submerged in part during the deposits of the Tertiary era.

Proof that It was Once United with South America: In the Pliocene period it was united with South América as proven by the remains of edentates found in a cave at the town of Morovis, and which have been classified by Mr. H. E. Anthony (Memoirs of the American Museum of Natural History, New Series, Volume II, Part II. The Indigenous Land Mammals of Porto Rico, Living and Extinct).

The author is in possession of a perfect skull and two vertebrae of the *Acrotocnus odontrigonus*, an illustration of which is shown here. This and the one in the American Museum are the only two complete skulls known to exist of this edentate which lived during the Pliocene period and has become extinct in Porto Rico.

Its congeners exist at the present time in South America. The existence of this mammalian fossil whose species has become extinct in the island is held as evident proof that this territory was united to those where the same species is found, likewise as fossil in the same terranes, and where even its present day representatives are still living.

The fact is that it being impossible for terrestrial mammals to transport themselves through the water like fishes, or through the air like birds, the island must necessarily have been united with the continent unless distinct centers of creation be admitted.

When the Island Ceased to Form a Part of the Continent: During historical time these edentates have not existed in Porto Rico, since neither tradition nor history makes any mention of them, and this fact undoubtedly serves to prove that during the Pleistocene Period the island ceased to form part of the Continent."

When the Island's Mineralization Cropped Up: Between the approaches of the three islands on the north, and the two small islands on the south, during the Oligocene period, the mineralization of the island cropped up.

MINERALOGY

Iron Ore Deposits: On the southern side, between the Luquillo Range and the north of the Yabucoa Range, there is about thirty to thirty-five million tons of Magnetic Iron Ore (above water level), averaging 69% to 71% with no sulphur, and only traces of phosphorus.

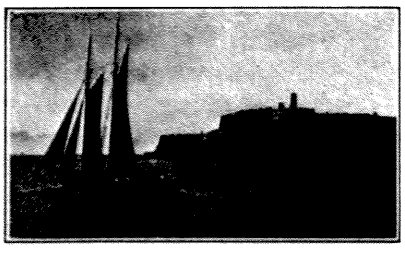
On the southwestern of the Yabucoa Range exist large quantities of good specular iron ore, and conrundum ore. Following the south coast, near Arroyo and Guayama and near Ponce, very good outcroppings of Iron Ore can be seen.

Gold, Platinum and Copper Deposits: On the north side of the Luquillo Range, from Fajardo to Rio Grande all the rivers bring gold that the natives, in flood times, pan out. The Spanish queen began to develop some auriferous veins, and sands near the town of Mameyes. The district of Corozal, celebrated since the Indians and old Spanish times, is famous for its gold and platinum bearing streams, some copper pockets of rich ore; 20% to 30% copper are also found.

Lead: On the south side, near Guayama, Barrio del Carmen, gold and lead is found, and this district is very promising. Also near Sabana Grande, the author has seen very promising prospects for gold, silver and lead.

Petroleum and Manganese Ore: For some time the author has been making investigations for Petroleum and has found the true rocks and good seepage along a zone from Bayamón to Lares, and about seven miles from the coast, precisely where the Oligocene period is more pronounced. Manganese ore, MnO_2 is being exploited between Juana Díaz and Coamo, and also in the Corozal district. During the late great war about 3,500 tons of it were shipped to the United States from Juana Díaz, and also 400 tons from Corozal.

Mineral Resources Should be Investigated: The island has not been investigated for its mineral resources, and the author sincerely hopes that the Federal Government of the United States of America, with the co-operation of the Porto Rican Government, will appropriate funds to realize the immense mineral resources that the island contains, and thus do much to make its people still happier.



Physical and Political Geography

By Conrado Asenjo,

Literary man and journalist. Author of various works on geography. Member of several scientific and literary societies.

Geographical Position. The island of Porto Rico is situated in the archipelago of the Antilles, in the region of the West Indies, between 17 degrees, 54 minutes and 18 degrees, 31 minutes North latitude, and 50 degrees, 16 minutes and 60 degrees, 56 minutes Western longitude of the San Fernando meridian, in Cádiz, and between the northern latitude and western longitude included between 65 degrees 35 minutes and 57 degrees 15 minutes of the Greenwich meridian.

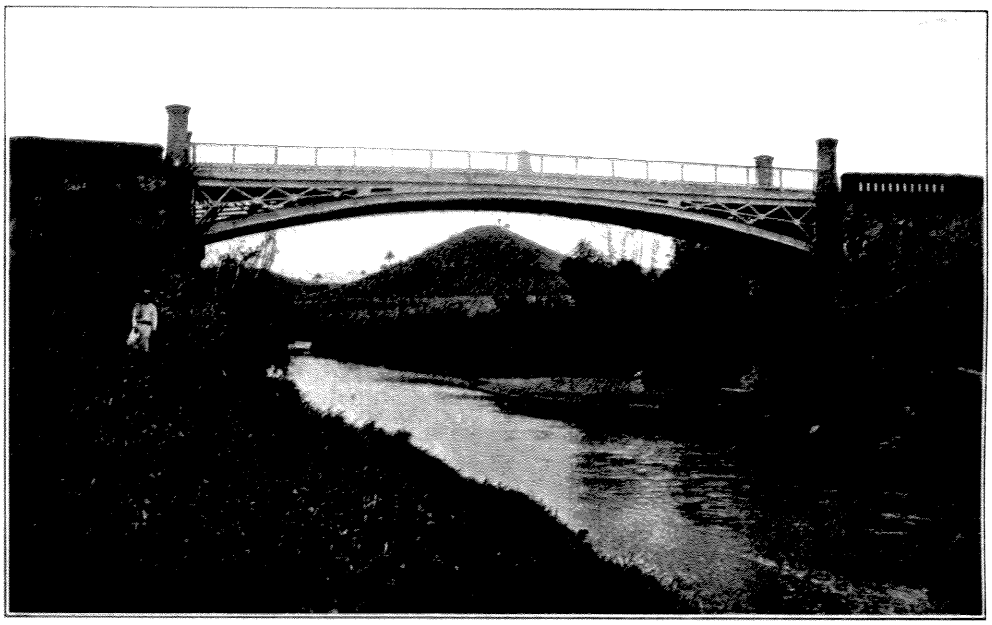
It is approximaely in the center of a chain of islands that stretches from Florida to Venezuela separating the Caribbean Sea and the Atlantic Ocean. To be more exact, it is situated 500 miles from Venezuela; 1,040 miles from Panama; 1,200 miles from Havana; 1,500 miles from New Orleans; 966 miles from Key West; 1,400 miles from New York and 3,000 miles from the port of Cádiz, Spain.

Boundaries. It is bounded on the North and East by the Atlantic Ocean; on the South by the Columbia Mediterranean, known as the Caribbean Sea or Columbus Sea; and on the West by the La Mona Channel, which separates it from Santo Domingo.

Extension. Its area is some 100 miles in length by 35 or less miles wide and contains an area of 3,349 square miles, and is therefore the fourth in size of the islands of the Greater Antilles, the islands exceeding it in area being Cuba, Santo Domingo and Jamaica.

If the adjacent islands of Vieques, Culebra, Mona and many other smaller ones which belong to Porto Rico are included, the area would be 3,435 square miles or 2,198,400 acres.

Population. The census of 1920 gives Porto Rico a population of 1,299,809 inhabitants, an increase of 170,760 inhabitants since the census of 1910. From this data we know that during that decade the island's average daily increase in population was more than 49 inhabitants,



ARTÍSTICO PUENTE SOBRE EL RÍO DE BAYAMÓN.
AN ANCIENT, BEAUTIFUL AND SKILFUL SPAN ACROSS THE BAYAMÓN RIVER.

and assuming that average to have been maintained since 1920 the present population of the island may be considered at around 1,300,000 inhabitants, which gives an average density of population per square mile of 387 persons which is more than ten times as dense as that of the United States.

Density of Population Compared with the States of the Union. In relation to the States of the Union, Porto Rico holds fourth place as to density of population per square mile, being exceeded only by Rhode Island, Massachusetts, New Jersey and Connecticut; while in relation to the nations in general, size considered, Porto Rico also holds fourth place, being preceded by Belgium, Holland and Great Britain.

Approximately it has seven times the density of the population of the Dominican Republic, and six times that of Cuba.

Physical Aspect. The Island's physical aspect is surprisingly beautiful, and all who see it, as is so well known, admire its wonderful scenery and many natural charms and its delightful climate as mentioned in other articles in this book—making Porto Rico a splendid place of residence the year round and especially in winter, for many people who desire to escape from the severity of the winter months in the United States.

A mountain range divides the island into two regions, northern and southern, the former being greater in area than the latter, which are crossed by several spurs of the Central Range also contributing to the beauty of Porto Rico. The innumerable peaks, hills, valleys and landscapes evergreen in the majority and the rivers that wind across its area, give the island a physical aspect of alluring beauty.

PLAYAS DEL CONDADO.—SAND DUNES NEAR SAN JUAN.

Only Four Per Cent of Negroes. Of this 1,300,000 inhabitants 4 per cent are negroes and 27 per cent are mulattoes, making the total population of the black race 31 per cent, while the remainder, 69 per cent, are white people.

Small Foreign Population. There are 1¼ per cent of foreigners in its population of which more than 50 per cent are Spaniards.

Twenty-five Per Cent More Women Than Men. In regard to the proportion of the sexes in her population, she has 25 per cent more women than men.

Rocky Heights that Defy the Sea. The Island has regions like the "Cabezas de San Juan," "Cape of Mala Pascua," etc., and in the northeastern portion between Quebradillas and Rincón, where the mountainous spurs of the range penetrate into the sea, thus affording beautiful and massive bluffs high above it.

But There Are Exceptions. With the exception of these and other places of minor altitude which are, however, low lying spurs penetrating into the sea, the coast is comparatively low—vast sandy plains or plains covered with a dense growth of mangrove trees.

CABEZAS DE SAN JUAN.—THE LONGEST CAPE.

Climate Tempered by the Trade Winds. Though Porto Rico is located in the tropics it is also located in the zone of the trade winds, and thus its climate is the most perfect and healthy in all the Antilles, a little hot during some part of the year, true, but with a constant breeze blowing at an average of eleven miles per hour, thus greatly refreshing the atmosphere.

Temperature Ranges. In general, the average temperature is 76 degrees Fahrenheit all the year, in the coolest months descending to 73 degrees and reaching 79 degrees during the warmest, with an average rainfall of 135 inches, the greatest average recorded being in the Luquillo range.

Capes. Almost quadrangular in shape the sinuosity of its coast that measures 360 miles, forms several capes of importance, such as the "Cabezas de San Juan" at the northeast, "Piñero" at the east, "Morrillos de Cabo Rojo," at the southeast, and "Borinquen" at the northeast.

Ports. There are several natural ports, such as San Juan at the north, Ensenada Honda at the east, Jobos, Salinas and Guánica at the South, and Puerto Real de Cabo Rojo at the west. At Culebra, too, in the island of that name, there is also a good port.

An Important Coaling Station of the Near Future. The beautiful harbor of San Juan, recently deepened to afford water for ships of 35 feet draught, is at no far distant day destined to become the most important coaling station on the route to the Panama Canal.

The Most Important Commercial Port. In its improvements, developments and commerce San Juan is the most important port of the island. Its imports and exports are more than a third of the total of the island, there also being the same rate concerning the arrival and departure of ships.

Hydrography. Difficult it would prove to find another island of the size of Porto Rico having as many water courses—the number of its rivers and minor streams that flow through it in every direction—enriching its soil—is more than 1,300, but—and this is a strange thing when its size is considered, only 51 of them empty into the sea.

The Four Important Rivers. The Río Grande de Loíza rises in the summit of the Cerro Gordo, at the northern part of San Lorenzo, and flows into the Atlantic Ocean near the town of Loíza; that of Bayamón, which rises in Cidra and flows into San Juan Bay, near its entrance near the town of Palo Seco; the La Plata river which has its source in the Cerro Pelado, in the Cayey range, and flows into the Atlantic near the town of Dorado, and the Río Grande de Arecibo, rising in the mountains of Adjuntas and flowing into the Atlantic near the town of Arecibo, are Porto Rico's four most important rivers.

Lagoons, Water Falls and Springs. The lagoons of the island are extensive, beautiful, plentiful and useful, and there are several noteworthy water falls, some—like the Salto de Comerío for example—being used for the purpose of securing hydro-electric power, and

there are several mineral springs, the most famous being Coamo Springs, the water of which is so widely known.

Orography. As before stated, the island is divided into two sections by the Central Range of mountains—northern and southern. This range is the only one existing in Porto Rico and is known as the Cordillera Central. It is nearer to the southern coast than the northern, the distance between it and the coast—at the south—being from ten to fifteen miles, this part of the range being the most abrupt.

At the north the slope is more gentle, and here, too, innumerable mountains and hills—whole ranges of baby mountains they look—are separated from the parent range penetrating into the sea.

Other Mountains. Other smaller groups of mountains also exist, like the Sierra de Luquillo in the northern part of the Island, and entirely separated from the former mentioned one. This is most noteworthy in history, as it afforded the last stand of the defense against the attack of the conquerors of the famous Indian Chief Loquillo, from whom the mountain group derives its name.

The Mountain That Lost Its Reputation. El Yunque, the peak once credited by all, and still considered so by many the highest one of the island, is located in this range. But, alas, science — that non-respecter of reputations not based on facts, has proved by its investigations that its height is but 3,483 feet, thus making it inferior to not only many peaks in the Cordillera Central but to another located in the southeastern part of the Sierra de Luquillo, but which though it attains an altitude of 3,532 feet, has not like proud El Yunque, attained a name, which is an illustration of the fact that high sounding names don't always signify the highest type of mountains any more than they do the highest type of man.

One Must Not Always Judge By What One Sees. The Sierra de Luquillo had the reputation of being the highest range, due to two facts—its solitary surroundings, away from any other large range, and its proximity to the sea, as the Yunque, which is one of the various

"EL YUNQUE", WHOSE HEIGHT IS STILL AN UNSETTLED QUESTION.

peaks in this range, because also of its nearly conical shape and its location close to the sea, had for a time the proud reputation of being the highest in the island, according to the views of some people.

The Highest Mountain Peak. Today bearing in mind the new orographical facts, we know that the central axis of the mountain system which crosses the island, is located in the central range, and in a spot to the west of the center of the island in the Jayuya and

Adjuntas districts, and where it reaches Jayuya at a distance of three miles, is the true highest peak in the whole mountain system, which spot is known as Pico de Jayuya, the elevation of which is 4,398 feet.

Many Peaks Higher Than "El Yunque." And more we know that near the above-mentioned peak located at the western part, there are several other peaks all of them higher than "El Yunque." Further we find that to the southeast, in the Adjuntas district, the peak "Silla de Guilarte" with a height of 3,950 feet, is located, which by the way was previously considered the second highest spot on the island, and that near it are three more peaks all of which in altitudes surpass the old champion El Yunque.

From First to Fifteenth. The average height of the Cordillera Central may be considered by virtue of modern scientific investigations as 2,500 feet, and also that range may be considered as comprising half of the entire total area of the whole island. All of which means that the old champion has been outstripped in the altitude climb by fourteen other spots, and is really only the fifteenth highest spot in the Island's mountain range, which shows that science sometimes proves that old legends are unreliable. However, the actual height of "El Yunque" is still a matter of discussion.

Mineralogy. Porto Rico's mineralogy is very fully treated elsewhere in this volume, but the author feels that some slight mention should be made here of the products of the island's mines, which are gold, silver, copper, lead, coal and calcareous phosphate from which it will be seen that the products of her mineral wealth are as varied as the fascination of her many charms. Further, one should remember that just as the relative supposed altitude of the old king of the Island's mountains was decreased by science, so science may one day prove the amplitude, both as to quantity and variety, of Porto Rico's mineral wealth, much greater than it is now known.

POLITICAL DIVISION

According to the Jones Act the island is divided in the following Senatorial and Representative districts:

San Juan, First Senatorial District—comprises the following Representative Districts: (1) San Juan, without the Santurce district; (2) Santurce; (3) Río Piedras, Trujillo Alto and Carolina; (4) Bayamón and Guaynabo; (5) Toa Alta, Naranjito, Corozal and Toa Baja.

Arecibo, Second Senatorial District—with the following Representative Districts: (1) Vega Baja, Vega Alta and Dorado; (2) Manatí, and Barceloneta; (3) Ciales and Morovis; (4) Arecibo and Utuado, except the Consejo District.

Aguadilla, Third Senatorial District—comprises the following Representative Districts: (1) Camuy, Hatillo and Quebradillas; (2) Aguadilla and Isabela; (3) San Sebastián and Moca; (4) Lares, Las Marías and Maricao; (5) Añasco, Aguada and Rincón.

Mayaguez, Fourth Senatorial District—has the following Representative Districts: (1) Mayaguez; (2) Cabo Rojo, Hormigueros and Lajas; (3) San Germán and Sábana Grande; (4) Yauco and Guánica; (5) Guayanilla and Peñuelas.

Ponce, Fifth Senatorial District—with the following Representative Districts: (1) The first, second, third, fourth, fifth and sixth districts of the city of Ponce; (2) the Ponce municipality; (3) Adjuntas, Jayuya and the Consejo District of Utuado; (4) Juana Díaz and Santa Isabel; (5) Coamo and Barros.

Guayama, Sixth Senatorial District—with the Representative Districts following: (1) Aibonito, Barranquitas and Comerio; (2) Cayey and Cidra; (3) Caguas and Aguas Buenas; (4) Guayama and Salinas; (5) Patillas, Maunabo and Arroyo.

Humacao, Seventh Senatorial District—with the following Representative Districts: (1) Humacao and Yabucoa; (2) Juncos, Gurabo and San Lorenzo; (3) Naguabo, Ceiba and Las Piedras; (4) Fajardo, Vieques and the island of Culebra; (5) Río Grande, Loíza and Luquillo.

JUDICIAL DIVISION

Porto Rico is divided into eight judiciary districts, each one comprising a number of cities and townships, the district (county) court house being located in the so-called capi-

tal of the district, as given in bold face below:

The First San Juan District: **San Juan,** Toa Alta, Vega Baja, Vega Alta, Comerío, Naranjito, Dorado and Corozal.

The Second San Juan District: Bayamón, Carolina, Río Grande, Río Piedras, Trujillo Alto, Loíza, and Guaynabo, the court house being located at San Juan.

The Arecibo District: **Arecibo,** Camuy, Hatillo, Quebradillas, Ciales, Manatí, Morovis, Utuado, Barceloneta and Jayuya.

The Humacao District: **Humacao,** Maunabo, Naguabo, Gurabo, Juncos, Fajardo, Vieques, Yabucoa, Caguas, Aguas Buenas, San Lorenzo, Culebra, Ceiba, Luquillo and Las Piedras.

The Aguadilla District: **Aguadilla,** Aguada, Rincón, Isabela, Moca, San Sebastián and Lares.

The Guayama District: **Guayama,** Arroyo, Salinas, Cidra, Santa Isabel, Patillas, Cayey, Aibonito and Barranquitas.

The Mayaguez District: **Mayaguez,** Cabo Rojo, Añasco, Lajas, Maricao, Las Marías, San Germán, Sábana Grande and Hormigueros.

The Ponce District: **Ponce,** Adjuntas, Yauco, Juana Díaz, Coamo, Barros, Guayanilla, Peñuelas, Guánica and Villalba.

The territorial division as regards the Registry of Deeds*, is the following: (1) the Aguadilla District: **Aguadilla,** Aguada, Isabela, Lares, Moca and San Sebastián; (2) the Arecibo District: **Arecibo,** Barceloneta, Camuy, Ciales, Hatillo, Jayuya, Manatí, Morovis, Quebradillas and Utuado. (3) the Caguas District: Aguas Buenas, Barranquitas, Barros, **Caguas,** Gurabo, Juncos and San Lorenzo; (4) the Guayama District: Aibonito, Arroyo, Cayey, Cidra, **Guayama,** Patillas and Salinas; (5) the Humacao District: Ceiba, Culebra, Fajardo, **Humacao,** Luquillo, Maunabo, Naguabo, Las Piedras, Vieques and Yabucoa; (6) the Mayaguez District: Añasco, Hormigueros, Las Marías, **Mayaguez,** and Rincón; (7) the Ponce District: Adjuntas, Coamo, Guayanilla, Juana Díaz, Peñuelas, **Ponce,** Santa Isabel and Villalba; (8) the San Germán District: Cabo Rojo, Guánica, Lajas, Maricao, Sábana Grande, San Germán and Yauco; (9) the San Juan District has two sections—the first comprising Carolina, Loíza, Río Grande, Río Piedras, **San Juan** and Trujillo Alto; and the San Juan Second Section: Bayamón, Comerío, Corozal, Dorado, Guaynabo, Naranjito, Toa Alta, Toa Baja, Vega Alta and Vega Baja.

INTERIOR DE UNA DE LAS CUEVAS DE MOROVIS, TAN RICA EN FÓSILES.
INTERIOR OF ONE OF THE MOROVIS CAVES—RICH IN FOSSILS.

* See article on Registry of Deeds in this book.

The Climate of Puerto Rico

By Oliver L. Fassig, Ph.D.,

Meteororolgist, U. S. Weather Bureau. In charge of the West Indies Climatological Service, and Forecaster for the Eastern District of the West Indies Forecast Service of the Weather Bureau.

The U. S. Weather Bureau in the West Indies. In 1898 the U. S. Weather Bureau established a storm warning service for the West Indies and adjacent coasts of Central and South America and the Caribbean Sea, for service during the hurricane season. At the same time a climatological service, comprising about 40 stations, was organized for the island of Porto Rico, active throughout the year.

During the hurricane season reports are received from about 30 stations at 8 A. M. and 8 P. M. daily and a broadcast of weather conditions is issued, by co-operation with the Naval Radio stations along the Atlantic coast and at San Juan. These reports are issued from Washington, for the United States and for the West Indies and Caribbean Sea from Santo Domingo westward, and from San Juan for the area from Santo Domingo eastward to and including the Windward Islands.

In 1919 the Chief of Bureau organized a climatological service in co-operation with the various governments of the islands of the West Indies, of Central America, and of the countries along the north coast of South America. Through this service daily rainfall records from about 500 stations are collected and published monthly at San Juan, the headquarters of this climatological service, making it possible for the first time to obtain a comprehensive survey of rainfall conditions over this vast and increasingly important tropical area —an area upon which we must depend in constantly increasing degree for certain of our necessary foodstuffs.

Since July, 1920, investigations leading to a further knowledge of wind velocity and directions at great elevations above the earth's surface have been carried on at the San Juan station, by means of small rubber balloons filled with hydrogen gas. These balloons have on several occasions reached the great elevation of 50,000 feet above the earth's surface, their direction and velocity being determined at intervals of a minute by means of a theodolite. The results obtained are of great value in investigating the movements of the atmosphere, especially during the progress of tropical storms, and in the study of aviation routes over the West Indies.

General Characteristics. The most characteristic feature of tropical climates is the regular recurrence of similar phenomena from day to day, throughout the year. The strong contrasts in temperature, which mark the seasons of the north, with the accompanying variations in the abundance and character of plant life, are conspicuous by their absence in the tropics. The periodic recurrences in plant and animal life are determined more by rain or the absence of rain than by marked changes in temperature. The contrasts between day and night conditions are more marked than the seasonal contrasts. The irregular changes in the weather, such as storms, cold waves, hot waves, etc., which largely control weather conditions in the United States, are so infrequent in the lower latitudes as to cut but a small figure in the making up of the average of weather conditions. Next to uniformity in the tropics we have the factor of abundance—abundant heat, rather than excessive heat; abundant moisture, both in the form of a high humidity and of rainfall and abundant and perennial plant and animal life.

When we come to consider the place which Porto Rico occupies in this favored zone of plenty, we find to her credit an attractive combination of many desirable physical and climatic features, especially for the planter and for the tourist. The island is primarily an agricultural country. Each succeeding year witnesses an increasing acreage in sugar, tobacco, coffee, citrus fruits, and pineapples. The great natural beauty of the island, its splendid system of macadamized roads, and the ideal

winter climate, is attracting an ever-increasing throng of winter tourists. With over a million inhabitants, and with a density of population equal to that of Massachusetts, the healthfulness of the island, based on the mortality statistics, ranks with that of favored localities in the States. The geographical position of the island within the trade-wind belt, combined with its elevation above the sea level, marks it as one of the most favored regions within the tropics.

Temperature. Porto Rico, in common with all islands within the areas swept by the northeast and southeast trade winds, has a warm but equable and comfortable climate. The small extent of the island, with its moderate elevations above sea level, insures a uniformity of temperature characteristic of marine climates in all latitudes. The carefully made daily observations of the United States Weather Bureau in fifty selected localities upon the island cover a period of more than twenty years, a period sufficiently long, in the tropics, to include all the variations in temperature likely to be experienced in any portion of the island.

The simplest expression for the temperature of a given region is the average temperature for a series of years, usually derived from daily observations of the highest and lowest readings of good thermometers. Such a record covering a period of more than twenty years at over forty selected stations shows a mean annual temperature for the island, combining the records at all stations, of 76°; the average for the coldest winter month is 73°, and during the warmest month of summer it is 79°.

The above values represent average conditions for the Island as a whole, coast stations and mountain stations combined. The figures will vary somewhat with elevation and other topographic conditions. For the towns situated upon the narrow coastal plain encircling the Island the average annual temperature is 78°, the average for January 75°, and for August 81°; at inland stations the average annual falls to a minimum of 72°; with 69° during January and 75° during August. The lowest temperatures are naturally those experienced along and near the summit of the main divide, at elevations varying from 2,000 to 3,000 feet; here the mean annual temperature falls below 72°. At Aibonito the mean coolest month of the winter season the average temperature for the year is 71°, with a January mean of 68° and a mean for July of 74°; the highest mean temperature for July was 77° and the lowest January mean was 66°.

The values quoted in the preceding paragraph may be compared in the following table with average values for the same seasons at selected points in the West Indies and at more remote points in the United States and elsewhere.

The smallest variations in the mean temperature noted in the tropical localities of the above table are characteristic of the islands within the trade wind belts. They are due to

TABLE I—COMPARATIVE STATEMENT OF TEMPERATURES

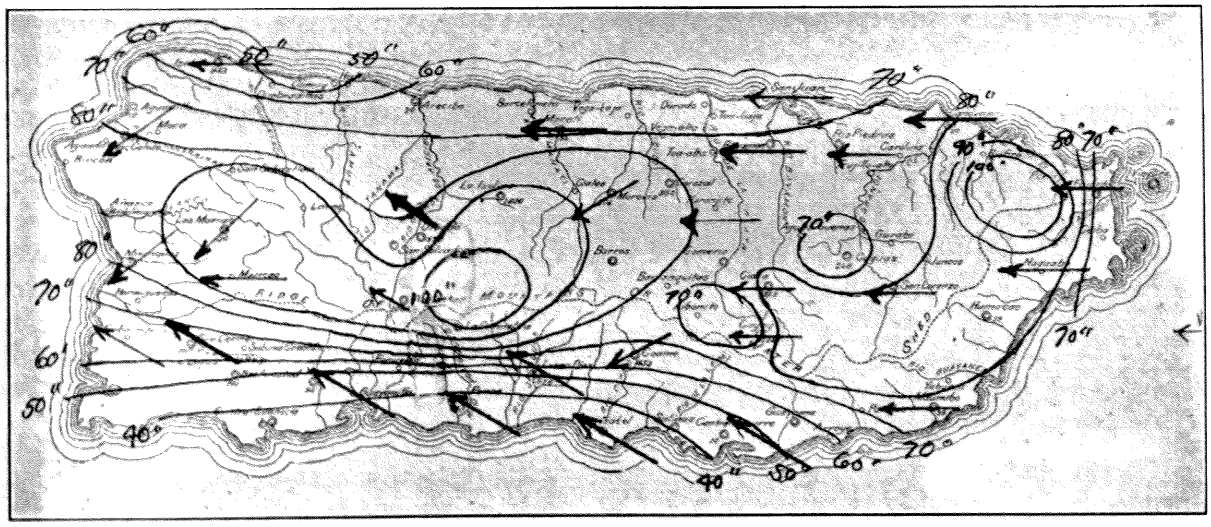
Locality	Mean annual temp.	Mean warmest month	Mean coolest month	Average daily range	Highest recorded	Lowest recorded
	Degrees	Degrees	Degrees	Degrees	Degrees	Degrees
Manila, P. I.	80	84	77	12	100	60
Colon, Panama	80	80	79	8	93	66
Barbados, B. W. I.	79	81	77	13	..	..
Kingston, Jamaica	78	81	75	17	97	57
San Juan, P. R.	78	81	75	11	94	63
Key West, Fla.	77	85	70	10	100	41
Havana, Cuba	77	82	71	11	100	53
Nassau, Bahamas	77	83	71	12	98	53
Porto Rico (Entire Is.)	76	79	73	19	103	40
Honolulu, H. I.	74	78	70	10	88	52
Aibonito, P. R.	71	75	67	24	98	40
Bermuda	69	79	62	..	..	..
New Orleans, La.	69	83	54	15	102	7
Los Angeles, Cal.	62	72	54	20	99	32

the slight difference in the elevation of the sun from season to season, to the small geographical extent of the land areas, and to the constant wind movement throughout the day and night. In the tropics the difference between the afternoon temperatures and the night temperatures is decidedly greater than the difference between the mean summer and mean winter temperatures, while in the higher latitudes the annual range in temperature in nearly all cases is larger than the diurnal range. Relief from the heat of the day in the tropics may almost always be found in the comparatively low night temperatures. During the middle of the day the sun's rays are tempered by the decreasing relative humidity and by the increasing force of the wind, which always accompany a rising temperature.

San Juan has a more equable temperature than any other portion of the Island, due to the fact that the city is almost surrounded by water—the ocean to the north and the harbor to the south. But few of the cities and towns of Porto Rico were built upon the immediate coast; the coastal plain towns have their "playas" or beeches, but the towns themselves were located two or more miles inland, beyond the reach of chance shots from passing vessels of the early days of the Island. Hence the temperature records of the coast towns show a diurnal range much greater than that of San Juan. The inland stations show a much larger difference between the early morning and the afternoon temperatures.

To those accustomed to the strong climatic contrasts of the northern latitudes, the difference between winter and summer temperatures in the tropics seem small and insignificant; they are, however, large enough to make a decided difference in personal comfort, especially at inland stations.

January is, on the whole, the coolest month of the year, although there is but a fraction of a degree difference between the mean values of January and February. From March there is a steady rise in the mean temperature, until a maximum is reached in August, generally, although frequently in July or in September. The differences between the mean temperatures of July, August, September and October, are very slight, and probably are due to differences in the rate of wind movement or variations in the amount of cloudiness. During the winter months the mean daily temperature is 75° to 76° along the coast, decreasing to 74° over most of the coastal plain. At stations farther inland the mean temperature ranges between 72° and 68°, depending upon the elevation above sea level. During the summer and early fall the mean temperature along the coast is 80° to 81°, although it frequently rises to 82° or 83° along the southeast coast. At the more elevated stations the mean summer temperatures vary from 76° to 74°.



PROMEDIO DE LLUVIA ANUAL EN PULGADAS Y DIRECCIÓN CORRIENTE DE LOS VIENTOS.
NORMAL ANNUAL RAINFALL (INCHES) AND PREVAILING DIRECTION OF WINDS.

There is fairly constant difference of 6° to 8° between the coast temperatures and those of the higher inland stations throughout the year.

Rainfall. The average annual rainfall for the entire island is 71 inches. This value is based upon the records of 44 stations, covering a period of 20 years. The annual amounts vary greatly from year to year, and in geographical distribution. In 1901 the average amount for the island as a whole was 94 inches, and in 1907, but 64 inches. The variations in geographical distribution are even greater. In the Luquillo Mountains, where rainfall is heaviest, the average annual amount exceeds 135 inches, with a maximum in 1901 of 169 inches; along portions of the south coast the average annual amount is less than 40 inches, with a minimum, at Aguirre in 1907, of 21 inches. At stations along and near the south coast the average annual rainfall is about 45 inches; along the north coast, the average is about 65 inches. Along the west coast the rainfall is greater, the annual fall being 75 inches, while along the east coast and at inland stations the average increases to 85 inches. These variations in the annual rainfall are due to differences of elevation, and to the trend of the mountain ranges with reference to the prevailing winds.

There are three well-defined areas of heavy rainfall, in each of which the annual amount exceeds 100 inches; (1) the Luquillo Range, a heavily wooded and comparatively inaccessible region in the northeast portion of the Island; (2) the peaks about Adjuntas, near the south-central part of the Island; (3) the mountains radiating from the western extremity of the main divide, in the vicinity of Las Marias and Maricao.

The most striking feature of the rainfall distribution is the contrast between the heavy and perennial rains north of the main divide and the light and irregular rains of the south-side coastal plain. Over the north side, comprising over two-thirds of the entire Island, an abundant rainfall may be counted upon in all seasons of the year, and protracted droughts are of rare occurrence; along the south coast the rainfall is not only comparatively light; but unevenly distributed throughout the year, and periods of several months with little or no rain are frequent.

The irrigation system along the south coast has in great measure overcome the disadvantages of an insufficient and irregular rainfall. In the mountains, but a few miles distant, there is an abundant water supply, available at all seasons of the year, which can be carried to the coastal plain at comparatively small cost. The main divide has been tunneled at two points, and the headwaters of the La Plata and Toro Negro rivers are being carried across the divide to the cane fields on the south side.

There are no well-defined wet and dry seasons on the Island. The winter rains are comparatively light, with a minimum in February at practically all stations. From February there is a steady increase in the average monthly amounts through May. From May to November the differences in the average monthly amounts for the entire Island are small. The maximum generally falls in September along the north coast, while in the mountains of the interior the time of maximum occurs in one of the summer months or as early as May. The seasonal distribution of rainfall shows a steady increase, for the Island as a whole, from 11 inches in winter to 24 inches in autumn, with 15 inches for the spring months and 21 inches for the summer months, making up the total of 71 inches, in round numbers, for the average annual rainfall of the Island.

The rains of Porto Rico, while frequently very heavy, are usually of short duration. The average duration of a shower is generally but a few minutes, although on many occasions a series of intermittent showers will extend over a period of several hours. During the passage of a tropical hurricane, or when one of the more extensive north Atlantic storms passes eastward along a more southerly route than usual, the period of continuous rainfall may be extended to several hours and even throughout the day, or there may be several successive days of unsettled weather with frequent showers. But such storms are of comparatively rare occurrence.

Rain occurs in some quantity, over some portion of the Island, practically every day

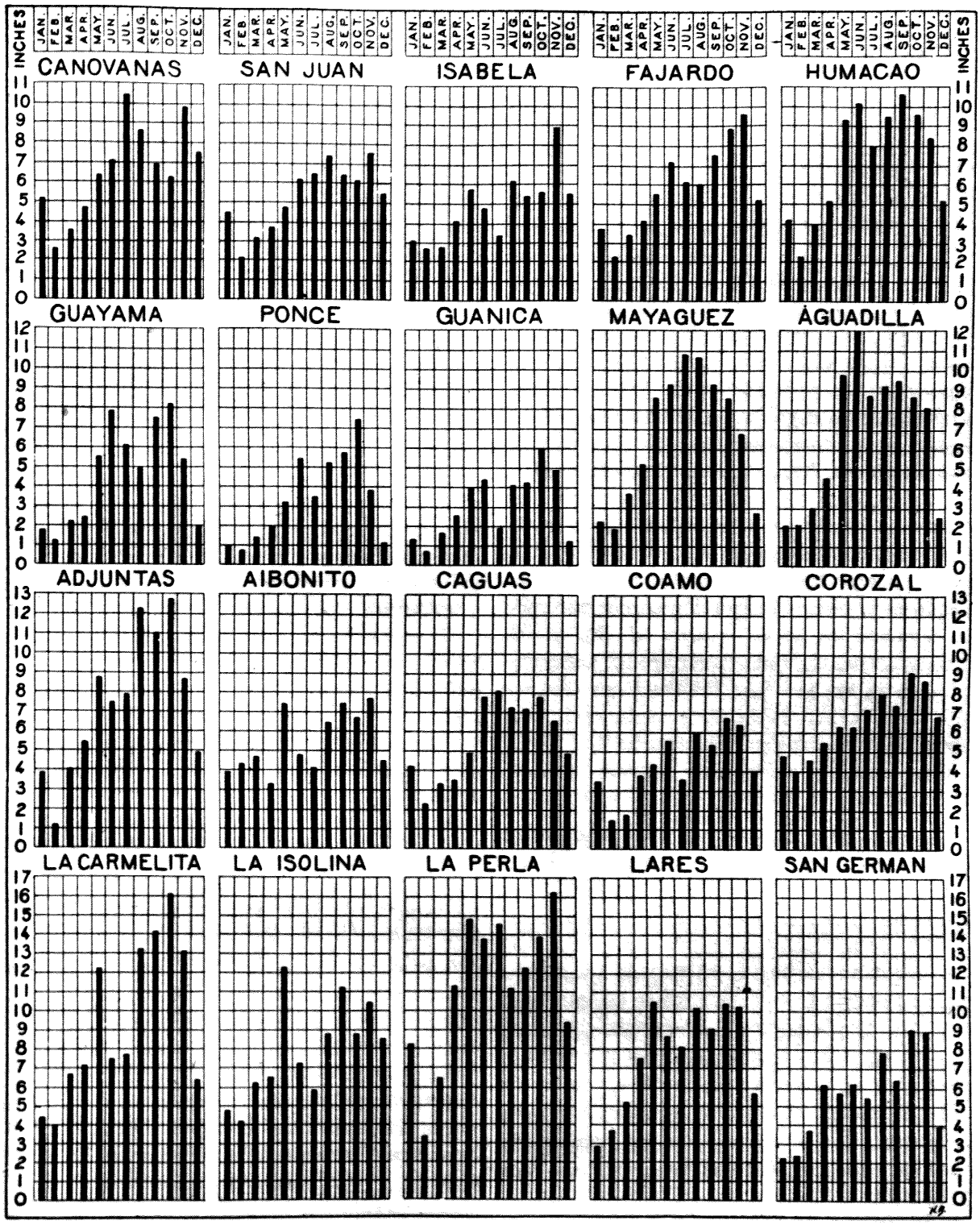


DIAGRAMA COMPARATIVO DE LA DISTRIBUCIÓN MENSUAL DE LA LLUVIA.
DIAGRAM SHOWING COMPARATIVE MONTHLY RAIN DISTRIBUTION.

in the year; it is probable that the month of February is the only month of the year having occasional periods of three or possibly four days without some rain somewhere within the Island. For the Island as a whole rain occurs on the average 162 days in every year. The minimum frequency in any one year was 28, at Guánica in 1907, while the maximum has been as high as 341, at La Perla, in the Luquillo Range, in 1900. The days with rainfall to the extent of .01 inch or more are distributed through the year with considerable uniformity, considering the Island in its entirety. The average monthly frequency varies between the narrow limits of 10 to 14 in the winter months, and 15 to 17 during the period from May to November. Along the southern coast the average annual number varies from 75 to 100; along the western and northern coasts, and generally in the interior, the average number of days with rain is about 175, and along the eastern coast the number exceeds 200. On the eastern slope of the Luquillo Mountains rain occurs on an average of nearly 300 days per year.

Humidity. The feeling of lassitude which is common to warm, moist climates, is to a great extent dissipated in Porto Rico by the persistent flow of the trade winds throughout the day and night, supplemented by the daily play of the land and sea breezes. While the large amount of moisture in the atmosphere becomes oppressive during periods when the winds fail, it is extremely favorable to the growth and development of vegetation throughout the year. On the dry south side of the Island the heavy dews of the night and early morning offer some compensation for the lack of rain. The high percentage of humidity also prevents the large and rapid fall of temperature during the night, so characteristic of drier climates. There are no official humidity records available for the drier inland stations of the island, but the observations at San Juan are typical for the entire coast. The variations in the average humidity from month to month are not large. The average for the entire year is 78 per cent; during the driest month, March, it is 74 per cent, and during the most humid months of October and November, it is 80 per cent. The relative humidity, of course, varies greatly during the course of the day, falling as the temperature rises with the advance of the day, and rising with the diminishing temperature of the night. The diurnal fluctuations are usually between 80 per cent in the early morning hours and 75 per cent in the middle of the day.

Sunshine and Cloudiness. While days with rain are frequent, and the rains are frequently heavy, there is an abundance of sunshine throughout the year in all portions of the Island. An inspection of the record of the comparative frequency of clear, partly cloudy and cloudy days will show a remarkable preponderance of clear and partly cloudy days over cloudy days. The record for San Juan, where hourly observations have been carefully maintained from sunrise to sunset for five years, shows on the average 139 clear days, 158 partly cloudy days, and 68 cloudy days per year. The variations at selected stations on the Island are shown in the following tabular statement:

RECORD OF CLEAR, PARTLY CLOUDY AND CLOUDY DAYS

	Clear	Partly Cloudy	Cloudy
Coast Stations:			
San Juan	139	158	68
Ponce	125	168	72
Mayaguez	95	189	81
Humacao	170	42	153
Inland Stations:			
Barros	220	108	37
Cayey	224	82	59
Coamo	216	53	96
Corozal	186	109	70
Lares	220	63	82

The Trade Winds. The trade winds, aided by the daily recurrence along the coasts of the cool, invigorating sea breeze, constitute a beneficent provision in the tropics for counteracting the enervating effects of a high temperature, combined with a large amount of moisture in the atmosphere. This is clearly shown during the occasional periods of a few days when the trades fail and light, variable winds prevail, accompanied by sultry and oppressive weather.

The average velocity of the winds is remarkably constant in Porto Rico, the hourly velocity from month to month not varying more than one mile from the average of 11

miles for the entire year, excepting in July, when it rises to 13 miles per hour, and in September and October, when it falls to 9 and 8 miles respectively.

Average Hourly Velocity and Prevailing Direction of the Wind at San Juan, Porto Rico. (Miles per hour)

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
Velocity	12	11	12	12	11	12	13	12	9	8	10	11	11
Prevailing direction	ESE	ESE	ESE	ESE	ESE	ESE	E	E	ESE	SE	ESE	ESE	ESE

Tropical Storms. Porto Rico is comparatively free from storms of all kinds. During the summer months a mild type of thunderstorm occurs with more or less frequency, but these storms seldom attain the intensity common to most portions of the United States during midsummer, and they attract little attention from the visitor from the north. The more destructive local storm of the type known as tornado is almost unknown in the tropics. In the middle latitudes, and particularly in the Northern United States, cyclonic storms pass across the country from west to east in all seasons with such frequency as to completely dominate the daily weather conditions; there is a constant succession of approaching, passing and disappearing cyclones. They vary in intensity from shallow barometric depressions which move quietly across the country producing only light winds and gentle showers, to storms of the greatest violence and of great geographical extent, at times covering more than half the area of the United States.

The tropics are singularly free from these cyclonic disturbances during the greater portion of the year, and there is a monotonous recurrence of similar weather conditions, interrupted only by light to heavy showers of short duration, or by the occurrence of a mild type of thunderstorm or squall. During the months of July to October, however, that portion of the trade-wind belt containing the West India Islands and the Caribbean Sea, is subject to occasional visits from the destructive type of cyclonic storm known as the West India hurricane. These storms are similar in form and general character to the temperate region cyclones, but differ from them in being more restricted in area and in moving more slowly. Their general direction is from east to west, within the tropics, being carried along with the general westward drift of the atmosphere. They curve generally in the Gulf of Mexico, or over the Bahama Islands, and then move northward and northeastward, either across the United States, up the east coast or over the Atlantic Ocean, where they can not be distinguished from the temperate region cyclones.

The recorded storms of this character within the limit of the area of the West Indies during the past 400 years number about 450, or an average of a little more than one per year. While they are liable to occur at any time from July to November, over 80 per cent of these storms during the past forty years have occurred in the months of August, September and October. Porto Rico has been singularly free from the severer types of these storms. Only on three occasions in forty years did the center of a hurricane pass over the Island—all of these in the month of August, namely, in August of 1891, 1893 and 1899. By far the most destructive of these storms was that of August 8, 1899.

These storms generally first appear within the field of view in the neighborhood of the Windward Islands, move in a direction between west and northwest at the rate of about 10 or 12 miles per hour, and then recurve to the northward and northeastward, increasing their velocity as they get into higher latitudes. The comparatively slow movement of these storms in the tropics is a fortunate circumstance, as it enables the official forecaster, after once locating the center, and determining the direction of movement, to give ample warning of their approach in the western waters of the Caribbean Sea and in the ports of the Gulf coast.

"LA CEIBA GIGANTE" DE PONCE.
"THE MOST SPREADING CEIBA IN NORTH AMERICA"—BRITTON.

Flora of Porto Rico

By Carlos E. Chardón, M.Sc.,

Commissioner of Agriculture and Labor. Former Expert in Cane Diseases, Insular Experiment Station. Former Member Cornell University Faculty.

The island of Porto Rico displays before the thirsty eyes of the student of Nature, one of the most varied and interesting floras of America. This flora has very marked characters which find its nearest relatives in the floras of the sister islands of Santo Domingo and Cuba. The island, however, has been separated geographically from the other Antilles for a period of time sufficiently long to have caused the origin of a large number of new species. Out of 2056 known species of ferns and flowering plants, 271, or more than 13% have originated in Porto Rico.

An Island of Exceptional Scientific Interest. This large number of endemic species has given to the island an exceptional scientific interest, since they indicate that evolutionary centers have originated in remote geologic epochs, the causes of which are unknown to us, but which have resulted in the origin of new species. One of the most remarkable of these evolutionary centers is still found in the sand barrens of Laguna de Tortuguero, N. E. of Manati. In this interesting region, and within the radius of a mile, are found 10 or 12 species of plants which are not known to occur in the rest of the island, nor in the rest of the world.

The varied topography of the island, the difference between the rain precipitation in different sections, the great diversity of soils, the numerous lagoons and marshes, all these factors have contributed in making of the flora of Borinquen, a treasure of scientific curiosities and botanical marvels. This rich flora, however, has scarcely received on the part of ourselves the insulars even slight scientific study, and we could only mention the names of a few of us who have been engaged in its investigation.

Contemporary Naturalists in the Island. The first place among the Porto Rican naturalists belongs, without doubt, to Dr. Agustin Stahl, of Bayamon. Although of German par-

entage, Dr. Stahl can be considered as a genuine native investigator. Among the sons of this land, he is perhaps the only one that through his scientific works, has achieved prominence in foreign circles. His botanical studies entitled "Estudios sobre la Flora de Puerto Rico" comprise several printed pamphlets, some of which yet remain unpublished, and constitute a scientific work which gives credit to his tireless investigating energy. The works of Dr. Stahl, which in other countries would have been considered as a subject of pride, appear in a few libraries only as a curiosity.

Contemporary with Stahl, Don Domingo Bello y Espinosa made studies on the flora of the island, but they were limited to its western portion, and especially to Mayaguez. He was born in the Canary Islands, but lived for many years in Mayaguez, where he practiced law. His works were published in the "Anales de la Sociedad Española de Historia Natural" under the title of "Apuntes para la Flora de Puerto Rico."

A large number of European and American botanists have visited the island with the purpose of studying the flora. During the Spanish regime, in the years 1884-1885, the German botanist Sintenis, collected extensively in the island and took with him to Berlin a very rich collection of plants. This collection was used by I. Urban as the basis for his work "Flora Portoricensis," which has been to the present time, the most complete treatise on our flora. The classification and nomenclature used by Urban is followed by the writer in the present paper.

Subsequent to the American occupation, the botanists O. F. Cook and G. N. Collins made studies on the flora which have been published in the "Contributions of the U. S. National Herbarium" under the title of "Economic Plants of Porto Rico." This work has lost much of its value on account of being out of date and of using a defective nomenclature, but still renders utility to the student.

The New York Botanical Garden has sent to the island various botanical expeditions with the purpose of completing the study of the flora. These expeditions have been headed by Dr. N. L. Britton, Director-in-Chief of the Garden. After many years of study, a complete revision of the flora has been written by Dr. Britton which will appear in the volumes of the "Scientific Survey of Porto Rico." The botanical portion of the survey, as well as the parts on zoology and geology, will constitute a veritable monument of American science and will raise Porto Rico to a scientific level much higher than that of any other island in the tropics. The complete work is being financed by the New York Academy of Science, aided by the Porto Rico government. Many of the most distinguished experts of the United States will contribute papers to it.

Classification of the Vegetable Kingdom. The vegetable kingdom is divided into two great groups of plants: The *Cryptogams,* or primitive plants which bear no flowers, and the *Phanerogams,* or higher plants which are provided with flowers.

The first group, *Cryptogamas,* includes the *Thallophytes* (algae, fungi and liquens) which on account of their simple structure have been considered as the most primitive plants, and the *Bryophytes* (hepatics and mosses) and *Pteridophytes* (ferns and fern allies) which have more complex vegetative structures and which have not abandoned the semiaquatic mode of sexual reproduction. A semiaquatic medium is needed for the process of reproduction which takes place by means of motile sperms.

The second group, *Phanerogamas,* includes the *Gymnosperms,* or plants bearing fruits but no flowers, and the *Angiosperms,* or plants which bear both flowers and fruits. The *Gymnosperms* are primitive flowering plants and a few of its species need the semiaquatic medium for the process of fertilization. The *Angiosperms,* on the contrary, have completely abandoned this mode of reproduction, and the sperms are enclosed in pollen grains which are transported to great distances by the wind and by insects. Nature has provided these plants with conspicuous flowers of showy colors and exquisite perfumes which attract the insects that are to aid in the process of fertilization.

Tree Ferns. Owing to the limited space given to the discussion of the Flora of Porto Rico, it has seemed advisable to omit the cryptogams, because they are plants which rarely attract attention. The ferns, however, may be cited as an exception, since the delicate and varied forms of many of its species, have often impressed the traveller. The ferns are found abundantly in the humid and cold regions of the interior of the island, where a few species have reached tree-like forms. These tree-like forms, or tree-ferns, one of the charming characteristics of the tropics, have given to the interior regions of the island a very salient botanical character.

Most of the space of this article will be given to the flowering plants, since these are the most common plants met with, and because it is the group that will really interest the reader. A discussion of the most important families will be presented, all of which will be given their botanical names, and an enumeration of the most common species of each of these families will follow. The common name will be given for each species, but for the benefit of those who would like to know their technical names, this is given in the appendix which concludes this article in Spanish.

How Botanical Nomenclature is Derived. Botanical nomenclature follows invariably the binomial system established by Linneaus which gives to a plant two latin names, the first of which is the generic and the second the specific name. The well known "bleros," to illustrate with a concrete case, belong in the genus *Amarantus,* family *Amarantaceae,* but there is a spiny species which is given the name of *Amarantus spinosus* to differentiate it from a non-spiny one, which is called ***Amarantus tristis.*** The scientific name of a species is international, and in this sense it is preferable to all common names, which we know vary in different countries, or even within the same country. Thus it will be realized the convenience of adopting an international language in the natural sciences, without which a chaotic condition will prevail.

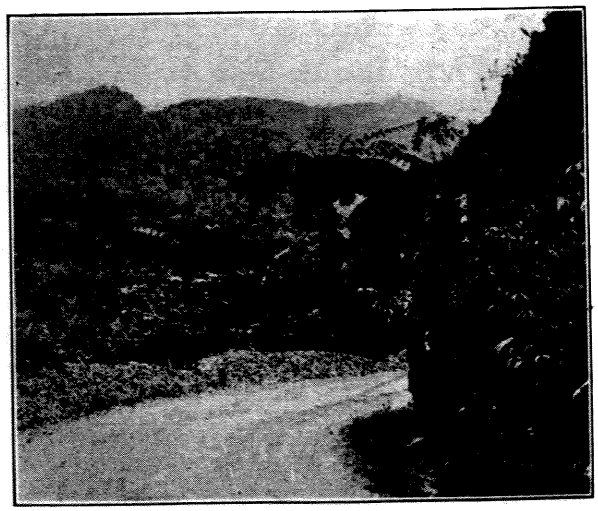
The discussion of the most important families will follow:

IMPORTANT FAMILIES AND SPECIES

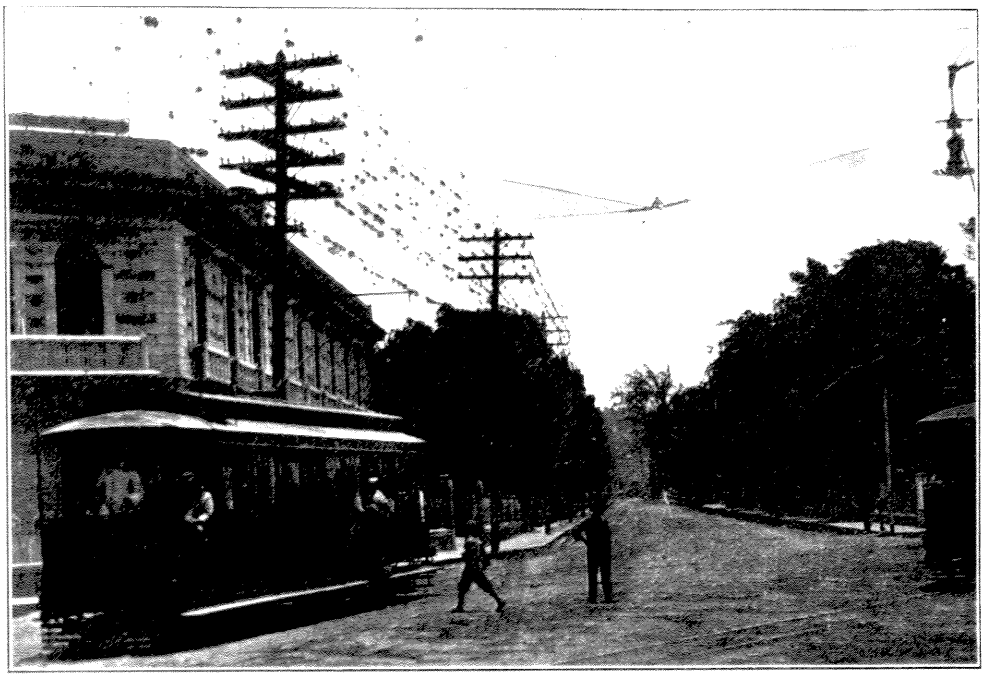
Class 1. Gymnosperms. To this class belong the conifers or pines, whose distribution is mostly limited to the cold regions of the earth. The contrast between the temperate and tropical landscapes is due to the exuberance of the pines in the former and their nearly complete absence in the latter. In the torrid zone the palms constitute the marked characteristic of the vegetation.

The *Gymnosperms,* properly speaking, are represented in the island's flora by only four native species, distributed in two families: 1. *Cycadaceae.* To this family belong the "Marunguey," which is said to cause the disease of cattle known as "ranilla." There are three botanical species in the island which have a very interesting geographical distribution: There is a broad-leaf species (1) which is found in the interior of the north coast, between Manati and Aguadilla; another with medium-leaves (2) which is found in the interior of the south coast, from Coamo Springs to Cabo Rojo; and a third, with long, narrow leaves (3) which is limited to the limestone hills near Guanica.

2. *Taxaceae.* There is a single species in Porto Rico, which is found only in the mountains of the Cordillera to the east of Maricao. There it is known as "caoba" and few specimens of it are now found. The species of this genus (*Podocarpus*) are of common occurrence



HELECHO ARBORESCENTE.—ARBORESCENT FERN.



NIDOS DE GUNGULÉN EN LOS ALAMBRES DE LA LUZ ELÉCTRICA DE LA AVENIDA HOSTOS, PONCE.
MOSS GROWING ON WIRES—NOT AN ELECTRIC PLANT.

in the tropical countries of the southern hemisphere, and the fact that one of them occurs in the hills at Maricao, is in itself an interesting fact in geographical botany.

Class 2. Angiosperms. This immense association of plants, among which are to be found those which on account of their properties and agricultural and industrial uses, have contributed to the welfare of the human species, is characterized by the possession of more or less conspicuous flowers. These flowers are provided with the organs of reproduction, the stamens, pistils and ovaries, and these organs, being the highest manifestation of the species, indicate, more than any other part of the plant, the affinities between the different groups. Thus the flowers constitute the fundamental basis for the classification of plants.

The *Angiosperms* are divided into two subclasses: the *monocotyledones* and the *dicotyledones* which form two divergent lines of evolution. The first of them, and perhaps the most primitive, terminates in the orchid group, a very interesting family of plants having very delicate flowers and many take their nourishment from the air; the second of them, after passing through a great diversity of flowerforms culminates in the Dandelion family; one of these flowers is made up of a large number of smaller ones, some of them staminate, others pistillate, and still others which have both sexes.

Other fundamental differences between the *mono-* and the *dicotyledones* are that the former generally have one cotyledon in the embryo, the leaves have parallel venation and the diameter of the stalk does not increase with age; while among the latter, there are two cotyledons present in the embryo, the venation of the leaves is not parallel but reticulate, and the stalks of some of the species increase in size with age forming a woody trunk, through the activities of the cambium.

Subclass 1. Monocotyledones. 3. *Typhaceae.* The "enea" constitutes the only representative of this family in the island. It grows very commonly in marshy places, along the shores of lagoons and river outlets.

4. *Gramineae* (122 species). This family has a large number of species many of which are of economic importance to our agriculture and industries. The sugar-cane (6) ranks first among our economic plants and a great part

of our welfare depends on the culture and industry, of this rich grass. The Uba or Japanese cane (7) which was introduced in the island to combat the mosaic or "matizado" disease (see the article on this disease) is being cultivated profitably in the western portion of the island and promises to do well in other sections of the island infected with the disease. The corn (8) and rice (9) are also important in our agriculture, although the area devoted to their cultivation is rather limited and their production does not supply the wants of the island. Among the forage species we have the Guinea grass (10) which was introduced with the negro importations from Africa, and the "malojillo" or Para grass (11), introduced from Brazil. The Bamboo (12), the most exuberant of the known grasses is a native of the far East, where it flowers and produces fruit in abundance, but in America, the bamboo very rarely flowers. Dr. Britton has on record a tree from Trinidad as having produced flowers and fruits in great abundance.

There are in the island, many other species of Gramineae which form natural pastures, and several other species recently imported by the Experiment Station of Mayaguez, which have decidedly increased the number of our forage plants.

5. *Cyperaceae* (86 species). With regards to the number of species, this family is abundantly represented in the island. It is similar to the latter, but has no species of economic importance. The genus *Cyperus* alone, includes 18 species, some of which are found in marshy places and others are troublesome weeds. Among the latter may be mentioned the "coqui" or "coquito," whose eradication in the cane fields is extremely difficult.

6. *Palmae* (10 species). The coconut palm (14) which is so characteristic of our landscapes, is found abundantly along the coast between Mayaguez and Añasco, on the beach at Humacao and between Rio Grande and Luquillo. Coconuts are today one of the island's chief fruits for export. There is also the Royal palm (15), the "Palma de Corozo" (16) and the "Palma de sombrero" (17). The leaves of this last named species are used for the hat industry at Cabo Rojo. The "Palma de Sierra" (18) is found in the high elevations, 2,000 feet above sea level and many of the high peaks of the Cordillera Central are found almost wholly covered with this rare species. The Date palm (19) which has been imported from Africa thrives well in the arid climate of the south coast; many exotic palms are grown for ornament.

7. *Bromeliaceae* (26 species). The pineapple (20) belongs to this family. The group includes many plants which get their nourishment from the air. The so-called "nidos de gungulén" (21) which are found on the telephone wires in Ponce and other places, possess specialized organs in the epidermis which enables the plants to absorb the humidity from the air. The "barbas de ucar" (22) which hang down from the "Ucar" trees in the region of Coamo, also belong to this group of plants.

8. *Musaceae* (5 species). This important family includes species with great agricultural value, among which may be cited the plantain (23) and the banana (24) with their numerous varieties. The classification of the genus *Musa* differs according to different authorities, and among them Cook and Collins refer the dwarf banana to a species (25) distinct from the ordinary commercial banana. Fondness for these fruits may be justified on the grounds that even Linneaus himself called the plantain the Musa of Paradise, or technically speaking, *Musa paradisiaca*. The traveller's tree (26) which has leaves very much like those of *Musa*

LA PALMA DE SOMBRERO CUYO ASPECTO PECULIAR ES CARACTERÍSTICA MUY SALIENTE. (THRINGIS LATIFRONS)—HAT PALM.

and which are arranged in fan-like array is an exotic species which comes from Madagascar; several of these are to be found in the gardens at Santurce.

9. *Orchidaceae* (86 species). The orchid family is very richly represented in the forests of the interior of the island. There they are found strongly adhering to the trunks and branches of trees showing their delicate flowers and attracting swarms of insects with their exquisite perfumes. The orchids, which have been called by Santos Chocano "caprichos de cristal," aside from their aesthetic value, represent in science the highest group in the evolution of the monocotyledones. In these flowers, the number of stamens has been reduced to one, and the association with insects is necessary for fertilization. In some of the species, as the vanilla (27) fertilization is so difficult in the process of nature, that it has to be aided artificially by man in order to secure fruits or pods.

Subclass 2. Dicotyledones. 10. *Casuarinaceae* (1 species). The Australian pines which are found in the Paseo de Covadonga of San Juan, have been imported to the island and constitute the only representatives of this family in its flora. It is a fast growing tree and deserves to be more grown in the island's gardens and along its public highways.

11. *Polygonaceae* (19 species). The genus *Coccoloba* includes various common species. The "Uva de Playa" (29) is found in abundance along the coast, but a few large specimens have been noticed growing several kilometers inland. Other well known species are the " ortegon" (30) and the "calambreñas" (31).

12. *Amarantaceae* (22 species). This family includes many species which grow in waste places and cane fields. The species of the genus *Amarantus* are vulgarly known as "bleros" or "bledoes" and there are five of them represented in the island's flora.

13. *Nymphaceae* (4 species). The "flor de agua" (32) which is found in stagnant waters is one of the species most conspicuous for the beauty of its colors. The flowers, however, do not possess a pleasing perfume and very soon wilt, so they have to be admired in their natural state. They have been seen abundantly in the neighborhood of Isabela along the road to Aguadilla.

14. *Annonaceae* (11 species). The species of the genus *Annona* are commonly found in the south coast. Three of them bear fruits which are greatly esteemed: the "corazon" (33), the "anon" (34) and the "guanabana" (35). The "ilan-ilan" (36) which bears flowers of inconspicuous appearance but with exquisite perfumes, also belongs to this group.

15. *Lauraceae* (24 species). The species of this family are mostly trees which produce excellent woods. To this family belongs the large variety of trees known as "laurels" and their allies which are found in the forests and moist regions of the island. Here also belongs the "aguacate" or Alligator pear, technically (37) known as *Persea gratissima.*

16. *Leguminosae* (136 species). With regards to the number of species, the Leguminesae is the largest family of the flora of Porto Rico. It is subdivided into three great tribes, which are sometimes raised to family rank. These are: *Papilionaceae, Caesalpiniaceae* and *Mimosaceae.* The family includes a great variety of plants of very diverse forms ranging from the well-known sensitive plant or "morivivi" (38) to the Flame tree or "Flamboyan de Indias" (39).

Among the plants of economic importance are to be found the bean (40), the lima bean (41) and the pigeon pea (42). Some of the trees are used for shade in the coffee plantations, such as the "moca" (43), the "guamá" (44) and the "guaba" (45). The "Campeche" tree (46) furnishes most excellent wood.

The species of this family are able to assimilate or fix the nitrogen from the air by means of small nodules which are found in their roots. These nodules are filled with certain bacteria which work actively in the fixing of the free nitrogen of the atmosphere and turn it from an inert condition to a form which can be readily used by the plants. This interesting process gives the Leguminosae a decided advantage in the plant kingdom, since the rest of the plants have to take the nitrogen from the soil where it is found in very limited quantities.

17. *Rutaceae* (16 species). The species of the genus Citrus belong to this group of plants:

the orange (47), grape-fruit (48), sour-orange (49), citron (50), lemon (51), "limon dulce" (52) and the mandarin (53). No other species of this family has economic importance, excepting possibly the "tea" or "palo de tea" (54) which furnishes excellent wood for fence-posts.

18. *Euphorbiaceae* (69 species). The Euphorbiaceae are characterized by the milky exudation of their stems. The family is very richly represented in the island's flora. Among the most common species may be mentioned the "grosella" (55) the castor oil bean (56), the "yuca" (57) and the "tartage" (58). The purgative effects of the nuts of the latter species are so strong that they may even bring death. The "túa-túa" (59 grows common in waste places and the infusions from their roots are reported to have cured cases of Bright's disease. The sandbox or "haville" (60), a spiny tree with very light wood grows well along the road from Carolina to Fajardo.

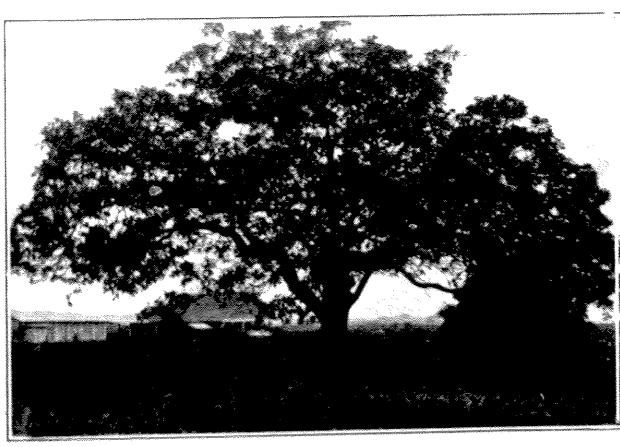
19. *Anacardiaceae* (7 species). The island representatives of this family are all trees, among which may be mentioned the well-known mangó (61), the "pajuil" (62) and the "jobo" (63).

20. *Malvaceae* (51 species). This is a group of plants of great economic importance to agriculture and industry since it includes the cotton (64). It is well known that the fiber from the cotton of the island is of the highest quality. The rest of the species have little or no value and are found as weeds in the fields and along the roads. The genus *Thespesia*, which is the only one in the group to include trees, has two species represented: the "maga" (65), an endemic species, and the "Santa Maria" (66).

21. *Bombacaceae* (3 species). The well-known "ceiba" (67) belongs to this family. This tree seems to thrive well in the semiarid region of the south coast. Its powerful root system penetrates very deeply into the soil and enables the tree to reach subterranean currents of water. The magnificent specimen of this species which is found on the Portuguese River, near Ponce, is one of the largest "ceibas" known in America. This botanical marvel which certainly dates back to the precolombian days ought to be declared public property by the city of Ponce as a symbol of the days of the old Borinquen. The "guano" (68) is also included in this family. The seeds from these two trees are provided with very light appendages and are carried by the wind through great distances. This greatly facilitates to propagate the species.

22. *Guttiferae* (9 species). The "mamey" (69) is a species of economic importance of this group of plants. There is also the "cupey" (70) and the "palo de Maria" (71). There are magnificent specimens of the latter species in the Borinquen Park of Santurce. It is a very rapid-growing tree and its planting along the roadsides of the island ought to be recommended.

23. *Passifloraceae* (8 species). The species of this family are included under the single



PAJUIL (ANACARDIUM OCCIDENTALE L.).

PALO DE GUANO. (OCHROMA LAGOPUS SIV.)—LIGHTER THAN CORK.

MARUNGUEY.—ZAMIA INTEGRIFOLIA AIT.

genus *Passiflora,* which means "Passion flower." In all the plant kingdom there is no flower that can be compared with it in the symmetry and the beauty of its arrangement. It has all the qualities which are admired in a flower, and especially its complexity is to be admired. Some of the species produce flowers with no perfume. Among the wild species may be mentioned the "parcha" (72) and the "tagua-tagua" (73).

24. *Cactaceae* (17 species). The interesting group of plants is richly represented in the south coast. The species of this family are found in abundance back of the mangroves of the coast between Ponce and Guayama, in the mountains at the Peñon in Ponce, and in the calcareous hills between Guayanilla and Guanica. The thickness of the stems of these plants permit them to withstand prolonged periods of drought. The characteristic aspect of the flora of the south coast is largely due to the presence of the cacti.

25. *Combretaceae* (5 species). The "almendro" (74) is the commonest example of this family, but the group includes also the "mangle colorado" (75), the "mangle blanco" (76) and the "úcar" (77), all of them trees. The "mangle colorado" is found growing in the shallow salt waters of the sea, but the "mangle blanco" grows on the mainland near the sea.

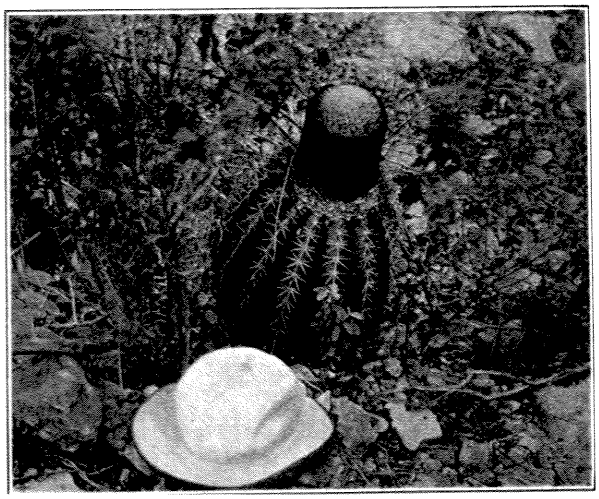
26. *Myrtaceae* (34) species). The *Myrtaceae* include the "granada" (78) and the "pomarosa" (79). The species of the genus *Eugenia* include some trees and shrubs which produce rich woods. They are commonly known under a great variety of local names. The "guayaba" (80), which is so common a shrub in waste places is slowly disappearing as the land is rapidly availed of for the growth of sugar-cane. It is not cultivated and man is thus dependent on the wild plants for their fruits which are used for the delicious guava jelly.

27. *Melastomataceae* (46 species). This family includes the "camaceys" with 18 species which are botanically included under the genus *Miconia.* The characteristic veins of the leaves of these shrubs are well known. These species, and also the "palo de cenizo" (81), are very characteristic of the flora of the northern coastal plain.

28. *Borraginaceae* (35 species). This is the family of the Heliotrope (82). It includes the important genus *Cordia,* with the following species common in the island's flora: The "cerezo" (83, 84), the "moral" (85) and the "capa prieto" (86), all of them trees which produce excellent wood.

29. *Convolvulaceae* (39 species). This family includes many trailing plants, all of which, with the exception of the genus *Cuscuta,* having very conspicuous corollas. The species of *Cuscuta* have no leaves and twine around the stems of other plants, and by means of special organs are able to absorb the food from the host plants. The genus *Ipomoea,* with 17 species, includes the sweet potato (87).

30. *Apocynaceae* (16 species). This is the



"MELÓN DE COSTA." (CACTUS INTORTUS.) "TURK'S HEAD".

PINO DE AUSTRALIA (CASUARINA EQUISETIFOLIA). MORAL (CORDIA SULCATA D. C.). JAGUA (GENIPA AMERICANA L.).

"Aleli" family (genus Plumiera), with three distinct species: The "Aleli" proper (88), the "Aleli blanco" (89) and the "Aleli cimarron" (90).

31. *Asclepiadaceae* (15 species). The flowers of this family are very attractive and conspicuous, as is the case with all the milkweeds. There are two species: the "platanillo" (91) which is the most abundantly found, and the "platanillo blanco" (92) which bears white flowers and which is found in the mountains. The "algodoncillo" (93) is common along the south coast. All these species are provided with special organs for dispersion by the wind.

32. *Verbenaceae* (30 species). From the standpoint of economic importance this family has but little value. Some of the common species are: the "cariaquillo (94) and the "cariaquillo de Santa Maria" (95). The family has also some well known tree-representatives; among which may be cited the "higuerillo" (95) and the "pendula" (97).

33. *Labiatae* (19 species). Family similar to the last one. The species are common in pastures and waste places but none of them have economic importance. None of the species are conspicuous excepting perhaps the "molinillo" or "rascamoños" (98).

34. *Solanaceae* (37 species). A well known family on account of its economic importance. It includes the tomato (99), the eggplant (100) and the potato (101). In some localities the tomato has escaped cultivation and some specimens of wild plants have been seen bearing very small fruit, which indicates that the species has gone back to its primitive type. More important than these is perhaps the tobacco (102) which constitutes the island's second article of export.

35. *Rubiaceae* (80 species). This is the coffee (103) family and as it may be seen by the number of species it is one of the richest of the island's flora. Besides the "jagua" (104) this family includes many other species which we do not feel justified in enumerating here; many of them are characterized by the possession of leaves in whorls. The "tea" produces wood of excellent quality.

36. *Compositae* (89 species). The family of the composites, one of the largest of the world, represent in the scale of evolution the highest complexity of the floral type. In this family the flowers are crowded together on a disc. This facilitates fertilization, since the bees are able to visit large numbers of them in a short time. Among the species represented, none are of importance to agriculture, and on the contrary, some of them are noxious weeds, such as the "romerillo" (106) and the "margarita amarilla" (107).

San Juan is said to be the best locality for the collection of star fish, and 49 different kinds are known. There are at least 162 different crabs and the large land crab that migrates inland has often been reported damaging cane fields. The types of lobsters and shrimps number about 59 and one small lobster is a near relation of the one so well liked in the Continental United States. Bivalve shells such as the oyster and clam are rather rare. The oysters in Porto Rico instead of occurring in beds are often found clinging to mangrove roots.

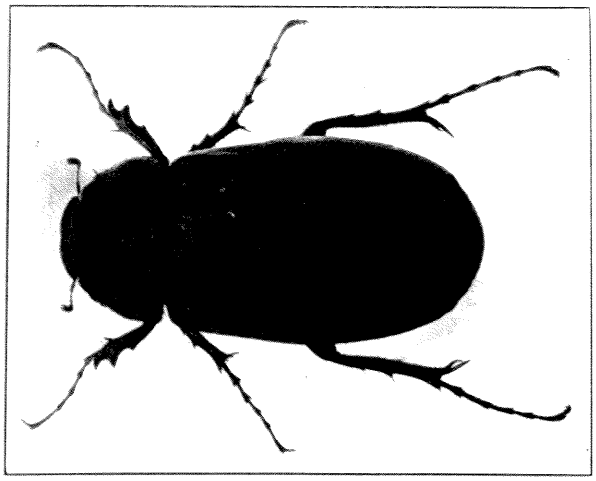
Higher Forms of Animal Life. The outstanding feature that will most often be noted about the fauna of Porto Rico is the absence of the alligator, crocodile, skunk, common toads and rabbits, and the scarcity of snakes. Perhaps the only snake of importance that has been recorded is of the boa-constrictor type. This can be partially explained by the fact that owing to the density of population many forms of animal life that once occurred are now extinct. It is known that this fact is true of some of the forms of bird life. The Manatee or sea cow is found rarely, turtles are rare except in the east end of the Island where the Hawks Bill and Green Turtles are found. The lizards on the other hand are very prevalent. There are ten common types of lizards ranging from the small tree lizard to the larger ground lizards. They do incalculable good by their feeding on numerous insects. It has been estimated conservatively, that they destroy from 4,480,000 to 22,400,000 insects per month on each square mile of land. Of little tree frogs there are several kinds including the little "co-kee" that is heard during the night hours. They also eat many insects. The mongoose was imported to Porto Rico from Jamaica in 1877 by Don Guillermo Lamb, a planter of Carolina. It was hoped that the mongoose would destroy the rats which are so prevalent in the sugar-cane fields and elsewhere, but it has not been as satisfactory as was expected.

Spiders and Near Insects. While the tarantula has occasionally occurred in Porto Rico, the large brown spider that often causes much excitement when it happens to be imported into the United States on a bunch of bananas, does no harm but good as it feeds on cockroaches and sphinx moths. There are only two near insects that are poisonous, the scorpion and the centipede, the latter is said to be very poisonous, but in a single instance known, its sting only amounted to a few days of severe pain and discomfort.

INSECTS

Insects, and the Role They Play. The insects are always of interest not only because of their beautiful colors, as are shown to the best advantage by the moths and butterflies, or because of their large and ungainly form as is typified by the giant rhinoceros beetle, but their greatest interest however is the part they play as carriers of disease, the good that they accomplish as well as the great economic losses that they cause to the farmers. The Naturalists of the early days were more generally interested in the insects alone while the Scientists of to-day are not only interested in the insects because of themselves, but because of their relation to man and his welfare. This latter phase is a most important and late development of the problem.

Relation of Birds to Insects. In cöoperation with the United States Biologic Survey, Mr. Alex Wetmore made an extended survey to determine the relation of the Island Birds to the Insect Fauna. This is well covered in his Bulletin "Birds of Porto Rico."



"CACULO". (PHYLLAPHAGA CITRI.) ATTACKS ROOT OF CITRUS TREES WHEN A GRUB.

FISHES

Importance of Fish to Porto Rico. The subject of fish and fishing ought to be of a great and increasing interest to the people of Porto Rico, because fish is one of the staple articles of diet and this is especially true in the interior of the Island. Large quantities of salt cod fish and herring are imported every year. With the exception of the coast towns, which have their markets and local venders practically no fresh fish is seen.

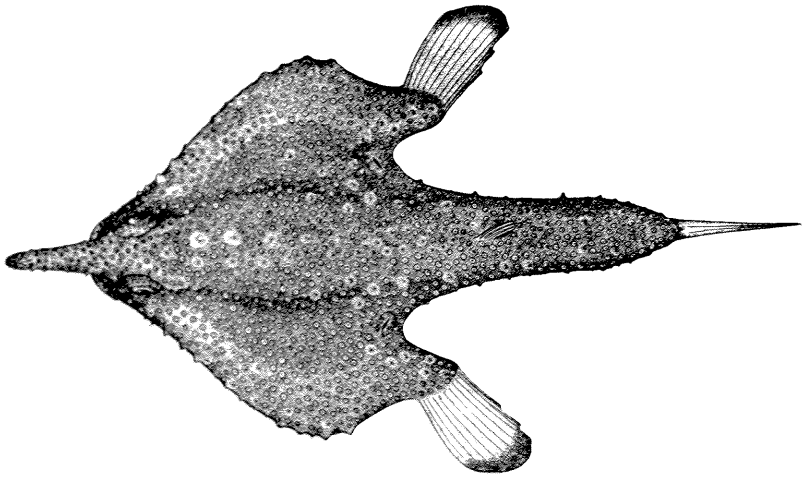
Fish of Interest to the Tourist. To the tourist, fish are not only interesting because of their dietetic value but also because of their qualities that lead them to be sought for as a pastime or sport. Then, too, there are others who are interested in fish because of their beautiful coloration or bizarre form or habits. Porto Rico harbors either in her rivers or seas fish of all of these types. This represents approximately two hundred and ninety one different kinds of fish which are representative of seventy six families and one hundred and sixty five genera.

Methods of Fishing in Porto Rico. But a comparatively few people are engaged in this industry and fishing as a sport is practically unknown. The fishing tackle consists of the simple hand lines, cast nets, haul seins, gill nets, and pots or traps. The frame of the pots is made of mangrove or other wood and the body is of woven cane, bark or bamboo, the whole is fastened together with calabash roots and resembles a very large six sided lobster pot. The traps are made by building a hedge of canes across a stream with a gateway for passing boats. Pockets are built at various places in this hedge and the fish thus caught are removed with dip nets.

Edible Fish. There are about fifty species of edible fish and among them may be mentioned: the Mullett and White Mullett much esteemed for eating; Lane Snapper, an important food fish of a beautiful rose color with a series of deep golden yellow stripes along the sides; Mutton fish, fairly flavored, but not delicate; Mangrove Snapper, which is not only edible but also makes a good fight, and hence is attractive to sportsmen; Silk Snapper, bright rose in color, a valuable food, about fourteen inches in length, caught in water of sixty fathoms depth with sardines as a bait. The Robalo is a game fish. The Herrings are represented in the fish markets by about five genera. They are mostly used for bait although some are very rich and delicate and compare most favorably with the sardines of commerce. The Dajao is an important food fish caught in fresh waters. The Gerridae or Mojarras are often found in the markets, only the largest of them is eaten however and is not much esteemed. The Nassau Grouper is an excellent food fish. The Pompanos are nearly all of food value. The Spanish Mackerel is too well known to need comment. From this brief resumé it is seen that there are many different kinds of edible fish about Porto Rico, and thus a great opportunity is offered for the improvement of the fishing methods, and the transportation and packing of fish for home consumption.

Game Fish. In addition to the fish already mentioned there are others that ought to be of great interest to sportsmen because of their gameness. The two best groups in this respect are perhaps the Snappers, represented by fourteen or more species in Porto Rico, and the Sea Basses. The Red Snapper which is also common in the southern coast waters, Gulf of Mexico and California Coast, attains the length of two to three feet and weighs from thirty to forty pounds. It is sluggish until it gets to the surface of the water when it becomes frightened and the battle royal begins. The best group of the Sea Basses are what is known as the Groupers. The Rock Hind is of this class and is one of the most beautiful of the tropical fishes. It is of a rich color, caught with hook and line and will take any kind of bait. Unfortunately but few have been found about Porto Rico. The Red Hind, also one of the same class, is one of the most beautiful of game fishes. It too is caught with hook and line at moderate depths near the coral reefs. It may be of interest here to say, that the young of the celebrated Tarpon of Florida, the greatest king of game fishes, have been taken at Fajardo and Húcares, P. R. No adults have as yet been reported.

Fish of Beautiful Coloration. The Butterfly Fish well deserve their name because of their brilliant coloration. It is said that their excessive quickness of sense and motion enables them to maintain their struggle for existence in spite of their bright colors. One of the handsomest of the Butterfly Fish is the Rock Beauty. This fish is of a soft black color, has a rich orange head and tail, and the rear fins are of red and orange. It reaches the length of a foot or more and is in addition a good food fish. The Parrot fishes are a herbivorous fish of the tropical seas, found about coral reefs. Their flesh is soft and flabby and they are chiefly interesting because of their high coloration.



"DIABLO".—BAT FISH.

Fish of Bizarre Type. The bizarre type is well represented in Porto Rico and among the most notable are the Pipe Fish to which the well known Sea Horse belongs. These fish are often pictured in the Natural Histories. In this family the eggs of the female are transferred to an egg pouch on the male. Here the eggs are kept until hatched and the young escape. The File Fish is so called because of the peculiar shape of the foremost dorsal fins. The Trunk Fishes are tropical, easily preserved, and most often seen in collections. This fish propels itself through the water with a curious half rotary motion similar to that of a screw propeller. The Puffer Fish have a peculiar habit of filling their stomach with air and floating belly upwards. They are said to be poisonous. The Porcupine Fish is always of interest because of its appearance. One of the Killi-Fishes is known only from the mountain springs of Porto Rico. The Bat Fishes have a curious flattened body covered with bony tubercles which gives them a grotesque look and by the ignorant are supposed to be venomous. In Porto Rico they are called "Diablo" or "Murcielago de Mar". The Hound Fish when startled swim most rapidly and often leaps into the air. Although of food value it is shunned because of its green bones.

This subject of Fish and Fishing is comprehensively treated in the "General Report on the Investigations in Porto Rico of the United States Fish Commission Steamer Fish Hawk in 1899 by B. W. Evermann." It is regretted that some of the handsome colored illustrations, taken from life, could not be shown here. It is also regretted that provision has not been made either by subscription or endowment for a suitable aquarium in Porto Rico, which would be of great interest to visitors and of much value in a scientific way.

Birds

By José J. Monclova Cagígal, Ph.G.,

Ex-Secretary and Ex-President of the Board of Pharmacy of Porto Rico. Honorary Pharmacist to the Royal House of Spain. Ex-Member of the Insular Board of Health. Representative of Porto Rico at the Paris Universal Exposition of 1889. Member of the Association of Pharmacists of Madrid and of Several Foreign Scientific Societies. Awarded two Grand Prizes and Numerous Medals at different local and Foreign Expositions for Pharmaceutical Preparations. Author of various Pedagogical and Scientific Works.

The study of natural sciences is the most attractive and suggestive of all studies because therein the observer always finds something new. But of all the natural sciences, Zoology is the one that counts on more devotees because of its two branches, Ornithology and Entomology.

Ornithology is that part of Zoology which deals with the study of birds. This study is of great value to agriculture, for birds are the soil tiller's best ally, since he bases all his hopes of welfare on the success of his crops.

According to Réaumur, Olivier and Latreille, entomology is that part of zoology dealing with insects and with all the articulates.

Birds are interesting not only because of their colors, gracious forms and agreeable song, but to a greater extent because of their usefulness as essential factors in the defense of plants which without the birds would be destroyed by the voracity of numberless insects and would entirely disappear.

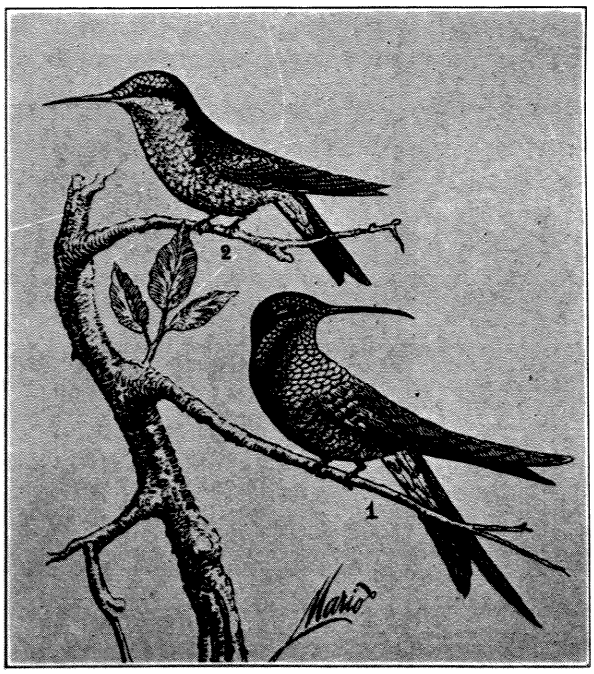
An Act for the Protection of Birds. About the middle of the last century the southern departments of France were invaded by numberless insect plagues which destroyed crops, ruined agriculturists and provoked a season of hunger. The government investigated the cause of the public calamity and discovered that it was lack of birds due to the rude and incessant persecution of which they were the object. What, then, was the remedy? A most severe law was passed for the protection of birds, while at the same time a number of different species of birds were introduced into the suffering zone. This alone was sufficient to cause the insect invasion to lose its nature as a plague.

The existence of birds, therefore, is conclusive evidence of the success of crops and of the welfare of the farmer, for which reason birds deserve protection.

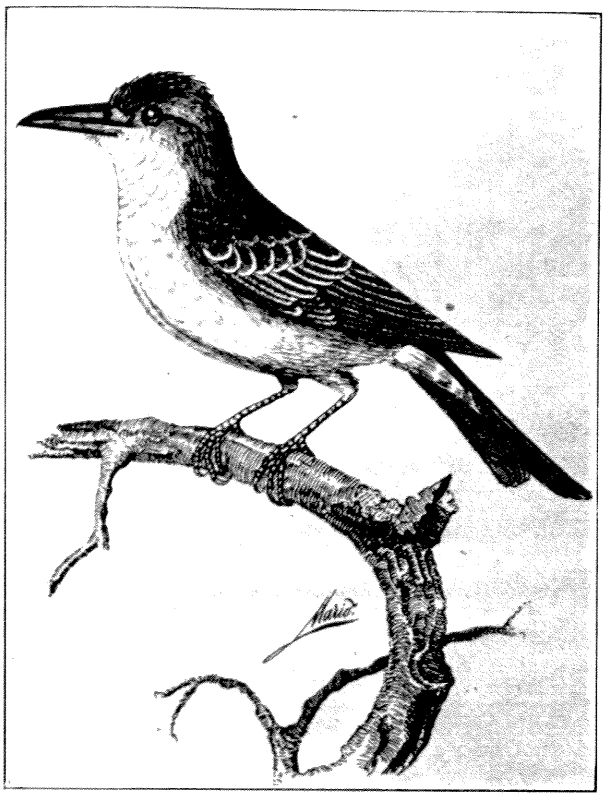
It is necessary to know the birds and their habits, and what they eat, in order to secure their existence and insure procreation.

Birds Existing in Porto Rico. In writing my work "Ornithology of Porto Rico," the principal object was to make known the birds of the island. This work was written in Spanish, French and English, with the scientific names in Latin, in order to spread a science which by its very nature must be of great advantage to public and private schools and libraries, since the work deals with a region of whose birds little has been written and of whose birds much less is known.

The number of different classes of birds



EL ZUMBADOR—MACHO (1) Y HEMBRA (2).
HUMMING-BIRD—MALE (1) AND FEMALE (2).



EL PITIRRE.—GRAY KINGBIRD.

existing at present in Porto Rico is 157, divided into orders and families as follows:

Order 1—Birds of prey—two families—six varieties; Order 2—Birds—thirteen families—57 varieties; Order 3—Climbers—three families—9 varieties; Order 4—Gallinaceous—two families—5 varieties; Order 5—Doves—one family—9 varieties; Order 6—Cranes—six families—45 varieties; Order 7—Web Footed—two families—26 varieties.

Birds Beneficial to Agriculture. From examinations made of the stomachs of many of the birds of Porto Rico we have been able to ascertain which of them are useful or beneficial to agriculture.

Here is a list of them: Falcon, turtle-dove, ani, humming-bird, gray kingbird, flycatcher, petchary, swallow, mocking-bird, Jamaican and Latimer vireo, parula warbler, prairie warbler, Adelaide warbler, black and white warbler, banana-quit, hooded weaver-finch, yellow-shouldered blackbird, oriole, grackle, spindalis, Carib grass quit, Bryant grassquit, sparrow.

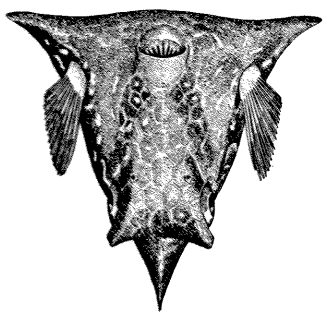
The song birds of Porto Rico are: Mocking-bird, euphonia, yellow warbler, Jamaican and Latimer vireo, troopial, oriole, bananaquit, sparrow and yellow-shouldered blackbird.

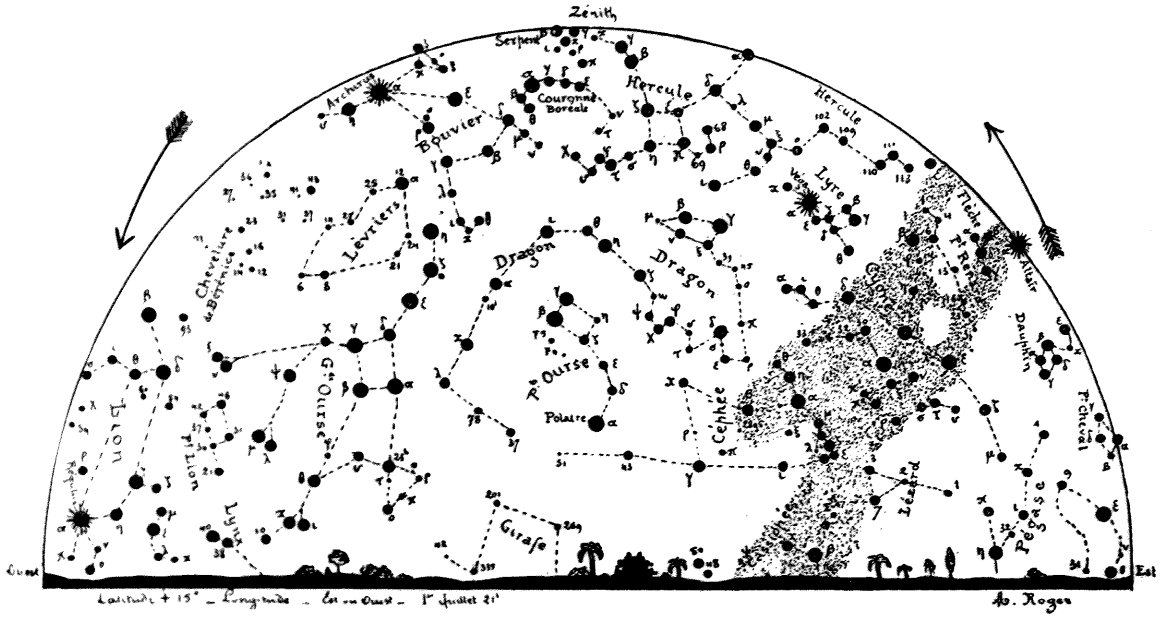
The Most Beautiful Birds. The birds of the greatest beauty are: Yellow-warbler, mocking-bird, goldfinch, woodpecker, yellow-shouldered blackbird, San Pedrito, humming-birds, doves, purple gallinule, jacana, the herons, night-herons, ducks, flamingo, white-head and sea-gulls.

Birds Outstanding in Song and Ferocity. As already stated, the number of birds existing in Porto Rico, divided ornithologically into orders and families according to their principal features, beak and claws, forms a long and interesting list which cannot be given in the narrow limits of this article because of the details and size of this book. For to appreciate all there is of beauty and attractiveness in this branch of human knowledge it is necessary to study a monograph of each and every one of the birds inhabiting the island's forests or lending enchantment to her fields. These birds frequently serve as a motive to her writers of prose and verse.

The mocking-bird, the euphonia, the oriole, the troopial and the yellow-warbler are close friends of the island's poets.

The rapacity of the red-tailed hawk and the ferocity of the gray kingbird have served as a theme to some writers for brilliant descriptive work in narrating the fierce fights of these two unequal but implacable enemies who give their battle-cry in space and in all cases manifest to observers the supremacy of intelligence over brute force.





AUGUST SKY.—"L'ASTRONOMIE."

The Porto Rican Sky

By Ana Roqué de Duprey,

Author of various scientific and literary books. Private Instructor of Mathematics, Latin and French.

That Porto Rico possesses one of the most admirable beauties of nature is an unquestionable fact; but Porto Ricans hardly realize this truth.

Stellar Panorama: During the bright nights of its latitude we can observe all the known constellations in the deep blue of its heavens.

Except during the seasons when the sun refracts and they are hidden in its light, we can see said constellations at any season of the year between the hours of six o'clock in the evening and six in the morning.

We can observe the *Ursa Minor* and the *North Star* which is 18° from our horizon; the *Pleiades,* with their *Algol;* the rhomb of *Cepheus;* the seven stars of the *Chair* where the mythological *Cassiopeia* sleeps the sleep of centuries, and other northern and equatorial constellations, even unto the polar *Puppis* with its unequaled *Canopus,* the rival of the white *binary Sirius,* both of which are queens of the sideral world.

We are also able to see the *Southern Cross* and the *Centaur* with our neighbor *Alpha* which are the stars nearest to us. Also the *Southern Fish,* the *Corolla,* and the polar *Triangle; Phenix,* the *Crane,* the *Toucan,* the *Peacock,* the *Altar* and the *Cup,* and the other southern stars invisible in Europe and the United States.

From our position we can also distinguish some of the *Magellan Clouds.*

All the aforesaid constellations belong to the *Milky Way* in the midst of which we live, and whose equator, with its millions of suns, we can see shining in space.

And who is there in Porto Rico who busies himself in scientifically studying such a sovereignly beautiful spectacle?

On the date of writing, August 29, 1922, we have the planet Mars between *Ophiuchus,* and the Scorpion, receding from *Antares* by virtue of an epicycle, after having been very near to the latter. The abnormal decoloration as seen in the present less red light of this planet is noticeable, this phenomenon having also been noted in 1909.

The planet will soon disappear from our view in its recession, and we may well congratulate

ourselves on the fact, specially since in December the earth will be in its perihelion and its approach to the sun causes earthquakes at the season or thereabout.

And if the coincidence should occur of the approach of Mars to us at the same time, as happened in 1918, the simultaneous attraction of the two planets might cause quakes like those of said year, which quakes Porto Rico can never forget.

The bold *theory of relativity* propounded by Einstein is greatly attracting the attention of men of science, because of this German wizard's modification of humanity's fundamental ideas of Time and Space, though truly, who can define Time?

However, Einstein's theory may be of great use as applied to astronomy, provided it is duly proven.

And where is there a better field for such studies than this land of light and color, of the purest skies at all seasons, and of clear and brilliant atmosphere which is an indispensable requisite in all astronomical observations?

Why does not the powerful American nation establish an astronomical observatory in this island which is a part of it, and where such splendid conditions exist for the purpose? Two things would benefit the United States in giving impulse to our progress: a *botanical garden* for the acclimatization of tropical products of the world in this fertile land, and an *astronomical observatory* for the promotion of the study of a science so important to humanity.

Astronomical Observations: We remember only the one made in November, 1882, by a technical commission from the San Fernando Observatory, of Cádiz, which came here to observe the *passage of Venus* in front of the sun. The members of the commission were Pujasón, Aranda and other astronomers.

They put up a good equatorial telescope at the Naval Station in San Juan. Among other instruments they had a meridian telescope and several chronometers that registered one-thousandths of a second.

Our love for these studies forced us also to observe the passage of the planet from the roof of our home.

Several amateur astronomers aided us in our observations, among them being Manuel Corchado, and my constant fellow-students Carlos Soler and Colonel Laguna.

We were able to note the external and internal contacts of the entrance of the planet, and to follow the *new Venus,* as a round, obscure point, in its passage through the solar disc, and even approximately to figure the angle, or better still, the spheric trajectory of the planet, which lasted several hours.

The following day several friends took me to the Naval Station and introduced me to the astronomers.

I showed them my calculations, and had the satisfaction of knowing that there was not a minute's difference between theirs and mine. The difference was only of seconds, for I had no instruments wherewith to figure them. They failed to note the final external contact of the planet for the reason that their telescope was too large, the planet having passed while they changed the eye-piece.

I observed that sun-spots were very numerous that year and by their appearance and disappearance was able to see the sun's revolution.

We also observed the gigantic comet which appeared in the same year.

I believe that was the only instance of the visit of an astronomical commission to Porto Rico.

Editorial Note.—The Editorial Board of this book desires to express within its pages its thanks to the American Museum of Natural History for the illustrations on pages 5, 7, 17, 21 and 54, and to the National Museum of Natural History for those on pages 55, 60, 63 and 67.