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# THE FORESTS OF THE DOMINICAN REPUBLIC \*

By WILLIAM DAVIES DURLAND

The visitor to the Dominican Republic who will forsake the historic towns and cities of the more populous seaboard for the less frequented highways and byways of the sparsely settled interior gains a profound impression of the country's forestal resources. Trees line the *Camino reales* and extend in a mass of entangled foliage, vines, ferns, epiphytes, cacti, and tree trunks for miles and miles up the valleys and on the mountain slopes to the fern-clad summits of the highest altitudes. If the traveler come by way of Porto Rico this impression of luxuriant vegetation will be still deeper by contrast, for, though only 70 miles distant to the east, this densely populated island is very sparsely forested as the result of native waste and despoliation.<sup>1</sup> Least known of the Greater Antilles, Columbus's island of Hispaniola has been least changed since pre-Columbian times. At least 75 per cent of the land area is still forest-clad with trees that can be classed as timber. The area of the entire island is over 28,000 square miles, of which approximately two-thirds pertains to the Dominican Republic.

## PHYSIOGRAPHIC DIVISIONS

The republic in general presents a rugged appearance: mountain ridges of varying height separate rather extensive plains and enclose broad fertile valleys. In the northern part the ranges and valleys have a general west-northwest trend related to the trend lines of eastern and central Cuba; in the southern part the trend is east and west in line with the major axis of Jamaica. The relief is known only in broad and approximate outline; some parts of the country, indeed, are absolutely unknown. However, under United States supervision topographical and geological surveys have been begun and a tentative classification into physiographic provinces is available.<sup>2</sup>

The Cordillera Central, commonly known as the Sierra de Cibao, the principal mountain range, divides the country into two parts. It is described as a "jumble of ridges and peaks" whose extreme irregularity is to be explained by complex geological composition and structure.<sup>3</sup> Several peaks of the main ridge attain elevations of 8,000 and 9,000 feet. The Cordillera

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\* Acknowledgment is made of the assistance of Professor H. N. Whitford, School of Forestry, Yale University, in the preparation of this paper and to Professor S. J. Record of the same school for identification of the wood samples collected by the author.

<sup>1</sup> L. S. Murphy: Forests of Porto Rico, Past, Present, and Future, *U. S. Dept. of Agric. Bull. No. 354* (Contribution from the Forest Service), Washington, D. C., 1916.

<sup>2</sup> T. W. Vaughan, Wythe Cooke, D. D. Condit, C. P. Ross, W. P. Woodring, and F. C. Calkins: A Geological Reconnaissance of the Dominican Republic (Geological Survey of the Dominican Republic, Memoirs, Vol. 1), Washington, D. C., 1921.

<sup>3</sup> *Ibid.*, p. 31.

Septentrional, or Monte Cristi range, follows the northern coast line from the base of the Samaná peninsula to Monte Cristi. The range is highest in the center north of Santiago where some peaks rise to elevations of 3,000 or 4,000 feet. The Samaná peninsula, which is considered a separate physiographic province, is also mountainous, reaching heights of 1,500 feet in the center. In the southwestern part of the republic the Sierra de Bahoruco extends from the province of Barahona into Haiti. The ridges with crest summits of 3,000 to 5,000 feet are intersected by valleys with local savanas. Two small ranges of hills, known as the Sierra de Martín García and the Sierra de Neiba, lie slightly further north, the former extending from the Caribbean Sea westward to the Sierra de Neiba, from which it is separated by the Rio Yaque del Sur. The Sierra de Neiba extends in a westerly direction into Haiti.

Between the central and the northern ranges lies the Valle del Cibao, the eastern portion of which, the Vega Real, is not only the largest and richest valley of the country but is described as "among the most impressively fertile districts in the world."<sup>4</sup> In the southern half of the republic similar but less extensive valleys lie between the various ranges, while in the eastern section between the main range and the sea are level regions that may be called plains. That part east of the Rio Jaina is known as the Seibo plain, or "Eastern Valley," a more humid region of forests and savanas; the western part is known as the plain of Baní and is drier, needing irrigation for its extensive crops. The plain of Azua is still drier, as is also the curious low-lying basin of Lake Enriquillo. Between the Sierra de Neiba and the central cordillera is the interesting Valle de San Juan, to be described later. Such is the abundant water supply of the country as a whole—a direct consequence of the high relief—that water for irrigation is almost everywhere plentiful. Except for one or two arid spots in the western portions it would be impossible to travel any distance in Dominican territory without encountering a stream or brook.

#### TEMPERATURE AND RAINFALL

Although the Dominican Republic lies entirely within the tropics—approximately between latitudes 20° and 17° 30' N.—the tropical climate is to a great extent tempered by the mountainous character of the country. In the lowlands of the coast the breezes cool the air the year round, blowing from the sea during the day and from the land after sundown: it is only the low, enclosed valleys that are excessively hot. Few actual meteorological records are available; in fact, on the entire island of Santo Domingo the only place from which a long continuous series of records is available is Port au Prince in the Haitian Republic. Port au Prince, however, is not far from the border, and the temperature regimen of that city may be taken as fairly typical, although the town because of its sheltered situation appears

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<sup>4</sup> *Ibid.*, p. 29.

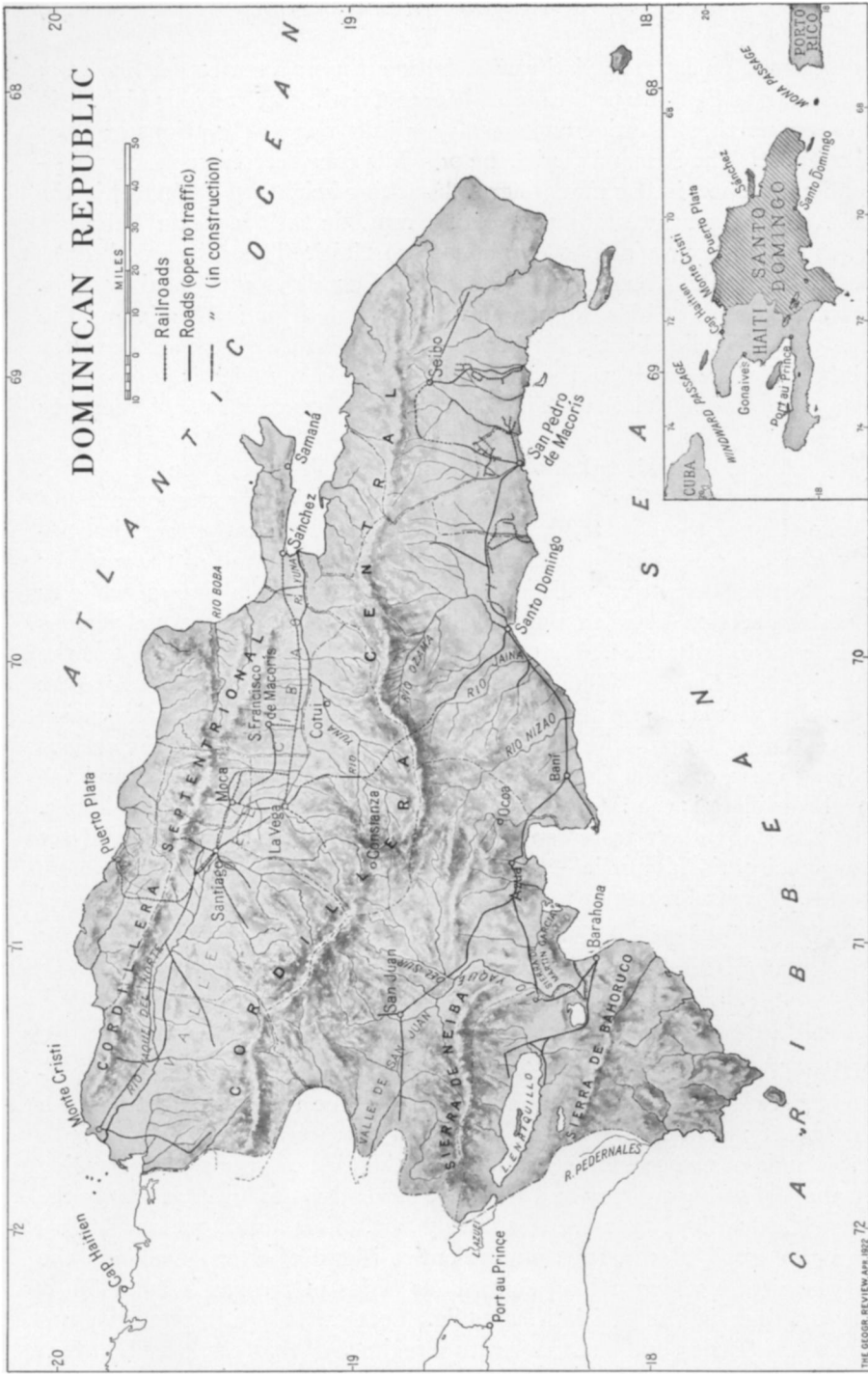


FIG. 1.—Map of the Dominican Republic showing relief and communications. Scale approximately 1 : 2,750,000. The inset map shows the entire island of Haiti or Santo Domingo in relation to contiguous territory. Scale 1 : 11,000,000.

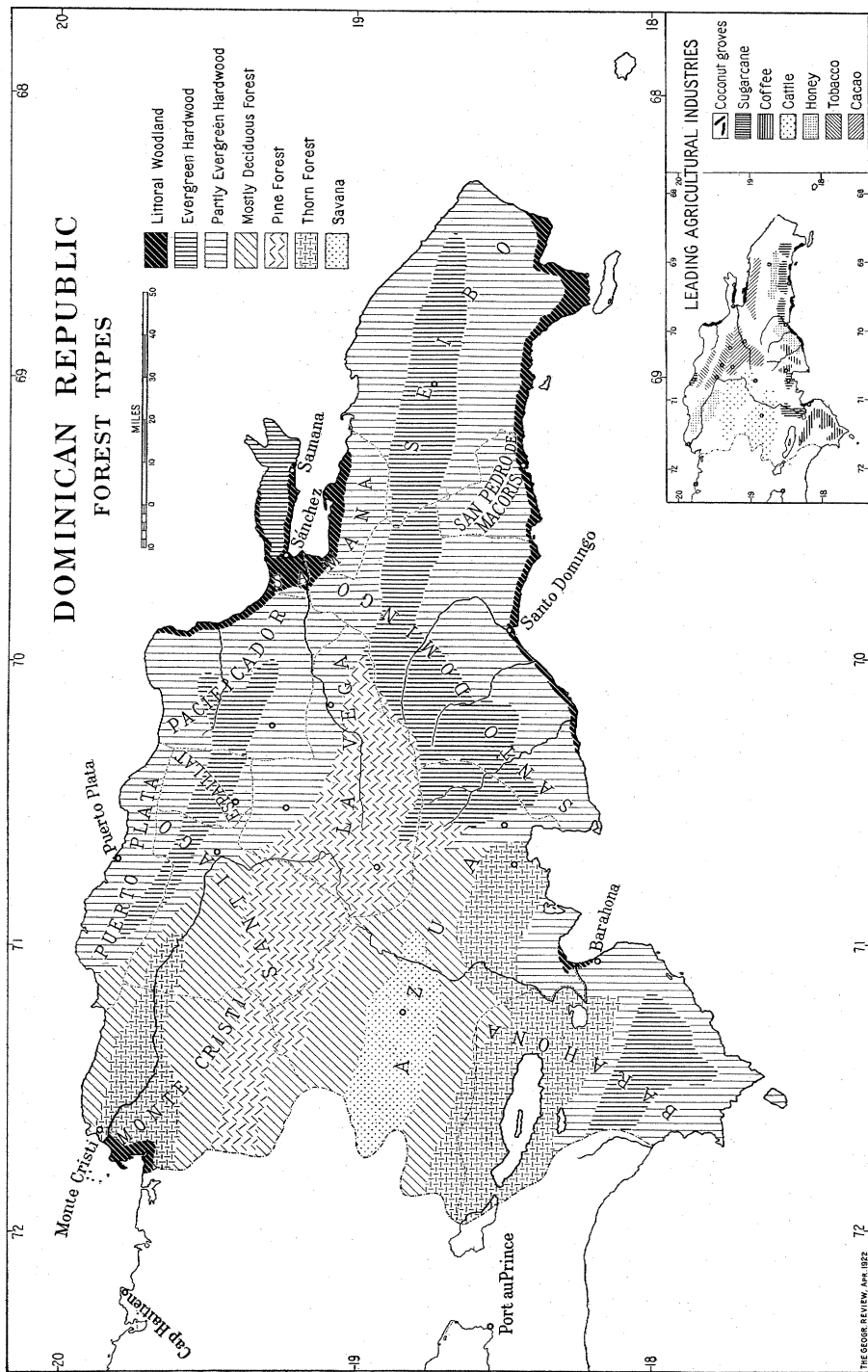


FIG. 2.—Map showing the forest types of the Dominican Republic. Compare with the relief map (Fig. 1) opposite. Scale approximately 1 : 2,750,000. The inset map shows broadly the areas in which the chief agricultural industries are being carried on. Scale 1 : 11,000,000.

to be somewhat unduly hot. The mean annual temperature is 79° F., ranging from 82° in July to 75° in January, the mean maximum being 98° and the minimum 61°.<sup>5</sup> At Santo Domingo City where the U. S. Weather Bureau maintained a station from 1898 to 1900 the mean temperature was 77°, ranging from 80° in August to 74° in January and February, the absolute maximum being 95° and the minimum 59°.<sup>6</sup> Closely similar are the records for the three-year period (1886-1888) at Sánchez, Samaná Bay—mean 76.8°; range 80° to 73°.<sup>7</sup>

Two seasons, winter and summer, are usually distinguished, the distinction being in large measure a question of precipitation. From the month of March to October rains are usually abundant, and from November to February the season is generally known as dry. This is well illustrated in the cases of Santo Domingo City and Sánchez.<sup>8</sup> Points in the interior and

TABLE I—MEAN ANNUAL PRECIPITATION AT STATIONS IN SANTO DOMINGO  
(In inches)

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Santo Domingo City (5 years)	2.0	0.9	2.1	6.8	6.2	7.4	8.3	6.7	7.6	9.6	2.7	2.1	62.9
Sánchez (7 years)	3.8	3.2	4.0	5.0	6.4	7.8	8.3	8.8	5.8	5.2	8.3	4.0	70
La Vega (7 years)	4.6	3.6	3.3	5.6	7.6	6.8	7.2	4.0	4.8	6.8	10.0	2.8	67
Port au Prince (39 years)	1.1	2.3	3.7	6.5	9.7	4.1	2.9	5.3	7.5	7.0	3.5	1.3	55

the west show a tendency towards two rainy seasons. This tendency is apparent at La Vega and is well marked at Port au Prince. A number of observations from such a dry region as the lower valley of the Yaque del Sur show at least 20 inches of rain at every station. At Barahona the annual mean is 41 inches with two rainy seasons, April to mid-June and late September to the end of October.<sup>9</sup> On the northern coast of Santo Domingo, on the contrary, the winter months are the rainiest.<sup>10</sup> Differences of rainfall on windward and leeward slopes in conjunction with great topographic irregularity cause pronounced local variations in climate.

#### THE GENERAL RELATIONS OF THE FOREST VEGETATION

Almost without exception the mountain ranges are covered with a forest growth and a sub-vegetation which together form a continuous canopy.

<sup>5</sup> Julius Hann: *Handbuch der Klimatologie*, Stuttgart, 1910, Vol. 2, p. 353.

<sup>6</sup> Observations quoted by Otto Schoenrich: *Santo Domingo*, New York, 1918, p. 128.

<sup>7</sup> Hann, Vol. 2, p. 348.

<sup>8</sup> C. E. P. Brooks: *The Rainfall of San Domingo*, *Meteorol. Mag.*, Vol. 56, 1921, pp. 73-74. [Rainfall at stations in the eastern half of the Cibao Valley.]

<sup>9</sup> T. W. Vaughan, etc.: *A Geological Reconnaissance of the Dominican Republic*, p. 197.

<sup>10</sup> See the statistics of rainfall at Puerto Plata and at points on the northern coast of Haiti in *Bull. Ann. de l'Observatoire Météorologique du Séminaire-Collège St. Martial*, Port au Prince, Haiti.

As a whole, these forests are very similar in character and composition to other tropical forests of the Antilles. Compared with Porto Rico and Cuba their resemblance is very close, with the exception of the pine forest which seems to have gained a superior foothold in the Dominican Republic.

Concerning the forest vegetation of this republic very little is known from a technical standpoint. It is evident that for many years the properly called "gold nuggets" of the forest have been cut out by dyewood and cabinet-wood seekers, both native and foreign, and the qualities of these woods are exceedingly well known. Satinwood, mahogany, fustic, logwood, ebony, pencil cedar, and lignum-vitae are the better known of these woods, and they have been exported in considerable quantity since trade first began with the republic. Outside of these well-known woods of commerce and a few others, there is very little knowledge to be had concerning the scientific identity and the technical uses of the remaining species of the forests. Hand specimens of a number of the native Dominican woods have been collected, and the identity of some of these has been established. A more or less complete list of the tree species to be found in the republic is included in the appendix to this article. At the present time there is great need for a botanical exploration of the forests.

All who are acquainted with the general character of tropical forests are aware that from the standpoint of the botanist they are exceedingly complex in composition. Contrasted with the temperate regions the great majority of the species are woody—either trees or woody vines. Furthermore, the tree species of the forests, because of their inherent tendencies, usually arrange themselves into successive stories or floors of varying and irregular heights which differ from the type of forest in which they are growing. Where the climatic and soil factors approach the best conditions for forest growth, the lower story is composed of tree species whose crowns, when mature, form the first story; towering above this at more or less regular intervals are the crowns of the species which go to make up the second story. The uppermost stories include the tallest trees of the stand and contain, comparatively speaking, fewer species than either of the first two stories.<sup>11</sup>

The writer has prepared a forest-type map showing the broad relations of the forest vegetation, and a general discussion of this map is to be found on the succeeding pages. The information upon which the construction of this map is founded was secured by numerous reconnaissance surveys over the entire republic extending throughout a period of nearly two years. It was collected en route from place to place over established trails; and as such it is, at best, only general. All the type division lines are more or less arbitrarily established, as no location measurements were taken. Accordingly there exists a wide variation between the actual and the platted locations of these types. The inset agricultural map is based on information collected during the same surveys; and, as such industry is correlated with

<sup>11</sup> Compare H. N. Whitford: Forest Conditions of Colombia and Venezuela, *Bull. Pan Amer. Union*, Vol. 6, 1918, pp. 468-483.

forestry, it is included herewith. It is hoped that, notwithstanding its summary character, the map will serve as a nucleus around which a more systematic investigation of the forest resources of this republic will be made.

The forests of the Dominican Republic represent, according to the climatic and the edaphic-physiographic factors which have influenced their composition, the fundamental types established by ecologists with their corresponding divisions and gradations. They are as follows:

1. Evergreen Hardwood Forest
2. Partly Evergreen Hardwood Forest
3. The Pine Forest
4. The Thorn Forest
5. The Savana
6. The Mostly Deciduous Forest
7. The Littoral Woodland

#### THE EVERGREEN HARDWOOD FOREST TYPE

The evergreen hardwood forests occupy the zones of greatest rainfall. They cover (1) the eastern half of the upper slopes of the Cordillera Central, from the head of the Vanilejo and Nizao Rivers, eastward to the termination of the range on the seacoast in the province of Seibo and (2) the upper slopes of the Cordillera Septentrional, from the headwaters of the Saledo and Juba Rivers, southeastward to the vicinity of the Gran Estero and the upper reaches of the Boba River. This type of forest is also characteristically developed in the peninsula of Samaná, where the rainfall is heavy and more evenly distributed through the year than in some parts of the country. The central part of the province of Barahona, which embraces the upper slopes of the Sierra de Bahoruco from the higher elevations southeast of the city of Barahona to the headwaters of the Pedernales River, is also covered by this forest. Because it flourishes here on the upper slopes and hence under more temperate climatic conditions there is some modification of the distinctive tropical characteristics of the evergreen lowland forest of more torrid regions. There is a gradual reduction in the wealth of tropical forms and a decrease in the extent and development of many specifically tropical peculiarities—large-leafed foliage, planked buttresses, woody lianas and epiphytes, with storied under-forests of varying heights.

The individuals of these forests, as the classification indicates, are evergreen hardwoods which are hygrophilous in character. Collectively they are rich in thick-stemmed lianas and epiphytes and contain a wealth of aerial roots which descend vertically and unbranched through the air from the tree crowns. One of the striking features of these trees is the mosaic coloring of the bark, resembling that of the beech of the north temperate zone. The temperature and moisture conditions are more or less uniform throughout the year, extending the actual growing period of the species



within this type over the entire twelve months. It is here, as would be expected, that the most luxuriant forest growth of the republic is found. Within these forests there is displayed a dense mass of foliage from the ground up to the tops of the tallest trees, beneath which there is scarcely any direct sunlight and through which it is exceedingly hard to make one's way. Indeed this particular type of foliage is so dense that it is impossible, as has actually been proved by airplane observation, to see through it.

The composition of this forest is very complex; and, because of its location and the moist condition of its habitat, neither of which are favorable for any extensive exploitation of the forest, it is the least known. With the decrease in temperature attendant on an increase in altitude on ascending the mountain slopes, the characteristic stature of the composite species decreases in size. The majority of the species in this zone range in diameter from 10 to 25 inches. Very few larger trees are found here, whereas on the warmer lowlands, under proper conditions of moisture, the trees often reach a size of 36 inches in diameter and over.

Other descriptions of tropical rain forests of similar altitude in the islands and mainland borders of the Caribbean apply very well to the conditions found within this type.



FIG. 3—Evergreen hardwood type. An individual, showing the planked buttresses and the mosaic appearance of the bark resembling our northern beech.

#### THE PARTLY EVERGREEN HARDWOOD TYPE

In general the partly evergreen hardwood type represents the transitional stages of the forest growth between the typical evergreen hardwood type and the mostly deciduous type. In the case of the Dominican Republic, however, where owing to extreme topographic irregularity the diversity of climate over the entire forested area is great, this type appears rather as an independent formation than as a transition form. The type resembles to

some degree the monsoon forest of Schimper. Such transition forms have been described by Pittier for Panama and Venezuela.<sup>12</sup>

Compared with the evergreen hardwood type the tree life, because of climatic and soil differences, is much more varied. The temperature is higher and more uniform throughout the year. There is a seasonal change as regards the occurrence of precipitation, whence the numerous deciduous species present in the type composition. The forest is more or less open, occupied here and there by small rolling savanas or grasslands, many of which are probably due to the activities of man. There is a wide variation in the plant growth forms from gnarled, deformed shrubs or dwarf trees to lofty individuals, true giants of the vegetable kingdom. In places the trees are found in groups or small groves resembling the wood lots of our native pasture lands.

This type of forest occupies large areas but differs from the evergreen hardwood forests in being confined to the lower elevations between the mountain ranges and the seacoasts. It extends from the lower slopes of the Cordillera Septentrional and the Sierra de Bahoruco inland for a short distance, where it more nearly represents the transition stage mentioned above. This type practically surrounds the evergreen hardwood forest of the three largest ranges and occurs in a more or less continuous belt following the outline of the republic.

Much of the surface covered by this type has been cut over that the land might be used for agriculture. Many of the areas so cleared and cultivated according to the primitive methods of the *conuqueros* have long since been abandoned. Especially is this the case in the provinces of Santo Domingo, San Pedro de Macorís, and Seibo where, next to the valley of the Cibao, the population is the densest in the republic.

Many natural savanas also occur within the type, and it is often difficult to distinguish between these and the artificial openings made by man.

In the southwestern part of the province of Santo Domingo, lying wholly within this zone, particularly on calcareous soils in the valleys of the Ozama, Jaina, and Nizao Rivers and their tributary streams near the seacoast, are found large quantities of mahogany. Dominican mahogany is said to be excelled by none as to color, quality, and adaptability to fine furniture and cabinet work. Less of this wood is now secured than formerly. Considerable quantity of logwood was previously obtained also, but the supply today is practically exhausted. A fact worthy of note is the effort that is being made to produce a second growth of mahogany. Every farm, both large and small, within the area is protecting the young trees with the hope that they will bring a profit to their owners.

Many edible fruit-bearing species, undoubtedly introduced and planted by man, together with the highly utilized palms which find conditions best

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<sup>12</sup> See for example H. Pittier: Our Present Knowledge of the Forest Formations of the Isthmus of Panama, *Journ. of Forestry*, Vol. 16, 1918, pp. 76-84; and Esbozo de las formaciones vegetales de Venezuela, Caracas, 1920, of which an abstract appears elsewhere in this *Review*.



FIG. 4



FIG. 5



FIG. 6

FIG. 4—Evergreen hardwood type. A stand of cigua and cabilma on the La Vega-Santo Domingo highway. This timber is equal to any American hardwood in quality.

FIG. 5—Evergreen hardwood type. Forest in the vicinity of Guanaito, province of Santo Domingo. The first and second storied trees have been removed as the first step in clearing the land.

FIG. 6—Partly evergreen hardwood type. A *conuco* clearing in the vicinity of San Cristobal, province of Santo Domingo. Smaller trees are first cut and burned followed by the larger trees, which if not burned are left to rot where they fall. After three or four crops have been raised the area is abandoned.

adapted for their growth within this type also, are prominent in its present composition.

From the standpoint of the lumberman this forest is better known than the one previously described because it supports the growth of many of the heretofore much-sought-for "gold nuggets" of the tropics.

#### THE PINE FOREST TYPE

The pine forest of the Dominican Republic is of more interest commercially than all of the other forest types put together. This can be explained perhaps by the fact that pine lumber has long been used and is well-known, chiefly because foreign pine has been extensively imported for general construction purposes. The species is resinous and heavy, barely floating in water. In past years a few attempts have been made to exploit this pine, but operations have been on a small scale and of a temporary nature. The still unsettled status of land ownership<sup>13</sup> and the previous unstable conditions of the native government have made exploitation as a business enterprise practically impossible, whence the lack of development of what is considered to be a domestic source of construction lumber and the unmolested condition in which this pine is found.

The boundaries of the pine forest are usually sharply defined. As a type it occupies the northern slopes of the main range from the vicinity of Cotui west to the Haitian border. Botanically the formation is not complex, 80 per cent and over of the surface area being covered by one species of pine identified as *Pinus occidentalis*. In appearance the type somewhat resembles the open parklike stands of pine in our own southern states though it is far less abundant per acre. It ranges in diameter on the average from 12 to 25 inches breast-high and in total tree height from 40 to 60 feet. Eggers reports that at the higher elevations (4,000 feet) individuals approaching 200 feet in height and 4 feet or more in diameter are not uncommon.<sup>14</sup> The trees are scattered more or less singly over the area in a very open manner, on the ridges in particular. They are found at times, although exceptionally, in dense pure stands. A luxuriant growth of wild grass over which cattle graze at will forms a ground cover beneath the pine. This ground cover is coincident with the occurrence of the pine and is characteristic of the type. A good picture of the pine forest landscape is given by Gabb in his description of the Constanza Valley on the southern border of the pine zone.

There is not a spot in Santo Domingo less tropical in appearance than the Valley of Constanza. The settlement of a dozen houses is in the midst of the woods. There is not a palm, plantain, or other tropical-looking plant in sight. The frowning black mountains, shutting in the valley on all sides; the tall columns of the pine trees, with the prostrate trunks and yet solid stumps of their fallen brethren; the little houses, encircled with split rail-fences and bargates; the browsing cattle, horses, and sheep, and above all the crisp morning air, so cold as

<sup>13</sup> Compare F. R. Fairchild: The Problem of Santo Domingo, *Geogr. Rev.*, Vol. 10, 1920, pp. 121-138.

<sup>14</sup> H. Eggers: Reise in das Innere von St. Domingo, *Petermanns Mitt.*, Vol. 34, 1888, pp. 35-41; reference on p. 36.

to condense one's breath into visible vapor, all point rather to the heart of the Sierra Nevada than to the interior of an island under the Cancer.<sup>15</sup>

The pine type is not found at all in Porto Rico. In Cuba it has a limited distribution occurring on certain rugged peaks of the Sierra Maestra at elevations not less than 1,800 feet above sea level.<sup>16</sup> The existence of the pine forest on such an extensive scale in the Dominican Republic is attributed to the simple operations of the *conuqueros* with their primitive methods of agriculture.<sup>17</sup> The continual cutting and burning of the original forest growth, which probably was an evergreen or partly evergreen hardwood



FIG. 7—A pine-clad slope in the vicinity of Jarabacoa, southwest of La Vega.

type, has destroyed the fertility of the soil to such an extent that it will no longer support the growth of these vegetative types. As a consequence the pine has been permitted to enter, perhaps from a lofty habitat where it naturally occurred on a small scale. In the absence of any competition and having the inherent capacity for growth on such soil, the pine has thrived and reproduced. The soil which practically supports the entire growth of pine is a reddish clay, or laterite, a fact which has been noted by Gabb.<sup>18</sup>

Evergreen and partly evergreen hardwood species mixed with pine are found in small, dense, thicket-like patches at the heads of many draws and in secluded valleys. The soil of these particular localities, in contrast to the laterite of the more exposed slopes and ridges, is composed of a dark rich

<sup>15</sup> W. M. Gabb: On the Topography and Geology of Santo Domingo, *Trans. Amer. Philosophical Soc.*, Vol. 15 (N. S.), 1872-80, pp. 49-259; reference on p. 133.

<sup>16</sup> B. E. Fernow: The High Sierra Maestra, *Forestry Quart.*, Vol. 4, 1906, pp. 239-273.

<sup>17</sup> O. F. Cook: Vegetation Affected by Agriculture in Central America, *U. S. Dept. of Agric. Bull. No. 145*.

<sup>18</sup> W. M. Gabb: Notes on the Distribution of the Vegetation of Santo Domingo, *Amer. Journ. of Sci.*, No. 102, Ser. 3, Vol. 2, 1871, pp. 127-129.

fresh loam. On such sites the pine, although a minor species in the composition, grows to a larger size and is a more healthy and vigorous tree.

### THORN FOREST TYPE

Schimper states that "thorn woodlands are also richly developed in the Antilles." Similar types of vegetation have also been found in definite regions of the Dominican Republic where it is described by Harshberger as chaparral.<sup>19</sup> The great Cibao valley becomes progressively drier as one goes westward. A critical point is reached a little west of Santiago where the

forest type of the Vega gives place to thorn forest. As the name indicates, this formation contains many species of trees and shrubs strongly armed with needle-like and piercing spines and prickles, so finely attached and arranged for defensive purposes that they seem to fly at one whenever within striking distance. The scenery has been compared with that of Lower California.



FIG. 8—The main street of a typical town of the Dominican Republic. The sides of the houses are made from boards cut from the highly utilizable palm.

The resemblance of this region to the arid plains of Lower California is very striking. The same dry soil covered with a scanty carpet of grass, the same low, straggling-limbed,

open-foliaged acacia-trees: the same tall columnar cactus, with its undergrowth of *opuntias*; even the same cloudless sky, make the likeness complete.<sup>20</sup>

Another hot and semiarid area of thorn forest is found in the southwest, extending from the Bay of Neiba and including the plain of Azua westward through Haiti and including the depression of Lake Enriquillo. The gradually falling surface of this salt lake is now 144 feet below sea level, and the barrenness of the surrounding area is due rather to the salinity of the soil than to the scantiness of rainfall. Throughout the thorn-forest regions, in fact, the rainfall is not so scanty as the vegetation suggests, but most of the rain falls in the form of torrential showers, and the benefits from this precipitation are practically entirely lost through run-off. The soil composition has been found to be very desirable for agricultural purposes, but artificial irrigation is necessary. *Lignum-vitae*, logwood, and fustic are included in the valuable products of the thorn-forest regions.

<sup>19</sup> J. W. Harshberger: *Phytogeographic Survey of North America, Die Vegetation der Erde*, Vol. 13, 1911, p. 681.

<sup>20</sup> W. M. Gabb: *On the Topography and Geology of Santo Domingo, Trans. Amer. Philosophical Soc.*, Vol. 15 (N. S.), 1872-80, pp. 49-259; reference on p. 157.

## THE SAVANA TYPE

The name of this formation usually implies grasslands intermingled with isolated plants and trees and an herbaceous growth, chiefly noticeable during the dry season of the year when it contributes a brownish, dried-up appearance to the landscape. The interior valley of San Juan which is more or less level and open, resembling a plain or prairie, presents such characteristics and is indicated on the vegetation map as comprising this type of formation. About 50 miles of the valley, which extends into Haiti, lies in the Dominican Republic and it is 10 to 12 miles wide. The soil is fertile, and there is more water for irrigation than in the adjacent plain of Azua; but this savana, rich in pasture land with a natural growth of succulent grasses and other herbaceous ground cover, is primarily devoted to cattle raising. Cattle are raised in almost every part of the republic; but in this valley, with San Juan as its chief commercial center, the industry is most favorably supported by the natural growth of the region and exceeds any development elsewhere. As in the case of the other types, detail information regarding the vegetation is lacking. However, as the Spanish name implies, it is not a timber-producing type, and the real forest vegetation other than shrubs and bush is widely scattered and of no significance in the general character of the formation.

## THE MOSTLY DECIDUOUS TYPE

The savana type of the San Juan valley is encircled by a belt of tropical forest distinct in character from either of its bordering neighbors. It occupies an elevation corresponding to the low-lying range of hills known as the Sierra de Neiba, which naturally separates the formations mentioned, and the southern slopes of the western part of the Cordillera Central. At the most westerly end of the northern range or Cordillera Septentrional and surrounding the thorn forest in the northwestern part of the republic there is a similar forest type. Both are classified as mostly deciduous forests. The temperature of these areas is, on the whole, high and more or less uniform throughout the year. The climate is semiarid, the rainfall being limited and seasonal. The species of these forests are for the greater part xerophilous in structure and occur in a mixed type of vegetation which as a whole has drought-resisting characters. The information at hand is too inadequate to describe it in detail. It could very easily be included with the partly evergreen hardwood type although the deciduous species occur far more abundantly in the type under discussion.

## LITTORAL WOODLAND TYPE

Two distinct types are here presented, as is the case with other littoral woodland formations of the Antilles and Central America. They are (1) the mangroves, or tidal woodlands, and (2) the woodlands above high-tide mark.

These types are formations of the tropical seashore and vicinity and are

characterized by the fact that the fruits or seeds of the composite species have, as a rule, devices which enable them to float. Mangroves and coconut groves are found in greatest abundance within this belt, which is confined to narrow strips along the seacoasts of the eastern and southern part of the republic, broken here and there by protruding headlands of higher elevations and by other areas unadapted to the support of such growth. The mangroves are found in the delta regions of the Rivers Yaque del Norte, Yuna, and Yaque del Sur.

#### CONCLUSION

Such are the forestal resources of the Dominican Republic. Commercially the bulk of the forests is unexploitable at present because of the unfamiliarity of the world markets with the exact nature of the woods, but as they become better known the real value of these forests will be more appreciated. Although the republic is greatly behind the times in its industrial and commercial development, it has a decided advantage over the neighboring islands in having maintained its forests in almost a natural state. But, if this wealth is to remain a permanent asset, measures must be taken to control the destruction that has already begun. The commonly known system of "conuco making," which is directly responsible for destruction of the forest, has placed Porto Rico in an undesirable economic position in respect of timber resources; and, should it continue in the Dominican Republic, that country will suffer the same fate—many devastated areas and a scarcity of wood for even the most humble of domestic uses. Any forester will grant that agriculture is a higher use of the soil and that it is of more fundamental importance to the development of a nation than the preservation of the forest trees; but to sacrifice one for the temporary progress of the other is more detrimental than beneficial. In the vicinity of Maniel (San José de Ocoa) particularly, acres and acres of cleared land that have served a temporary progress of providing a few scanty crudely cultivated agricultural crops, and that have long since been abandoned, are but a few examples of what is taking place over the entire forested area of the Dominican Republic. Such clearings are on a small scale, to be sure; but with increasing population will come increasing destruction, for the people as a whole are purely agricultural. An attempt has already been made to correct the destructive tendency and to further the utilization of the forests. A continuance of this policy is necessary if the republic is to maintain its present enviable position as regards timber resources.

#### Appendix

The following list contains some of the tree species previously referred to in this article. Specimens of these woods were collected under the name used locally in the Dominican Republic and were brought to the United States for study and deposited with the collection of tropical woods at the School of Forestry, Yale University. In most cases it has been possible to establish the scientific identity of the species, and in such instances the technical name is listed with the common name. No detailed study, however, has as yet been



made of these specimens, and hence only the better-known of the species have been identified. There is a possibility that the local classification differs in different parts of the republic. By a preliminary examination of the specimens and by comparing them with other known woods of tropical and semitropical countries, together with the application of such knowledge concerning similar woods as is available, the following scientific nomenclature has been determined. In some cases identity was not established beyond the family name.

No attempt has been made to correlate the species with the vegetative types established, because of insufficient information concerning their distribution. In general, however, the majority of these tree species occur in the partly evergreen hardwood type at elevations between sea level and 1,000 feet.

Baitoa, caoba, cedro, espinillo, mora, guayacán, campeche, and sabina are the more important woods of commerce. Baitoa is used in connection with the manufacture of scientific apparatus as a boxwood; caoba is the true mahogany of commerce; cedro is considered an excellent wood for cigar boxes and other containers of tobacco products; espinillo is known on the market as satinwood; mora is commercial fustic which is a source of vegetable dye; guayacán is *lignum-vitae*, especially desirable for use as brush bearings in ship propellers; campeche is the logwood of commerce, a source of vegetable dye frequently known as haematoxylin stain, and sabina is eagerly sought for as a desirable wood for the manufacture of high grade pencils.

All of these woods are exported from the republic in varying quantities. For the most part they are more valuable as products for export than for local consumption.

Bayahonda, candelón, capa prieto, capa de sabana, and calla blanca are woods which are almost entirely used locally, chiefly for railroad ties, native sugar-mill rollers, ox-cart hubs, and wheel spokes. Hoja ancha is purchased by the government in natural tree lengths for telephone poles. Pichipin is made into saw lumber, but to a very limited extent, and is all readily consumed in the immediate vicinity of the small mills. Almacigo is said to make very desirable wood pulp for high grade paper manufacture.

Aguasero	Granadillo ( <i>Gymnanthes lucida</i> )
Alfiler ( <i>Betulaceae</i> )	Guaconejo ( <i>Amryis silvatica</i> )
Almací ( <i>Bursera gummifera</i> )	Guasumilla (?)
Amacei, copaiba ( <i>Copaifera officinalis</i> )	Guayacán, <i>lignum-vitae</i> ( <i>Guaiacum officinale</i> )
Ausubo ( <i>Myrtaceae</i> )	Higuerillo (?)
Baitoa ( <i>Phyllostylon brasiliensis</i> )	Hoja ancha ( <i>Myrtaceae</i> )
Bayahonda ( <i>Calliandra formosa</i> )	Laurel ( <i>Lauraceae</i> )
Cabilma ( <i>Cedrela angustifolia</i> )	Malagueta ( <i>Sapotaceae</i> )
Calla blanca	Mangle blanco ( <i>Laguncularia racemosa</i> )
Calla colorada ( <i>Sapotaceae</i> )	María, or Santa María ( <i>Calophyllum calaba</i> )
Campeche, logwood ( <i>Haematoxylon campechianum</i> )	Membriyo ( <i>Cerasus occidentalis</i> )
Candelón ( <i>Colubrina ferruginosa</i> )	Mora, fustic ( <i>Chlorophora tinctoria</i> )
Caoba ( <i>Swietenia mahogani</i> )	Nisperillo ( <i>Sapotaceae</i> )
Capa de sabana ( <i>Petitia domingensis</i> )	Olivo (?)
Capa prieto ( <i>Cordia gerascanthus</i> )	Ozua ( <i>Myrtaceae</i> )
Cedro ( <i>Cedrela</i> sp.)	Pichipin ( <i>Pinus occidentalis</i> )
Ceiba, silk-cotton tree ( <i>Ceiba pentandra</i> )	Quebra hacho ( <i>Dipholis nigra</i> )
Chicharrón ( <i>Chicharronia intermedia</i> )	Roble blanco ( <i>Tecoma pentaphylla</i> )
Cigua ( <i>Lauraceae</i> )	Roble prieto ( <i>Catalpa</i> sp.)
Coquito (?)	Sabina ( <i>Juniperus</i> sp.)
Corbana (?)	Saona (?)
Daguilla, or la guilla (?)	Sapotillo ( <i>Sapotaceae</i> )
Escobón ( <i>Myrtaceae</i> )	Sinaso (?)
Espinillo, satinwood ( <i>Zanthoxylum</i> sp.)	Yaya ( <i>Cordia</i> sp.)
Espino ruvial ( <i>Rutaceae</i> )	

In the following list are other tree species that the author has seen growing in the Dominican Republic. Those tree species which have the same local, or common, name as is contained in a list of Dominican trees by D. José Ramon Abad have been correlated with the common names of the tree species as they are known to the author, and the scientific identity as established in the former case is included herewith. The better known of these little-known woods are mangle rojo (or colorado), divi-divi, lana, and ébano. Mangle rojo supplies a tanbark. Considerable quantities of this bark are shipped annually, principally from the port of Sánchez. Divi-divi produces a bean which furnishes a valuable dye. This product has, however, in recent years become practically exhausted. Lana produces a vegetable wool which at certain seasons of the year is collected by the natives, baled, and exported. Ébano is the ebony of commerce and is exported in limited amounts. Javillo, known in some foreign markets as possumwood, is found in varying quantities, but as yet none has been exported.

Some of the listed tree species produce edible fruits at certain seasons of the year. Of these algaroba, almendrón, guanabano, and caimitillo are the most important.

Acana ( <i>Acrasia</i> sp.)	Guayacancillo ( <i>Guaiacum verticale</i> )
Aceituno ( <i>Aextoxicon punctatum</i> )	Higo ( <i>Ficus</i> sp.)
Algaroba, W. I. locust ( <i>Hymenaea courbaril</i> )	Higuera ( <i>Crescentia cujete</i> )
Almendrillo ( <i>Pommus occidentalis</i> )	Jagua ( <i>Genipa americana</i> )
Almendrón ( <i>Terminalia catappa</i> )	Jagüey ( <i>Ficus</i> sp.)
Bera, or vera ( <i>Bulnesia arborea</i> )	Javillo, possumwood ( <i>Hura crepitans</i> )
Cabo de hacha ( <i>Trichilia spondiodes</i> )	Jia ( <i>Casearia alba</i> )
Caimitillo ( <i>Chrysophyllum oliviforme</i> )	Jobos, hog plum ( <i>Spondias</i> sp.)
Cañafistulo ( <i>Cassia fistula</i> )	Juan prieto (?)
Caobilla de costa ( <i>Croton lucidus</i> )	Juan primero (?)
Caucho ( <i>Castilla elastica</i> )	Lana ( <i>Bombax pyramidale</i> )
Chácara ( <i>Coullteria fistula</i> )	Limoncillo cimarrón ( <i>Pimenta pimento</i> )
Cochinilla ( <i>Comocladia integrifolia</i> )	Mangle rojo, or colorado ( <i>Rhizophora mangle</i> )
Cocuyo (?)	Nogal ( <i>Juglans jamaicensis</i> )
Copey ( <i>Clusia rosea</i> and <i>alba</i> )	Palo amargo ( <i>Ceanothus americanus</i> )
Divi-divi, or guatapana ( <i>Caesalpinia coriaria</i> )	Palo blanco ( <i>Tecoma leucoxyton</i> )
Ébano de Santo Domingo ( <i>Brya ebenus</i> )	Palo de leche ( <i>Brosimum galactodendron</i> )
Espino ( <i>Zanthoxylum lanceolatum</i> )	Palo de tabaco (?)
Guanabano ( <i>Artabotrys palustris</i> )	Palo muñeco ( <i>Quassia amara</i> )
Guara ( <i>Cupania americana</i> )	Péndola ( <i>Catalpa</i> sp.)
Guaraguo ( <i>Bucida capitata</i> )	Tarana (?)
Guaraguo, or cacao (?)	Vara de lazo (?)
	Yagua ( <i>Varronia alba</i> )