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AGRICULTURAL RESOURCES AND CAPABILITIES OF PORTO RICO.

MESSAGE

FROM THE

PRESIDENT OF THE UNITED STATES,

TRANSMITTING

A REPORT ON INVESTIGATIONS OF THE AGRICULTURAL RESOURCES
AND CAPABILITIES OF PORTO RICO WITH SPECIAL REFER-
ENCE TO THE ESTABLISHMENT OF AN AGRICULTU-
RAL EXPERIMENT STATION IN THAT ISLAND



WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1901.

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*U.S. - Agric., Dept. of - Experiment Sta
tions; Office of*
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EXPERIMENT STATION IN THAT ISLAND.

DECEMBER 11, 1900.—Message and accompanying papers ordered printed and re-
ferred to the Committee on Insular Affairs.

To the Senate and House of Representatives:

I transmit herewith a report on investigations of the agricultural resources and capabilities of Porto Rico with special reference to the establishment of an agricultural experiment station in that island, made in accordance with the act of Congress making appropriations for the Department of Agriculture for the fiscal year ending June 30, 1901.

WILLIAM MCKINLEY.

EXECUTIVE MANSION, *December 10, 1900.*

LETTER OF TRANSMITTAL.

UNITED STATES DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., December 5, 1900.

SIR: I have the honor to transmit herewith a report on the agricultural resources and capabilities of Porto Rico with special reference to the establishment of an agricultural experiment station in that island, made in compliance with the act of Congress making appropriations for this Department for the fiscal year ending June 30, 1901. The investigations have, in my judgment, shown the desirability and feasibility of maintaining an agricultural experiment station in Porto Rico,

and I earnestly recommend that provision be made by Congress for the establishment of such a station in the Territory on a permanent and efficient basis in accordance with the recommendations of the Director of the Office of Experiment Stations, herewith submitted, and that an appropriation be made for this purpose equal to that which is given for the maintenance of similar stations elsewhere in the United States.

I have the honor to be, sir, your obedient servant,

JAMES WILSON, *Secretary.*

The PRESIDENT.

UNITED STATES DEPARTMENT OF AGRICULTURE,
OFFICE OF EXPERIMENT STATIONS,
Washington, D. C., December 5, 1900.

SIR: I have the honor to transmit herewith a report on the agricultural conditions in Porto Rico with special reference to the establishment of an agricultural experiment station in that island. This investigation was made in accordance with the terms of the appropriation act for this Department for the fiscal year ending June 30, 1901, which authorizes the Secretary of Agriculture to "investigate and report to Congress on the agricultural resources and capabilities of Porto Rico with special reference to the selection of locations for agricultural experiment stations and the determination of the character and extent of agricultural experiments immediately demanded by the condition of agriculture in that island." As the agent to make this investigation, Prof. S. A. Knapp, formerly of the Iowa Agricultural College and more recently engaged in agricultural enterprises in southern Louisiana, was appointed special agent in charge of agricultural investigations in Porto Rico and sent to that island about the middle of June, 1900, with the following instructions:

The following subjects should be included in your investigations:

- (1) The general agricultural conditions existing in Porto Rico and the necessary and feasible measures for the improvement of these conditions.
- (2) The lines of experimental investigations which should be undertaken in Porto Rico, and especially those which should be undertaken in the immediate future. As far as practicable, the scope, extent, and cost of the experimental inquiries immediately demanded should be determined.
- (3) The locations suitable for agricultural experiment stations in Porto Rico, including a main station with laboratories, farm buildings, and experimental fields, and outlying stations, whose work shall consist of field, garden, and orchard experiments and experiments with domestic animals.
- (4) The buildings, land, and equipment required for the proper maintenance of agricultural investigations in Porto Rico on the plan indicated in section 3. Careful estimates should be made regarding the cost of the buildings, land, and equipment needed to inaugurate the work of the experiment station in the island, with special reference to the sum required for these purposes during the fiscal year ending June 30, 1902. The methods of acquiring real estate for the use of the station should also be investigated.
- (5) The needs of the agricultural people of Porto Rico as regards information on agricultural subjects, and the best means for supplying them with this information by publications, oral instruction, and demonstration experiments, or otherwise.
- (6) The desirability and feasibility of securing the cooperation of the residents of Porto Rico in the conduct of experimental inquiries and the dissemination of agricultural information; the desirability and feasibility of including instruction in agricultural subjects in the curriculum of the schools of Porto Rico.
- (7) The facilities for preparing, printing, publishing, and distributing in Porto Rico circulars of inquiry and bulletins of information on agricultural subjects in

the English and Spanish languages, and the best ways of securing the preparation and dissemination of such information in printed form.

(8) The cost of inaugurating and maintaining agricultural investigations and disseminating information (exclusive of the buildings, land, and equipment) in a manner similar to that of an agricultural experiment station in one of the United States having an area approximating that of Porto Rico. An estimate should be made with special reference to the cost of maintaining such work during the single fiscal year ending June 30, 1902.

Professor Knapp's report of his investigations is submitted herewith. In this report the need of experiment-station work in Porto Rico is plainly shown, and it is recommended that a station should be established with headquarters in the vicinity of San Juan. This station should give immediate attention to promoting the production of larger and better crops of coffee, sugar, and tobacco, and of food products for home consumption. As soon as practicable it should undertake work in horticulture, forestry, animal husbandry, and dairying. Besides conducting experiments, it should give object lessons in improved farming and should disseminate information by publications and agricultural meetings. In these recommendations of Professor Knapp I heartily concur. In my judgment an agricultural experiment station should be immediately established in Porto Rico on the same general plan as that pursued elsewhere in the United States.

Land should be obtained in the vicinity of San Juan on which to erect office, laboratory, and farm buildings and to conduct experiments. A competent man should be appointed to act as the chief executive officer of the station, plan and supervise its operations, and begin the organization of a staff of scientific and practical men to conduct investigations in various lines and instruct the people in improved methods of agriculture. It will be best to limit the work of the station at the outset to a few main lines, which will require the services of only a small staff, and develop the organization of the working corps as the station becomes more fully established and the way is opened for the extension of its work. As the station will not have the aid of an agricultural college already equipped with buildings and land, as has been the case with most of the stations established in the United States, it will be necessary at the outset to devote a considerable amount of money to its equipment. Without doubt as much will be required for the current expenses involved in the proper maintenance of an experiment station in Porto Rico as is the case elsewhere in the United States. I can see no good reason why an appropriation of \$15,000 a year should not be given to Porto Rico for the maintenance of an experiment station as well as to the other Territories of the United States, and I hope that Congress will make the first appropriation of this kind during its present session. For the purchase of land and the erection of buildings the station should have in addition an initial fund of \$15,000. In the case of the other Territories such expenses have been largely provided for by the local governments, and I think it would be well if this plan could be followed in Porto Rico, a portion of the revenues of the island being set aside for this purpose by the action of Congress or the Territorial legislature.

Authority should be given the Secretary of Agriculture in the appropriation act to establish and maintain an agricultural experiment station in Porto Rico, including the purchase of land, the erection of buildings, the printing (in Porto Rico), illustration and distribution of reports and bulletins in the English and Spanish languages,

and all other expenses essential to the maintenance of said station. Half of the first appropriation should be made immediately available.

Very respectfully,

A. C. TRUE, *Director.*

Hon. JAMES WILSON,
Secretary of Agriculture.

LAKE CHARLES, LA., *September 22, 1900.*

SIR: I have the honor to submit herewith my report on the investigations regarding the agricultural conditions existing in Porto Rico, with special reference to the establishment of an agricultural experiment station in that island, made under your instructions dated June 11, 1900. I arrived at San Juan June 19, 1900, and immediately commenced my observations on the agricultural conditions and capabilities of the island. I traveled by private conveyance over 350 miles in the rural districts, and was everywhere cordially met by the farmers and given every facility for obtaining the information desired.

Respectfully,

SEAMAN A. KNAPP,
*Special Agent in Charge of Agricultural
Investigations in Porto Rico.*

Dr. A. C. TRUE,
Director of Office of Experiment Stations.

AGRICULTURAL RESOURCES AND CAPABILITIES OF PORTO RICO.

GENERAL STATEMENT.

The island of Porto Rico is situated in latitude 18° north and lies in the direct line of trade between New York and South America. In a general way it may be described as about 100 miles long and 36 miles wide, and has an area, including its dependencies—the islands of Vieques, Culebra, and Mona—of 3,530 to 3,860 square miles. The whole island may be classed as mountainous except a border on the seacoast and numerous interior valleys. The mountains are not in bold and forbidding ranges, but consist of an endless variety of immense segregated and fertile hills, with interspersed valleys, in an ascending series, but without special order, from the north coast to two-thirds the distance across the island, where the hills attain an elevation of 1,500 to 2,500 feet, and the valleys, many of which are of considerable extent, are from 500 to 1,500 feet above the sea.

CLIMATE.

The temperature of the island is tropical, but is so modified by altitude and ocean winds that extreme heat or cold is never experienced. Cold never reaches the frost line and rarely drops below 65° F., while 91° is usually the extreme of heat in a season, and that only for a short period. As the temperature is largely modified by the winds from the ocean, and especially by the trade winds, considerable variation is found in different portions of the island, it being warmer where the trade winds are shut off by mountains. A much greater difference is observable in the rainfall. Some sections are ordinarily deficient in rainfall; in others it is very heavy.

In a recent report on the water resources of Porto Rico, H. M. Wilson¹ states "that all the crops which the soil will produce can be grown over three-fourths of the extent of the island with the aid of the abundant rainfall alone. The other one-fourth, including all the region near the coast and from Cabo Rojo on the extreme west to beyond Guayama on the east, must be irrigated if the soil is to produce the full measure of crops of which it is capable. The total area of these irrigable lands is, however, relatively small."

The weekly crop bulletin issued by the Weather Bureau of this Department, San Juan, P. R., June 18, 1900, confirms the above statement.

¹ Water Supply and Irrig. Papers, U. S. Geol. Survey, No. 32, p. 28.

Temperature and rainfall for the week ending June 18, 1900.

City.	Temper- ature.	Rainfall.
	° F.	Inches.
Arecibo.....	78.4	1.65
Manati.....	80.4	.58
Isabela.....	80.0	1.22
Baynas.....	79.2	1.90
San Lorenzo.....	79.8	4.37
Cidra.....	77.2	3.40
Maunabo.....	80.8	3.19
Humacao.....	80.2	6.52
Juana Diaz.....	80.4	4.72
Lajas.....	80.3	4.20
Bayamon.....	80.9	.30
Canovanas.....	82.9	1.48
San Juan.....	81.4	1.33

The above being a report for one week does not indicate the relative rainfall for the year at the different points, but it shows how unequally the rainfall is liable to be distributed in a given period. It is said that the rainfall was much more equal when the summits of the mountains were well wooded. An article by Prof. Mark W. Harrington, of the United States Weather Bureau (in U. S. Treasury Doc. 2118), is instructive:

The published observations of Porto Rico are very scanty, consisting of a total of about nine years at San Juan only, and these are fragmentary, being scattered through twenty years. They show a true tropical climate, with a high mean temperature (78.9° F.) and very little difference in season, except in rainfall. The coldest month on the average is February (75.7°) and the hottest, June (81.5°), but December to March are very much alike in temperature, and so are the months from June to September. The very coldest month on record is January, 1895 (70°), and the very warmest is June, 1878 (86°). The average change from the coldest to the hottest is only 6°, but this is very appreciable to one who has lived long in the Tropics. The cool months really seem to the natives to be decidedly cold, requiring additional covering on the bed and heavier clothing. The coldest temperature on record in San Juan is 57.2° on a day in January, 1894. The very hottest on record is 108° on a day in May, 1878. The absolute range of temperature observed is therefore between 43° and 44°. The former temperature is far above frost, but would seem to the natives very cold and would check the growth of tropical plants. The latter would seem very hot, for the air of San Juan is very moist and the evaporation of perspiration is slow.

The comfort of San Juan as a place of residence, not to mention its healthfulness, is very much increased by the "briza," which is not given in the public reports. It is the northeast trade wind which has been turned toward the west, until the "briza" comes quite regularly from the east. It is not felt much during the day, but springs up late in the afternoon and lasts through the evening. It is a soft, gentle breeze, laving the body and giving an effect which is most fresh and delightful. It has a regularity approaching that of the sun, and Santurce and Cataño, two suburbs of the capital, get it both more strongly and through a larger part of the twenty-four hours. At Cataño it may be felt until the middle of the forenoon, and begins again in the mid afternoon. At Santurce it makes the nights positively cool.

The year at San Juan is divided into the dry season and the wet season: but the dry season has about as much rainfall as the Northeastern States, and the wet season more than twice as much. The dry season embraces the months from December to March, with a rainfall of 10 or 11 inches. It is the most attractive season of the year, relatively dry and cool. It is the proper season for the visits of Northerners to San Juan, and winter residents would find its climate very gentle, mild, and safe. The wet season embraces the other eight months in the year, and has a rainfall of 48 to 49 inches, or more than the whole of the year for the most of the United States. The total rainfall at San Juan is nearly 60 inches, and the culmination is in November, when an average of nearly 8 inches falls.

The rainfall is not excessive. It is equaled in many places in the Southern States and in the northern part of the Pacific coast, and is surpassed in many places. It is less significant from the ease with which the rain comes down. There are no threatenings of storms for days beforehand. There is little wind and little light-

ning. Rainy days are rare, but rainy afternoons or evenings—for an hour or two—common. The rain begins suddenly, falls heavily, and ends soon. There is no impression of rainy climate, except that everything seems constantly fresh and clean.

The healthfulness of San Juan is the greatest of any city in the West Indies. Yellow fever is never at home here, and when imported it rarely, if ever, spreads. * * *

The climate of the rest of the island is much like that of San Juan, with modifications due to elevation above the sea and to changes in the “briza” due to the topography. The change of the temperature with elevation is relatively rapid here, being approximately 4° of temperature to every 1,000 feet.

Now, Mount Yunque, at the northeastern part of the island, is, according to the chief of the department of engineers of the island, about 6,000 feet high, and its summit would have a mean temperature as low as that of many places in the States. Besides, elevations of 2,000 feet are not unusual for towns; snow apparently never falls upon the islands, but hoarfrosts are reported as occasional in high places. Several towns of some size in the interior have a popular reputation as being cold—Cayey, Adjuntas, and Utuado. That black frosts do not occur, however, is evident from the fact that the banana grows freely up to at least 2,000 feet, and is very sensitive to frost.

There appear to be three mountain ridges running from end to end in the island, but the central is the commanding one, and the elevations are, on the whole, highest toward the eastern end, and especially at the northeastern angle. The result is that the “briza” most wets and refreshes the eastern end of the island, and the rainfall changes greatly from point to point. Judging by Jamaica, of which the climate has been carefully studied, the heaviest rainfall is in the northeast, and it may here in places amount to 100 inches annually or more. In Jamaica it is known to surpass 200 inches in some places, and El Yunque, as seen from San Juan, is very generally capped by a rain cloud. The interior valleys of the island are relatively dry, while the northern and eastern mountain slopes are wet.

The following summary, taken from the United States Weather Bureau report for Porto Rico, shows the temperature, rainfall, cloudy and clear days, and wind velocity at San Juan for one year:

Summary for twelve months.

Month.	Highest temperature.	Date.	Lowest temperature.	Date.	Mean.	Greatest daily range.
November, 1898	° F. 88	1	° F. 65	9	° F. 77.2	° F. 18
December, 1898	85	12	66	18	75.9	17
January, 1899	82	28	66	19	74.6	13
February, 1899	85	8	66	20	75.2	16
March, 1899	82	35	66	8	74.7	15
April, 1899	90	21	66	4	76.6	16
May, 1899	89	43	68	1	79	17
June, 1899	91	22	71	6	79.4	17
July, 1899	87	2	70	5	80	16
August, 1899	88	29	71	20	80	16
September, 1899	91	11	71	30	81	14
October, 1899	89	10	68	1	80	17

Month.	Least daily range.	Cloudy days.	Partly cloudy days.	Clear days.	Rain.	Maximum velocity of wind. ⁸
November, 1898	° F. 7	° 2	° 4	° 12	<i>Inches.</i> 12.08	-----
December, 1898	8	-----	9	22	5.34	-----
January, 1899	8	-----	9	22	2.92	22
February, 1899	8	-----	9	19	.80	20
March, 1899	10	1	9	21	2.29	21
April, 1899	8	2	8	20	6.09	24
May, 1899	10	2	18	11	2.59	19
June, 1899	9	6	17	7	7.23	24
July, 1899	7	4	16	11	7.53	19
August, 1899	7	5	12	4	10.38	766
September, 1899	7	6	11	13	13.66	31
October, 1899	7	13	12	6	10.21	38

¹ Also 19, 22.

² Also 28.

³ Also 7, 19, 20, 29, 30.

⁴ Also 4, 22, 27.

⁵ Also 8, 27, 28.

⁶ Beginning Nov. 13.

⁷ Eighth. east.

⁸ Miles per hour.

SOILS.

Near the ocean the soil is quite sandy, merging into a sandy loam a short distance inland and gradually changing into a clay loam as the hills are approached. This is generally but not universally the case. Sometimes a spur of the mountain projects into the ocean and carries its soil conditions to the water's edge. Occasionally there are tracts of gravelly soil, but all very fertile as far as observed. The soil along the larger streams is a deep, rich, sandy loam, merging into a clay loam near the hills and frequently extends to the top of the hills and minor mountains, rendering them so fertile that they produce excellent crops of sugar cane. The soil of the mountains is a peculiar ferruginous clay, which readily disintegrates when exposed to the air, and under the influence of tropical heat and moisture furnishes an abundant supply of plant food. Bananas and coffee grow luxuriantly on the mountain sides, more than 2,000 feet above the sea level. Limestone is abundant in all portions of the island and more or less affects the soils, producing on the mountains a slightly calcareous soil. A green-sand marl, similar in appearance to that of New Jersey and rich in phosphates, is, according to Wilson,¹ "found extensively in the north-western portion of the island, between Lares and San Sebastián, and also in the neighborhood of Carolina, at the northeastern extremity of the island." The division of soils for taxation by General Henry in his Order No. 6, dated January 19, 1899, throws some light on the way soils are classified. It is as follows:

LANDS AS CLASSIFIED FOR TAXATION.

(1) The assessment of taxes upon lands will hereafter be made in accordance with the various cultivations existing in the island and the quality of the land taxed.

(2) In accordance with the various cultivations there will be taxes on cane lands, coffee lands, tobacco lands, pasture lands, minor-produce lands, and forest lands.

(3) In accordance with the quality of the land there will be taxes of the first, second, and third classes—the first class comprising the best lands, the second class the next best, and the third class the poorest.

(4) On all lands of the first class there will be a tax of 1 peso per cuerda (acre); on all lands of the second class a tax of 0.50 peso per cuerda; on all lands of the third class a tax of 0.25 peso per cuerda.

(5) Each municipal corporation will appoint a classifying commission, which will select commissioners in the different districts of each township, the subcommissioners to report to the classifying commission on the class of lands in their respective districts.

(6) These commissioners will be guided by the following instructions:

First-class cane lands are plains and valleys and other alluvial lands lying near settled communities, highways, railroads, and seaports, and the lands of drained lagoons and mangrove marshes.

Second-class cane lands are the highland plains, generally surcharged with oxides of iron, and known in the country as clayish lands.

First-class coffee lands are valley lands and hills abounding in organic detritus.

Second-class coffee lands are highlands having a calcareous or limy formation.

First-class tobacco lands are valley lands watered by rivers.

Second-class tobacco lands are loamy highlands mixed with clay and sand.

Third-class tobacco lands are sandy lands along the coast and calcareous lands among the hills.

First-class pasture lands are valleys, lagoons, and glens, where grow "malojila" and guinea grass.

Second-class pasture lands are those on the hills and those on the coast, where grow guinea and dog grass.

¹ Loc. cit., p. 33.

Third-class pasture lands are those along the coast and lime hills, where grow only brush, "rat-tail," sweet grass, etc.

First-class minor-produce lands are valley lands.

Second-class minor-produce lands are highlands.

Third-class minor-produce lands are sandy and limy lands.

First-class forest lands are those growing virgin forest whose timber can supply building and cabinet woods, e. g., "aceitillo," "cedar," "capa," "ausubo," etc.

Second-class forest lands are lands with a rocky and calcareous soil growing only bushes available for fuel.

RENEWAL OF SOIL.

While the soils of Porto Rico retain their fertility to a remarkable extent, they have deteriorated in a measure under the effects of constant cropping without the use of manure. Like most tropical soils, they are deficient in humus, and this is particularly noticeable in old fields "turned out to rest." The Porto Ricans say that the land is "tired." It is further noticeable in the fact that the soil is too adhesive in wet periods, and too dry, with a tendency to "bake," in dry weather. That there is no deficiency of elements in the soil is shown by the large grass crops these old fields will produce. Cowpeas, velvet beans, and other renovating crops have enormously vigorous growth and furnish a ready means of supplying humus. In all parts of the island are caves with vast quantities of bat guano, which is a cheap and ready source of nitrogen. The large number of cattle and horses furnish considerable manure, easily obtained, because many cattle are herded on account of the absence of fences.

RIVERS AND DRAINAGE.

Few countries are better drained than Porto Rico. It is claimed that there are over 1,200 streams in the island, of which 50 are rivers of considerable size. Springs are abundant in the mountain district and the water is pure.

There are several mineral springs of value, such as the sulphur baths near Ponce, the mineral springs near Coamo and at San Sebastian and San Lorenzo, and the hot springs of Caguitas.

FORESTRY.

One of the most serious obstacles confronting the agriculturist in Porto Rico is the scarcity of timber and wood. There is practically no accessible building timber. Occasionally a small log is brought from the interior at great expense and sawed into boards by hand. There is not a power sawmill in the interior of the island. There are a few sawmills in the coast cities, mainly for sawing imported timber. At Mayaguez one of these mills had a small stock of native logs. They were from 6 to 12 inches in diameter and 8 to 12 feet long, crooked and knotty. The mill had a stock of four or five thousand feet of native lumber, in which were a few tropical cedar boards, short but of superior quality.

The principal lumber sold in the coast cities is hard pine, which retails at \$30 to \$50 per 1,000, depending upon the quality. This scarcity of timber accounts for many things. It renders it almost impossible to erect or maintain creditable farm buildings in the interior, especially where there are no good roads. It renders it necessary to construct the cottages of the laborers of bark and poles. It precludes the fencing of the farms into suitable fields for keeping the variety of

stock best adapted to the conditions and yielding the largest profits to the farmer. It accounts in part for only one-eighth of the arable land of the island being under cultivation. The absence of timber on the mountains is believed to affect in a large degree the amount and regularity of the rainfall. The records of history and the samples of the woods preserved prove that Porto Rico at the time of its discovery had a wealth of timber unsurpassed by any island in the world. In the United States quartermaster's department at San Juan is the relic of an old Spanish military museum, which contains samples of Porto Rican woods selected over fifty years since, from which Mr. Paul L. Hardy, engineer, made me a list of 150 varieties, with the uses for which they are valuable. Among them are found cabinet woods, as mahogany, satinwood, cedar, walnut, etc.; other woods that are almost indestructible in air or water, especially valuable for wharves. Many varieties are suitable for posts, fencing, and building purposes. That immediate steps should be taken to reforest the island to the extent of its own uses is self-evident, especially as there is plenty of idle land for this purpose. There is much government land in the mountains that can be profitably used for woodland, on which could be planted hard-wood trees of quick maturity for fuel and more durable woods for posts and building purposes.

FARMHOUSES.

The huts in which farm laborers live are either in tent form, 10 by 14 feet on the ground and 6 feet high at the ridge, made of poles and covered with the bark of the royal palm or with grass, with the ground for floor; or they are made house fashion, 12 by 16 feet base, 5 to 6 feet high at the eaves, sides and roof covered with palm bark, with which the so-called windows are closed at night; rarely the roof is thatched with grass. In the vicinity of towns the sides are frequently made of boxes. Most of the huts built in house form stand on short posts and have a rough floor made of palm boards sawed by hand. Many of them have a small room, possibly 6 feet square, for cooking. In these small houses large families are raised. Sometimes more than one family reside in one house. There are rarely any gardens, flowers, or fruit, except the banana. The water is not always the best, and few make any effort to improve it. Under such circumstances it is impossible to have comfort or good morals. The houses occupied by the proprietors or farm managers are generally fairly comfortable dwellings, occasionally of a superior type, according to the taste and wealth of the owner.

PUBLIC ROADS.

In a country like Porto Rico there are no medium roads. They are either good or so bad as to be impassable with a wagon. Unless a road is constructed of stone, thoroughly ditched and bridged, the torrents in the rainy season will wreck it. There are about 150 miles of first-class road, which were constructed by the Spaniards at an average cost of over \$12,000 per mile (gold). These roads are a monument to the science and thorough work of the Spanish engineers. Outside of these military highways transportation must mainly be by pack train. The cost of this in some seasons of the year operates as a complete embargo on marketing farm products. Landslides cover the trail, bridges have been swept away, and the swollen streams are impassable at the fords. One person reported that he sometimes paid

\$12.80 (gold) for an ox load—distance, 21 miles. To relieve the most important rural sections and to furnish labor to the peasants, deprived of labor by the destruction of the coffee plantations, the insular government has undertaken to construct about 125 miles of first-class roads in the island. (See map.) The construction of these roads will cost about \$1,000,000. In addition, large sums have been expended in repairing the old military roads injured by the floods at the time of the hurricane. When these are completed and dirt roads constructed in sections not liable to torrents, nearly all portions of the island will be accessible.

LACK OF MANUFACTURES.

There are very few manufactures in Porto Rico, except such as are the necessary adjuncts of a farm crop, to fit it for market—as coffee and sugar mills. Manufactures other than these are not sufficient to produce any material effect upon the general industrial situation. At the time of the American occupation they were limited to cigars, cigarettes, macaroni, chocolate, ice, matches, and rum. The cost for the initiative, or the privilege of starting the enterprise, was high; the permit was slow in coming, and sometimes never granted; an enormous tax was placed upon the importation of all kinds of machinery, and, finally, the laws were so framed as to favor the Spanish merchant. For example, wheat and wheat flour had to pay a high duty when imported directly from the United States into Porto Rico, but they could be shipped to Spain and thence to Porto Rico free or at a nominal duty. This benefited the millers of Spain and the manufacturers of biscuits, soup paste, and other products of flour. The following statement from the report of Dr. Henry K. Carroll (U. S. Treasury Dept., Doc. 2118), is in point:

As between Spanish and Porto Rican producers and manufacturers the latter had no chances. Nor were the needs of Porto Rican consumers, however urgent they might appear from the insular point of view, treated as worthy of serious attention. Indispensable articles of food not produced in the island had to come in a roundabout way through the hands of the merchants in Spain or pay enormous duties if imported direct from other countries. The Porto Ricans thought that some of the many streams of the island might well furnish power to mills to grind wheat from the United States or Canada into flour, but the Government at Madrid punished these aspirations by making the duty on wheat almost as high as that on flour. Flour paid \$4 per sack of 92 kilos (about 200 pounds) and wheat \$3.15, and flour paid also, for municipal purposes, a consumption tax of \$2.30. There were mills in Spain, and by importing wheat for them from the United States they could be kept going. The millers of Spain profited; the people of Porto Rico suffered.

Attempts were made in the island to manufacture soup paste and crackers. The result is graphically described in the report of the manufacturers of Ponce, drawn up in 1898 for the use of the colonial minister at Madrid and presented to the commissioner of the United States without change, as the best statement possible of the needs of the island. The cracker manufacturers had to pay the high duty on flour and compete with crackers from the Peninsula entered free of all duty. Those who invested largely in the manufacture of soup paste saw their business killed in the same way. Their petition to the liberal minister, from which they hoped so much, is pathetic in its pleadings for simple justice. Appeal after appeal was made, they say, but all "slept the sleep of the just" (are pigeon-holed), for if ever a minister intended to cast a pitying glance upon such injustice and relieve so much misfortune by some saving measure this intention never materialized, but was strangled in its birth by the influences brought to bear by Spanish manufacturers.

The shoe manufacturers have the same story to tell; shoes imported free from Spain, shoes of the poorest quality—"pasteboard soles, badly made, unsightly, coarse, and without durability"—while Porto Rican manufacturers were heavily

taxed for the raw materials. Of course shoes are costly, and 700,000 out of the 900,000 population go bare-footed. It was the opinion of the industrialists that they could make better shoes and furnish them more cheaply than the Balearic Island manufacturers, but they were not given the chance. They believed that the result of home manufacture would be to lower the prices, as in other instances, but competition with Spanish producers, when the latter had both the home and insular markets, was impossible. There are salt mines at Cabo Rojo, but salt from Spain is free, and vessels loading with salt had to clear from Mayaguez, increasing the expenses of shipments, because the port of Cabo Rojo had been closed, so the salt industry was crippled.

Those interested, or who would be glad to be interested, in the manufacture of soap show that while soap from Barcelona paid only the transitory duty of 10 per cent at the ports of the island, amounting to \$15 for every hundred boxes of a hundredweight each, the insular industry is compelled to pay \$32.82 in duties for the raw materials to make that quantity of soap. No wonder they ask, in despair, What business can succeed under such circumstances?

AGRICULTURE ON NARROW LINES.

Agriculture in Porto Rico is conducted on narrow lines. Sugar, coffee, tobacco, and cattle constitute almost the entire exports. In 1897 the total agricultural exports amounted to 18,352,541 pesos (peso valued at 60 cents gold), and of this total, sugar, coffee, tobacco, and cattle furnished 18,133,682 pesos.

Rural lands are classified, as declared by their owners for assessment, as follows:

Classification of rural lands.

	Cuerdos (acres).
Tobacco.....	4, 264. 07
Sugar cane.....	61, 558. 43
Coffee.....	122, 359. 76
Minor crops.....	93, 511. 08
Cultivated grasses.....	16, 277. 23
Natural pasture.....	1, 127, 087. 55
Mountain lands and forests.....	664, 273. 37
Total area of island.....	2, 089, 331. 49

SUGAR-CANE LANDS.

Cane lands may be divided into three divisions, according to quality required for this purpose:

First. The rich alluvial bottoms along the rivers.

Second. Second bottoms somewhat remote from the rivers.

Third. Fertile hill lands.

The best cane lands produce 50 to 60 tons of cane per acre when virgin, and one planting will last ten to twelve years. After the land has been in cane four or five years the annual crop falls to 30 and 35 tons, and finally to 20 tons. The productive power of the soil gradually declines under the system of cultivation at present pursued.

Twenty to 25 tons of cane per acre is now regarded as a fair crop on old land, and one planting will not continue profitable more than three years on an average.

Second-class land yields on virgin soil 30 to 35 tons of cane per acre and must be replanted after three crops. When somewhat worn, 15 to 20 tons of cane per acre is an average crop, and must be replanted the third season.

Third-class lands produce about 20 to 25 tons of cane on virgin soil, and deteriorate within a few years below the point of profitable cultivation.

The extent of first-class sugar lands is quite limited in Porto Rico, and nearly all of it has been farmed for many years. The proprietor of one tract stated that it had been in cane continuously for ninety

years without fertilization of the crop, a proof of the marvelous productive capacity of the soil. The growing crop of cane looked as if it would yield 20 tons per acre.

CANE CULTURE.

Instead of planting in drills as in the United States, with the middle upon each side deeply furrowed for drainage, the Porto Rican method is to plant in double rows of hills, allowing the rubbish from the canes of the previous crops to be windrowed between the rows of cane and alternating with the deeply plowed middles, thus placing the drainage middles about 10 to 12 feet apart. The drainage middles are 5 to 6 feet wide, but those for piling the rubbish are narrower. This has some advantage over our plan and some disadvantages. It is of great benefit to the soil to allow the rubbish to decay upon it. It acts as a mulch and as a positive fertilizer. On the other hand, while our method of burning the rubbish is wasteful of the fertilizer, it gives better drainage by allowing a deeply plowed middle on each side of a row of cane. Cane planting is almost a continuous operation from December till July following, as canes are cut for the mill. On the 2d of July, near Arecibo, I saw trains of carts carrying cane to the sugar factory, and as late as the 7th of July a factory south of Mayaguez was still grinding cane. In both cases I was informed that the saccharine contents were very low—reduced by the rains—and gave only about 130 pounds of sugar per ton of cane.

The average period for maturing cane is one year, dating from the cutting of the previous crop. Where the planting for some exceptional reason must be done as late as July, generally white cane is planted and allowed to stand till a year from the following December before cutting, allowing eighteen months in which to mature. Ribbon cane, if allowed to stand so long, matures and cracks open, souring the juice. This long period is given to avoid cutting in the rainy season.

MANUFACTURE OF SUGAR.

There are but few modern sugar mills in Porto Rico. Most of them have a single three-roller mill and are strictly upon the old open-kettle or Jamaica plan, using the dried bagasse under the kettles for fuel, and completing the reduction in an open steam evaporator. Draining is accomplished in the usual way, producing a low to extra grade of muscovado sugar, according to the care taken. Little fuel in addition to the bagasse is required.

Large planters have introduced steam train vacuum pans and centrifugals; a few have double mills, triple effects, vacuum pans, etc. All defecate the juice with lime, but I found no filter presses, though I was informed that some were in use. Factories make from 140 to 190 pounds of sugar per ton of cane, according to process pursued. Only one factory was reported as making 200 pounds.

The progress of the sugar industry may be noted by the following statistics:

Equipment of sugar factories, 1888 and 1898.

Factory equipment.	1888.	1898.
Factories with steam vacuum pans	20	50
Factories with open steam evaporators	140	100
Factories using ox power and open kettles	286	100

MOLASSES AND RUM.

Inferior machinery used in such a large number of sugar factories leaves the molasses rich in sugar. Part of this is exported for reboiling in the United States; the remainder is manufactured into rum.

In 1897 the number of distilleries of rum was.....	198
In 1897 the number of distilleries of bay rum was.....	28
<hr/>	
Gallons of rum distilled in 1897.....	1,615,075
Gallons of rum exported in 1897.....	85,252
<hr/>	
Gallons of rum consumed at home.....	1,529,823
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Gallons of bay rum manufactured.....	15,143
Gallons of bay rum exported.....	13,843
<hr/>	
Gallons of bay rum consumed at home.....	1,300
Total export of molasses in 1897:	
Number of gallons.....	3,543,330
Value.....	\$291,906
Value per gallon.....cents..	8.2

GENERAL COMMENTS ON THE SUGAR INDUSTRY.

With United States markets and under Spanish conditions of labor in semiservitude, Porto Rican planters could make money rapidly even with existing methods; but under American conditions of labor—i. e., labor under American laws—it is an even thing between the production of cane sugar in Porto Rico and cane sugar in the United States. The sugar estates in Porto Rico pay lower wages than those in the United States. They have a longer period in which to mature and manufacture their crop, with no danger of frost. The cane has a full year for growth and five months in which it can be ground under favorable conditions, as against nine months for growth and seventy-five days for manufacture in the United States.

Labor, however, owing mainly to the primitive methods employed, accomplishes very little in a day in Porto Rico, and notwithstanding that men were paid only 50 cents a day, silver (worth 30 cents gold), it was expensive labor. It required 6 yoke of oxen and 3 men to plow three-fourths of an acre in a day. The oxen subsisted on grass without grain, could plow only half a day at a time, consequently 3 yoke were used in the forenoon and 3 in the afternoon. One of the most thorough planters in the island stated to me that he used 420 oxen to cultivate and harvest his cane crop—a little over 800 acres. He thought it would be economical to substitute mules. The farm work is universally done with oxen. No labor-saving machinery is employed in the cane shed or in the field.

RENOVATING CROPS.

Sugar planters appear to have little knowledge of the importance and value of renovating crops. When a field has been in cane so long that it is exhausted, the Porto Rican planter says "it is sick," or "it is tired," and forthwith turns it out to common till it is recuperated. A system of rotating cane with corn and the free use of cowpeas (which grow luxuriantly) would soon restore the cane fields. One planter near Bayamon put some manure on his old field, and he reported a crop of 50 tons per acre last year. Improved implements, modern methods in handling cane fields, the substitution of mules for oxen,

and better sugar machinery will enable the Porto Rican farmer to compete with any country in the world in the sugar industry. The available lands for sugar are too limited in Porto Rico, however successfully managed, to materially affect the markets of the United States. Wages are certain to advance. In fact, since the substitution of the gold standard, August 1, 1900, laborers are demanding 50 cents per day in gold instead of silver, and some sugar planters have granted the advance. With better wages more sugar will be consumed in the island. If the Porto Rican laborer used as much sugar as the American, nearly the entire crop would be consumed at home and there would be little sugar for export.

PRESENT CONDITION OF THE SUGAR INDUSTRY.

Prior to the American occupation of the island the sugar industry was in a bankrupt condition, owing to the low prices of sugar and other causes. Many planters allowed their sugarhouses to go to decay, and turned their cane fields into pastures. Of the 26 sugar estates in the district of Farjardo, 14 were idle and turned out for grazing in 1898—the year of our occupancy. Had they been prosperous they would have been in cane that year. Further statistics show that about two-sevenths of the larger sugar estates of the island had gone out of business. A few sugar estates, with capital and close management, were able to pay expenses and continue the business. For the ten years prior to 1898 Porto Rico had marketed in the United States an average of over 80,000,000 pounds of sugar annually, at prices ranging from 1.7 cents to 2 cents per pound. The crop of 1899, though injured about 33 per cent by the hurricane, netted the planters more money than any crop for several years. They stated that they realized from $3\frac{1}{2}$ to 4 cents per pound, according to quality. It is estimated that the present crop will furnish about 80,000,000 pounds for export. The sugar industry is therefore in a flourishing condition.

THE COFFEE INDUSTRY.

The coffee plant is strictly a tropical evergreen, and, if left unpruned, attains a height of 20 to 30 feet. It should be headed low, so as to be more productive, and to make all parts easily accessible to the picker. The leaves are 4 or 5 inches long, oblong-ovate, dark green in color. The whole plant is fresh and attractive in appearance. The fruit is much like a cherry in form. Each berry contains two seeds, surrounded by a thin, sweet pulp. The flat surfaces of the two seeds are facing and are separated by a thin layer of pulp, and also by a tough membrane or skin which envelops each. As the fruit approaches maturity the berry turns red, and later a dark purple. The plant requires good drainage. The taproot penetrates to a depth of 3 to 5 feet, and is injured if it reaches standing water.

COFFEE CULTURE IN PORTO RICO.

The favorite places selected for coffee plantations in Porto Rico are narrow ravines on the sides of mountains, where on three sides the plant will be protected from the wind. Plants are started in a seed bed and when 1 year old are transplanted into the field and set in rows 4 to 5 feet apart. In Porto Rico little attention is given the preparation of the soil, and no fertilizer is used. Very little pruning

is done. Shade for the first five years is furnished by planting bananas between the coffee plants. Later guava trees furnish shade. On the coffee plantations I visited little attention had been paid to setting in rows to any exact distance apart. In many instances two plants had been set together, on the theory that one might die. Sufficient care was not taken to thin the bananas, so as to furnish the requisite amount of sunshine. The most reliable information I could obtain placed the average annual yield of coffee per acre at 100 to 400 pounds; but if the total product of coffee any year be divided by the number of acres given by the planters for assessment, it shows a product of 430 pounds per acre for the entire island. Notoriously, however, the number of acres given for assessment was below the real number in crop, and consequently is not an exact guide.

A coffee plantation should improve every year with increase in age for twenty-five to thirty years, and the annual product should average 1,000 pounds per acre under cultivation. When it falls to 250 pounds, it shows faulty cultivation.

The crop commences to ripen in the early fall, and is picked by hand at an average cost of half a cent (gold) per pound for the green fruit. There are three processes of curing. One exposes the ripe berry to the sun till the pulp is desiccated, which requires several weeks. In the second process the berries are passed between the rollers of a "pulper," and reduced to a pulp, which is dried in the sun before removing the grain. By the third method, and the one generally used, the pulping process is followed by washing, to free the grains from the pulp. The grains are then dried and sent to the merchant's warehouse, or to the port, where the skin enveloping the grain is removed by machinery and the grain polished. Mocha and Old Government Java are prepared by the first process, which is considered to give a coffee of higher flavor. The third process enables the planter to market his crop much earlier and with less labor.

MARKETING THE CROP.

Before placing coffee upon the general market it is graded by selection into six classes, known in the island by the following names, in order of quality: First, caracolillo; second, hacienda; third, pueblo; fourth, cubano; fifth, merinda; sixth, frilla. The quality of the better grades of Porto Rican coffee is excellent, and compares favorably with the best coffees of the world. Till the American occupation it was chiefly marketed in Europe, as shown by the following table for the year 1896:

Exportation of coffee from Porto Rico for the year 1896.

Countries to which exported:	Pounds.
Spain	16,405,900
France	11,306,689
Germany	8,120,409
Italy	4,388,819
Cuba	15,577,710
United Kingdom	304,119
Austria-Hungary	2,280,221
United States	322,591
Danish possessions	19,595
British possessions	452
Santo Domingo	22,501
Total	58,780,006

FINANCIAL CONDITION OF THE COFFEE PLANTERS.

All careful investigations show that when Porto Rico came under American control the financial condition of the coffee planters, in the aggregate, was about as bad as it could be. Of course there were some exceptions. A few wealthy merchants owned plantations, and some planters were very thrifty; but about 70 to 75 per cent of the coffee plantations were heavily mortgaged, 30 per cent or more being mortgaged to the full value of the plantations. To make clear how this occurred, the financial system under which coffee plantations were managed should be explained. It is well known in Louisiana as the system of "advances." At the commencement of the fiscal year the Porto Rican planter arranged with some city merchant (provided the planter was not a merchant or a capitalist) to advance him from time to time money and supplies sufficient to make his crop. He pledged his plantation and crop by mortgage, agreed to pay 12 to 18 per cent interest, as the merchant might demand, and to turn over his crop, when harvested, to be sold at the option of the merchant. The planter received very little money and was charged a profit of 50 to 75 per cent on all supplies. The merchant, if he found it necessary, could buy his goods in foreign ports on a year's time. The coffee planter opened a small store on his plantation and paid his laborers in orders on this store or gave duebills on some branch store of his merchant. Under this system it cost the planter 30 to 40 per cent for funds to make his crop, and at the end of the season he had no option as to price or time in disposing of his crop; the merchant was the sole judge. Frequently the crop did not pay expenses; then a mortgage was retained, which increased from year to year till it absorbed the property.

The testimony of Mr. Sasteria Francisca, before United States Commissioner Carroll, November 1, 1898, is in point:

Importations formerly were made on a half scale in Porto Rico—that is to say, were imported over and above the needs of the island, because the importers could get a year's credit from Paris, London, or Hamburg commission houses. These merchants or importers, when they sold to smaller houses, charged them from the date of invoice one-half per cent interest [monthly] outside of their commission on the merchandise shipped, while they only paid their bankers at the rate of 4 per cent per year. Moreover, these importers sold that very merchandise on long terms to merchants in the interior, these terms extending as long as one year and a half in some cases, and generally sold at wholesale at higher prices than were paid by retail at the rates prevailing in the capital. These merchants of the interior would do exactly the same things in turn with the smaller merchants of the country, selling to them on long terms, and charging them at least 1 per cent a month on the invoiced values, and often from $1\frac{1}{2}$ to $2\frac{1}{2}$ per cent.

This class of smaller merchants in the interior consists for the most part of cultivators, and it is a very important matter to be considered that these small cultivators are charged at least 35 per cent per annum over and above any profit realized in any country in the world. The results of that system have been that at least one-quarter of the small proprietors in the island, buying in that way, in the period of five years have all lost their estates, the estates going into the hands of Spanish merchants who commenced selling goods on credit without any capital to speak of, and who after five or ten years have become worth \$20,000 and even \$50,000. The estates on which they held mortgages were unable to produce sufficient to pay back at the half rates that were collected.

The evidence is to the effect that planters with plenty of capital could make money in the coffee industry, but those who were obliged to borrow lost money. The Porto Rican coffee crop of the years 1892 to 1896, inclusive, sold in foreign markets in cargo lots at over 14 cents per pound (gold). This high price stimulated speculation in coffee plantations till they were rated at fabulous prices. In some cases

they were quoted at \$600 (gold) per acre for all the land in coffee-bearing plants. Probably \$150 to \$200 would be nearer a true average. Many coffee estates were sold on long time at these high prices to planters. Small payments were made at the time of the purchase, and the unpaid amounts were secured by mortgage at 12 per cent interest. The records of mortgages in Porto Rico show \$15,664,971.69 uncanceled mortgages on country property in 1898. By careful comparison of this with statements by bankers, it appears that the mortgage indebtedness of coffee estates at that time was about \$8,000,000. The total acreage of coffee reported for assessment was 122,389.76 acres, which would make the indebtedness on coffee lands equal to \$65.46 on every acre in cultivation. If 30 per cent of the estates were not mortgaged, as appeared evident, but were owned by capitalists, then the mortgage indebtedness on the remainder must have been \$93.51 per acre, an amount altogether too large for a farmer to safely carry. The mortgage is purposely attached to the lands in coffee, for in coffee estates they are the only income-producing property. Under these conditions coffee planters were compelled to face a great decline in prices, owing to increased competition in the markets of the world and special changes in the Porto Rican market arising from change of flag.

Under such burdens the coffee planters entered upon the season of 1899 and secured such advances as they could to make the crop. August 8, 1899, a destructive hurricane visited all portions of the island, sweeping away many buildings and a large portion of the coffee crop, tearing up the trees used for shade for the coffee, and greatly damaging the coffee plants. This left the coffee planters without means to continue work, because it destroyed credit as well as property. Had the planter possessed the capital to go immediately after the storm and clear away the débris, restore the buildings, and straighten up the coffee plants, the damage would largely have been limited to the partial loss of a crop; but not being able to do this, the loss in most cases amounted to the practical destruction of the plantation, which it will require five years to restore. In tropical countries the growth of grass, weeds, and vines is very rapid, converting the uncultivated coffee plantations in a few months into a jungle and destroying the trees.

From 70 to 75 per cent of the coffee plantations are now seriously injured, and the value of all coffee lands has declined. In case of the abandonment of this large percentage of coffee plantations these lands will become nonproductive, except the slight value in grasses and brush. This will reduce the export products of the island, as coffee constituted about seven-tenths of the exports of the island, during 1895, 1896, and 1897. In 1896 it amounted to 58,780,000 pounds and brought \$8,505,665. Abandonment would mean death to many laborers, who could find no other immediate employment. If not to be abandoned, vigorous steps should be taken to restore old plantations and set new ones.

Can this be done profitably? Planters claim that it now costs 9 cents a pound on an average to make and market a crop of coffee; that if former methods are to be continued and Porto Rican coffee is to be sold in the United States in competition with the Rio, it is better to abandon coffee planting in Porto Rico. But it is not necessary to continue former methods. The average product per acre should be increased three or fourfold, which would reduce the cost of production below 5 cents per pound. The best coffee in the world should be produced. Such coffees ought to average 14 to 20 cents per pound. This result could be accomplished at a nominal expense by the United States

Department of Agriculture through an experiment station, experimenting in, and disseminating knowledge of, coffee production. From this standpoint coffee production in Porto Rico has a hopeful future.

THE TOBACCO INDUSTRY.

Tobacco, the third chief product of Porto Rico, does not labor under any such disadvantages as coffee, as the loss of a crop can be repaired in one year. Aside from the temporary loss by the hurricane, the chief difficulty of the tobacco industry is the change of markets. Formerly a large percentage of the tobacco of Porto Rico was shipped to Cuba. This consisted of the better grade of "fillers and wrappers." In 1895 the amount shipped to Cuba was 2,160,347 pounds, or nearly two-thirds of the entire crop exported. In Cuba it was manufactured and sold as Cuban product. Of the remainder, about 1,000,000 pounds were manufactured and consumed at home. Of the balance, mainly low-grade tobacco, 1,375,751 pounds were sent to Spain and smaller lots to Germany, France, and other countries.

In January, 1899, the Cuban tariff, imposing prohibitive duties (\$5 per pound) on the Porto Rican product, went into effect, and the market for two-thirds of the crop was at once lost. The Spanish market was lost by change of flag, and tobacco was compelled to seek new markets. In this emergency the tobacco dealers met the difficulties by studying the markets of the United States and producing the qualities here demanded. Formerly they assorted their tobacco into three grades. Recently some have employed Cuban experts and are making fifteen or sixteen grades.

Porto Rican tobacco produced near the coast is of a low grade, but in the interior valleys the tobacco is very superior and ranks with Cuban where the seed, care, and curing have been similar. The hills near Cayey are dotted with immense sheds for curing tobacco. Formerly tobacco was grown in the valley only; later it was discovered that the hills produced a better grade than the valleys. The plants are set in August or September, and the crop is harvested in April and May. At the proper time the stem of the tobacco plant is cut on the two-leaf plan and hung in the sheds for about fifty days. It is then taken down, stem removed, and packed in a warehouse. The average production is 400 to 600 pounds per acre. Afterwards it is assorted, which gives the country people employment. A majority of the persons employed in the assorting were women, girls, and boys. Labor in the tobacco districts is noticeably better paid than in the coffee districts. As soon as it has been ascertained that Porto Rican tobacco and cigars can be profitably sold in the United States, there will be a large increase in the annual output, as coffee planters will engage in the industry to provide an income while they are restoring their coffee plantations. The following table shows the quantity and value of the tobacco exports for the eleven years preceding American occupation:

	<i>Tobacco exports.</i>	Pounds.
1887.....		7,633,000
1888.....		3,347,000
1889.....		7,736,000
1890.....		3,984,000
1891.....		5,287,000
1892.....		4,207,000
1893.....		4,208,000
1894.....		3,370,000
1895.....		3,665,000
1896.....		2,220,000
1897.....		6,253,953

This table shows that the tobacco industry had been on the decline for nearly a decade. In 1897 it showed sudden increase, due doubtless to the condition of the sugar and coffee industries.

MINOR CROPS.

Corn, rice, beans, potatoes, bananas, peanuts, citrus fruits, pineapples, cocoanuts, vegetables, etc., are classed as minor crops. According to records, 93,511 acres are assessed as devoted to these products, the chief of which is corn.

CORN.

The climate, rainfall, and soil of Porto Rico indicate, upon the whole, a good country for corn. Farmers report a crop of 60 bushels upon virgin land of good quality and 20 to 25 bushels on old land. This is equal to the average crop in the corn belt of the United States. A further evidence of the corn-producing capacity of Porto Rico is shown by the exports. In 1897 Porto Rico exported to Cuba 4,246,776 pounds of corn and 7,946 pounds of corn meal, and to Spain 30,133 pounds of corn. No corn was imported that year, thus showing that Porto Rico produced more than sufficient for home consumption. It should also be taken into account that the interior of the island could furnish no portion of this surplus, because, with the exception of one military road, there were no roads in the interior on which it could be transported to the coast. With a better knowledge of the corn plant and the conditions requisite for its best yield we may expect large corn products in Porto Rico.

RICE.

In former years Porto Rico produced considerable rice, and the only reason why it might not again is that there is very little level land easily flooded except near the coast, and this can be more profitably devoted to sugar cane. On the mountain summits, where there is a surplus of rain during the rainy season, small fields are raised without flooding. Here, however, the mole cricket (*Gryllotalpa*) attacks it and does considerable damage. It is probable that Porto Rico will continue to import the rice required by her people. The advance in rice at this time came inopportunistically for Porto Rico, but it has increased the consumption of flour and corn meal. The annual importation of rice into Porto Rico will be seen from the following statistics:

	<i>Imports of rice.</i>	Pounds.
1894		72,674,540
1895		74,145,046
1896		70,763,249
1897		77,994,122

This is an average of over 73 pounds per capita.

BEANS, SWEET POTATOES, AND BANANAS.

Beans are planted on farms for home consumption. The quality and yield are good. I was unable to obtain any data showing the amounts produced annually, but from the crops observed the supply appeared entirely inadequate to the necessities of the people. The nutritious sweet potato flourishes in all portions of the island, but, like beans, the supply produced for home consumption is less than it

should be. It is a much more healthful article of food than unripe bananas, and if supplied in abundance to the peasants of the coffee district there would be greater health and vigor.

Bananas are ordinarily produced in great abundance, because they furnish the shade of the young coffee plants. They are also grown for food without reference to coffee shade. They constitute the principal vegetable food of the laboring classes. The banana possesses some advantages. The product per acre on rich land is enormous, yielding in some cases as much as 60,000 pounds of fruit. In well-cultivated orchards it is possible to have fruit most of the year, though it is more abundant at certain seasons. The fruit should be cut before it is ripe and hung in a dark place till mellow. Some place it in a dirt house till mature; others simply cover it with dirt. In most tropical countries the ripening is neglected and the fruit is eaten in an immature state. It is usually cooked. A dwarf variety, known as Guineo fruit, about 4 inches long, is greatly prized. The skin is very thin, meat yellow and highly flavored. I observed a good many stems that had failed to mature more than half a bunch of bananas, probably the result of a deficiency in fertility or moisture, or both. A little knowledge and care would easily remedy this defect. When a line of fruit steamers is established to Porto Rico bananas will constitute an important part of the exports.

VEGETABLES.

A visit to the markets does not give a favorable impression of the capacity of Porto Rico to produce vegetables. The cabbages for sale are very inferior in size and quality. Many are not more than 4 inches in diameter, and not solid heads. The tomatoes usually range from 1 to 2 inches in diameter. Root crops are in proportion. Watermelons offered are inferior in size and quality; the lettuce is small and bitter. An inspection of the gardens or fields where these vegetables are produced affords an entirely different view of the garden problem. Vegetables are planted on land long in use, imperfectly tilled, without fertilizer, and turned over for further care to Providence. The seeds in many instances are sown broadcast. Gardeners from south Florida, located near San Juan, showed good results. Their vegetables were not only of good size, but of excellent quality. One gardener near Rio Piedras delivered in San Juan several loads of watermelons each weighing 50 pounds or over. His produce brought high prices. The following vegetables can be successfully raised:

Vegetables which can be raised in Porto Rico.

Beans.	Kenep.	Peppers (green).
Beets.	Lettuce.	Peas.
Cabbage.	Lentils.	Pumpkins.
Cassava.	Lechosa (species of musk- melon).	Radishes.
Carrots.	Muskmelons.	Sesame.
Celery.	Okra.	Squash.
Corn (sweet).	Onions.	String beans.
Corn (field).	Potatoes (sweet).	Tallote.
Cucumbers.	Potatoes (Irish).	Turnips.
Eggplant.	Peanuts.	Tomatoes.
Garlic.	Peppers (tabasco).	Watermelon.
Gourds.		Yams.

ORANGES, LIMES, AND LEMONS.

Porto Rico is well adapted to the growth of the orange. Here the tree is hardy, healthy, a rapid grower, a marvelous producer, and

retains its vigor for many years. It develops its fruit perfectly, even in the wild state in the forest. In all parts of the island it is possible to find many excellent locations for orange orchards. The planter can select such a conformation of hills as to protect his orchard from prevailing winds. In soils he can take his choice between the rich, sandy loam, the fertile gravel (6 feet deep), and the porous clay loams. Lands for such purposes can be purchased at from \$5 to \$20 per acre near a good port. At Mayaguez I visited the fruit farm of F. G. Molina on the bay and photographed an orange tree 3 years old from setting. It was 6 inches in diameter at the base and about 18 feet high with branches 5 or 6 feet long, full of fruit. I also photographed a tree 5 years old, which bore 5,000 oranges last crop, and another 7 years old, which bore 7,000 oranges. Mr. Molina sold his oranges at \$3 per thousand f. o. b. ship for New York.

What has been said of oranges applies equally to limes and lemons, except that lemons are produced solely by cultivation, and very little attention has been paid to them.

SHADDOCK, GRAPE FRUIT, OR POMELO.

The shaddock is in habit like the orange, grows 30 to 40 feet high, ornamental, globose or pyriform in shape, pale yellow in color, and produces a large subacid fruit, rather coarse, with thick rind. Specimens of this fruit sometimes weigh 10 pounds each and in rare cases 15. It is a native of the Polynesian Islands, and was early brought to the West Indies. It is hardy in Porto Rico.

Grape fruit, the best variety of the shaddock family, attains perfection in Porto Rico. Conditions of growth are like those of the orange, except that it is more sensitive to frost, which makes it an unsafe product in the United States, only in the extreme south of Florida. This large, luscious fruit would be greatly appreciated in all portions of the United States if it could be placed on the market at a moderate price. With the low freight rates to New York, Porto Rico should supply this demand.

MANGO.

The mango is a luscious semiacid fruit, greatly prized in the Tropics. Its reliability as an annual product is one of its chief merits. It is valuable simply for home consumption.

COCOANUTS.

The cocoa palm is one of the most valuable trees produced in any country. It thrives on the sand dunes, valuable for little else, near the seashore. The trees are from 50 to 90 feet high, and 100 to 160 can stand upon an acre. When mature the trees produce an average of 150 nuts each annually. With due allowance the crop of an acre may be estimated at 10,000 nuts annually, worth \$150 on shipboard. To gather the nuts, remove the fibrous shuck, and load costs \$2.40 per 1,000 nuts, or \$24 total cost of crop per acre. The shuck is sold for matting material. Trees begin to bear at 5 years old and continue for about one hundred years. Every part of the tree is valuable. The hard portion of the trunk makes the celebrated porcupine wood; the leaves are used for baskets and thatching; the fibrous husk of the nuts is made into mats; the shell of the nuts is used for drinking cups, frequently beautifully carved; the meat is used for confectionery, and the water or liquor is an agreeable and healthful drink.

PINEAPPLES.

Pineapples are produced in all parts of Porto Rico with great success at a trifling cost of labor. Eight to ten thousand plants are set on an acre, and after the sets are well established no further care is taken. As a rule, after the plants are set they are neither hoed nor shaded, as in Florida. The ripe fruit weighs from 2 to 16 pounds per plant, and may be averaged at 6 pounds. At 3 cents apiece the pineapple crop is very profitable. It is one of the most luscious of fruits when ripe, and if sold at reasonable rates the United States will prove an unlimited market for it. In time pineapples should become as abundant and as cheap as apples in our market. At Fajardo, San Juan, and Mayaguez small farmers are prepared to make large contracts for delivery to anyone establishing a cannery.

GUAVA.

The variety cultivated for the fruit is a small tree from 9 to 15 feet high, with angular branches and an abundance of pointed, elliptical leaves. The fruit is about 1 inch in diameter, apple or pear-shaped, yellow, very fragrant, and filled with a yellowish or reddish pulp, sub-acid in flavor. It is an abundant bearer, and furnishes one of the best fruits known for the manufacture of jelly.

PEACHES, PEARS, FIGS, AND GRAPES.

These fruits have not yet been produced to any extent. Sample trees of the peach, of the Leconte and Keiffer pear, planted near Bayamon, show excellent growth and vigor. There is apparently no reason why they should not become staple products. Figs are yet on trial. They do fairly well in some parts of the island. It is a question whether they have been given a fair trial.

Few grapes are produced. Under Spanish rule grape culture was discouraged, because it might interfere with the wine industry of Spain. Wine is commonly used as a table drink in Porto Rico. In 1897 the import of common wine was 4,314,473 liters (a liter is about a quart), at a cost of about 52 cents per liter. Mr. George Bird, of Fajardo, stated to me that his father, on his return from Spain some years since, brought from Malaga a few of the best varieties of grapes produced there, and on trial they did better in Porto Rico than in Spain. By pruning he had produced in some years four crops.

List of fruits and nuts produced in Porto Rico.

Alligator pear.	Grosella.	Orange.
Almond.	Grape fruit.	Pajuil.
Bread fruit.	Grapes.	Pineapple.
Banana.	Guava.	Plantain.
Cactus pear.	Ivory nut.	Raspberry.
Cocoanut.	Lemon.	Rose apple.
Cherry (tropical).	Lime.	Russet fruit.
Cocoa plum.	Mamee sapota.	Shaddock.
Chocolate bean.	Mango.	Soursap.
Cayoll (palm fruit).	Mangosteen.	Strawberry (wild).
Coffee.	Mulberry.	Tamarind fruit.
Custard apple.	Nutmeg (spice).	

Fruits and nuts that may safely be introduced.

Blackberry.	Strawberry.	Japanese persimmon.
Japanese plum.	Keiffer pear.	Leconte pear.
Olives.	Pecan nut.	Walnut.

STOCK RAISING.

Five conditions are requisite to make an excellent stock country:

- (1) Abundant grasses, of superior quality, and pasturage as nearly continuous as possible.
- (2) Pure and abundant water.
- (3) Equable climate.
- (4) Freedom from annoying insects.
- (5) Good markets.

Porto Rico possesses all of these advantages in an eminent degree. As a grass-producing country it is unsurpassed. Its hills are covered with grama grass, corresponding for pasture to the mesquite grass and the buffalo grass of the United States. The cultivated grasses, guinea grass (*Panicum maximum*) and malojilla, are very nutritious, and produce a large amount of forage per acre. Dr. Don Augustin Stahl states that 50 square meters of these grasses will sustain an ox or a horse, which would be equal to 81 horses or oxen per acre. This could scarcely hold good for the entire year. Twelve animals are probably nearer the average. Authentic cases are given where land set in guinea grass has produced 130 tons of green fodder per acre, equal to 32.5 tons of hay. Cattle and horses in the working season rarely receive any other food than these grasses, cut and fed in a manger under shelter.

The creeks and rivers have sufficient current to keep the water pure, and springs are plentiful in the mountains. The weather is always cool, mornings and evenings, when the stock is grazing. Flies and mosquitoes are about the same as in the higher portions of the Southern States. Cuba and St. Thomas take all surplus stock at good prices. The horses are the exact type of those descended from Spanish stock in the prairie sections of Louisiana, very small but full of energy. The foundation was evidently of the best Arabian stock, but now greatly deteriorated.

The cattle are also of Spanish stock, but have been crossed more or less with Senegambian males, adding something to the size and fattening properties, but reducing their value for milk.

Some sheep are kept, but the industry has not been a great success. There is too much rain in the highlands. Goats are common in all parts of the island, and with a better stock might be made the basis of an industry of much profit.

Comparatively few swine are raised. Possibly the absence of fences is the cause. With small fields of cassava, sweet potatoes, peanuts, and sorghum it ought to be possible to raise hogs at a nominal cost, and the market is excellent.

The small amount of poultry kept is a perpetual surprise. One may travel for miles in the country without finding a good flock of chickens. Most of those raised are inferior in size and quality. The eggs are small and lack in flavor, but the price is large enough—36 cents per dozen. Chickens sell at 40 to 75 cents each. Investigations show that there is little reason why chickens should not be produced in great abundance.

FARM WAGES.

The usual hours of work in the field are from 6 to 6. A majority of the field hands commence work in the morning without having eaten anything. A few take early coffee. At 11 o'clock half an hour is given for breakfast. Breakfast consists of rice and beans, bread and

cheese, or sweet potatoes and fish. Where the plantation boards the hands, as sometimes occurs in the sugar-harvest season, board consists in furnishing daily one-half pound of rice and one-fourth pound of beans, or 3 pounds of sweet potatoes and half a pound of fish (dried), or 1 pound of bread and one-fourth of a pound of cheese. The laborers on coffee estates rarely eat meat, except on Sunday. Many laborers eat nothing till the close of the day.

The customary wages were 30 cents (gold) per day prior to the changes in currency, but, instead of money, in most cases the payment was made by giving an order on the store, which reduced the value at least 33 per cent. In coffee-picking time the women were able to earn 15 to 25 cents per day. Coffee planters are generally liberal in allowing their laborers to use the bananas on the farm, and in giving them the use of small tracts for vegetables if they will use them. The laborers complained that they had no time to make a garden. Many laborers were unemployed in the coffee districts because the plantations were uncultivated and had remained so since the hurricane of last year. In the tobacco and sugar districts labor was in a much better condition. Tobacco culture gives more employment to women and children. On the sugar plantations higher wages have usually been paid during sugar making, which continues for four or five months. This better condition is shown more by the personal appearance of the laborers than by improvement in their houses and home surroundings. The constant efforts of the insular government since the island came under American control have been directed to the relief of the labor situation.

(1) All personal taxes have been removed from laborers.

(2) The oppressive consumers' taxes on food and articles of necessity have been abolished.

(3) The change of the money standard, which took effect August 1, 1900, has benefited labor. In many cases laborers are now receiving in gold what they formerly received in silver.

(4) Thousands of laborers in the coffee districts have been given employment on the public roads now in process of construction by the insular government.

(5) The Porto Rican tariff on flour, corn, and rice was formerly very high; now they are admitted free.

(6) Indirectly labor has been benefited by the removal of the export taxes on sugar, coffee, and tobacco, and by the repeal of the law levying royal dues and taxes on importing agricultural implements.

CHARACTER OF THE LABORING CLASSES.

The laboring classes have surprisingly active minds, considering the conditions under which they have lived. They are mechanically inclined, kindly disposed, and respond readily to fair treatment. With opportunities and reasonable encouragement they will rapidly improve. Many American employers of Porto Rican laborers gave a very encouraging report of their industry and faithfulness. It was gratifying to note the desire to be self-supporting. The Women's Aid Society of Porto Rico gives partial employment to about 400 poor women, many of whom are from the country. Garments are given to the very poor. Only 3 per cent of the women employed, however, accept alms, preferring to pay for their garments by installments at the rate of 5 cents per week. Their average earnings are 15 cents per week.

DEPRESSION IN AGRICULTURE.

Many persons are under the impression that the agricultural industries of Porto Rico were prosperous under Spain, and that their decline is due to bad management upon our part and to the hurricane of August 8, 1899. The American flag was not formally raised over the island till October, 1898. Almost immediately evidence was taken setting forth the condition of agriculture. This evidence conclusively establishes the fact that, while the income of the coffee farms was considerable, the profits did not go into the hands of the tillers of the soil, but went to enrich the capitalist, who in many cases returned to Spain in a few years to enjoy his wealth. Blocks of stately buildings in Barcelona and other Spanish cities are shown the traveler which were built with the profits obtained from the products of Porto Rican farms.

The conditions upon which the coffee planters secured loans to make their crops is proof that the coffee industry had not been prospering as it should. But there is plenty of direct proof taken prior to the hurricane, and all to the same effect.

Señor Luis Cenal, of Fajardo, stated on November 6, 1898:

The abandoned cane estates are run to pasture, but as this is not making proper use of the land it can be calculated that 75 per cent of the district is, properly speaking, unproductive.

November 7, 1898, Mayor Eustaquio Torres, of Guyanilla stated:

Agriculture, which has been languishing and has been impoverished, is overwhelmed by enormous tributes, wanting facilities afforded by an agricultural bank, and fighting an unequal fight with the merchants, owing to the fact that the difficulties of the money system closes to it foreign and national markets. From this cause originates the general depression of the country, especially of the laboring class. This class does not earn enough to buy food, and its ranks are being swelled enormously by small proprietors, who, wanting in means to till their small farms, are obliged to sell them. That is the reason why public wealth is concentrated in the hands of a few capitalists in each town, and also why so many uncultivated lands are seen, their owners, owing to their great extent, not being able to give them attention.

The above evidence was taken before Dr. H. K. Carroll, commissioner; and evidence was placed before me proving that the sugar interests had scarcely paid expenses for the ten years prior to 1899.

CAUSES OF DEPRESSION IN AGRICULTURE.

It is pertinent to inquire the causes of the decline of agriculture under Spanish rule. They may be summarized as follows:

- (1) The system of credit or "advances"—explained under head of "coffee."
- (2) The manufactures necessary to obtain full value of farm crops discouraged.
- (3) Farms taxed for benefit of cities.
- (4) Tendency to build up large farms.
- (5) The consumption tax on food.
- (6) Laws favoring the merchant class.
- (7) No country roads; cost of transportation excessive. In some cases it costs \$1.25 to transport 100 pounds 5 miles.
- (8) Economic conditions bad. Little agricultural machinery and few implements used on account of excessive import duties; labor depressed and unable to do good work.
- (9) Landlordism. Farms fell into the hands of town and city people who knew little of farming. Many farmers were so involved that they could not control the management of their farms.

(10) Too narrow a range of agricultural production. The agricultural products imported amounted to about five-elevenths of the total imports. In 1895 the agricultural products imported amounted to \$7,171,352 (gold), and the total nonagricultural to \$9,644,101, or 42.60 per cent of the former to 57.40 per cent of the latter. The total exports of native products in 1895 were \$15,190,856, of which amount \$14,573,366 were agricultural. Tersely stated, they imported 50 cents' worth of rice, flour, fish, etc., for subsistence to enable them to produce one dollar's worth of sugar, coffee, and tobacco for export. If there was any failure in the dollar crop, money must be borrowed to pay the 50 cents.

(11) No agricultural schools nor journals to disseminate knowledge upon agricultural subjects, without which no nation has taken front rank in agriculture.

EFFECTS OF SUCH CONDITIONS.

The consumption tax was a tax levied by towns and cities upon the necessities of life, such as maize, rice, lard, sugar, flour, silk, charcoal (used for cooking), petroleum, etc. It was not placed on dry goods, jewelry, and similar articles. This tax was very heavy, as the following will illustrate:

	Consumption tax (silver).
Muscovado sugar -----per cwt..	\$2.00
Flour.....do...	1.25
Rice.....do...	2.25

This tax was far-reaching in its effect. It not only nearly doubled the cost of living, but it prevented the establishment of small farms in the vicinity of cities, because the farmer must provide for the consumption tax before he could sell. This was practically prohibitory.

The effect of landlordism is to obtain the largest present revenue from the land possible, regardless of the future. To this may be charged the complete destruction of all the timber within merchantable distance of any good road or any market. Present fertility of soil is taxed to the utmost at the expense of future production. Improvements are cheap and rude.

Under such conditions it was only a question of time when general bankruptcy must be forced on the producers. It was certain to follow any general failure of crops, any great decline in prices or radical change in the character of the markets, or any monetary crisis which should destroy credit. Unfortunately for Porto Rico, all these things occurred at once. Change of flag necessitated new markets for a majority of her staples, the hurricane destroyed most of the crop in 1899, and credit to planters was totally withdrawn. The hurricane was a crowning calamity. It swept away not only crops, but the improvements, and devastated the island in all portions to an amount scarcely to be estimated. While it visited the coffee plantations with special violence, it left its wreckage marks on every sugar plantation in the island.

HOW CAN DEPRESSION IN AGRICULTURE BE RELIEVED?

I have stated the condition of agriculture and the cause of its decline somewhat fully in order to point out clearly the relief. It is evident that the only immediate relief that can be afforded the agricultural interests in Porto Rico must be provided through the established lines

of industry—sugar, tobacco, and coffee. While immediate steps should be taken greatly to increase the number of profitable agricultural industries, such changes can only be effected gradually and should be regarded rather as part of a wise economic policy for the future than as a measure to afford the immediate relief required. All the farm labor of the island was formerly given employment. The insufficiency of employment now arises chiefly from the prostration of the coffee farms. While the sugar and tobacco industries will provide about the normal amount of labor the present year, they can be greatly strengthened financially. Better drainage, the use of renovating crops, and a judicious system of crop rotation will enormously increase the product per acre, and more improved machinery will add largely to the sugar product.

SCIENTIFIC INQUIRY AND EXPERIMENTS.

These improvements require scientific inquiry and experiments along practical lines. These experiments, to be of assured value, must be made upon Porto Rican soil. The tobacco industry comes nearer being able to sustain itself and provide for future improvement than the other industries. This, however, applies more to the large planters and manufacturers than to the small producers, who at least need instruction. Few crops require more technical knowledge and skill in production and manufacture than tobacco. The production of the best varieties is a fine art and is complicated by fashion, which differs in different markets. What is a very high grade in one market is a low grade in another, and small producers can not investigate methods as adapted to markets.

HOME PRODUCTION OF FOOD.

A further means of improving agricultural conditions is for all the sugar, coffee, and tobacco plantations to produce a variety of food crops sufficient for their employees, and for each employee who is the head of a family to produce the food for his household. This should be a cardinal principle adopted by all planters. For an island as fertile as Porto Rico to import annually 50 cents' worth of alimentary products in order to export one dollar's worth of sugar, coffee, and tobacco is an unsafe policy and should be discontinued at once.

INCREASE OF SMALL FARMS.

Naturally when a large number of small farms fell into the hands of the capitalist he consolidated them and placed them under one administration. If it was not convenient to work them, they were grazed, reducing the demand for labor.

The number of small farms should be greatly increased and their products diversified to the limit of profit. The fruit and nut crop in ten years should exceed the combined annual export of all farm crops at this date. Winter vegetables, poultry, and dairy products should form large items in the export columns.

INDUSTRIAL VILLAGES.

The early establishment of a number of minor industries closely related to agriculture is of vital importance to future prosperity. The

object of such industries is to give profitable employment to the wives and children of farm laborers, so that the earning ability of the home may be doubled and in some cases quadrupled. Under such conditions, if the head of the family fails for any cause to earn his wage, the home goes on; the earning capacity is lessened, but the home is not destroyed. This has its moral as well as economic bearing. Many philanthropic Porto Ricans suggested that the farm laborers on the coffee and tobacco plantations scattered upon the mountains, without roads, society, or schools, children nude and semiwild, could never derive the full advantages of free education and be influenced by the elevation of society until they were gathered into small villages and became amenable to society. In a republic this can not be done by force, but once establish small industrial villages in the country and the small, scattered mountain population will be attracted to the village by its superior earning capacity and its advantages for schools, society, and better living. This will be no detriment to the farms, because the village laborers will be within reach of every farm. The industrial village where all are workers, is fundamental in Japanese civilization. The manufacture of hats, straw goods, and matting, the production of raw silk, and the canning of tropical fruits are examples of the employments in question.

BETTER HOMES.

It is of vital importance to the future prosperity of Porto Rico that there should be a great improvement in the homes of the farm laborers, better houses, and more comforts. To this end a larger and more comfortable house must be devised that will be within the means of the laborer to build. This can be done with a slight addition of the labor expended upon it. In this connection the necessity of encouraging the planting of trees for building purposes is apparent.

PRESENT AGRICULTURAL RESOURCES AND POSSIBILITIES OF PORTO RICO.

The exports of Porto Rico for the fiscal year ending June 30, 1901, may be estimated as follows:

Estimated exports of Porto Rico for 1901.

Articles.	Pounds.	Value.
Sugar	80,000,000	\$3,000,000
Molasses		300,000
Tobacco and manufactures	5,000,000	1,000,000
Coffee	25,000,000	5,505,762
Other exports		800,000
Total		10,605,762

NOTE: The total exports for 1897 were \$11,011,524.

The sugar crop of 1900 will be less than normal, but, by reason of the better price, will bring considerably more money. The tobacco crop is placed at normal, and the coffee crop at 50 per cent of normal. It will be seen that the estimated exports of the fiscal year ending June 1, 1901, are only \$405,762 below those of 1897, the last year of Spanish possession, regardless of the destruction of the hurricane, which reduced the coffee export about \$5,500,000. The farmers have given

more attention this year to the production of food crops. It may, therefore, be fairly claimed that, as a whole, the net income of Porto Rico from farm crops will be about the same as usual; but this will not relieve the distress, because it will not be as widely distributed as formerly, the deficiency occurring in the coffee districts.

POSSIBILITIES OF AGRICULTURE IN PORTO RICO.

As to the possibilities of agriculture in Porto Rico I submit the following statement:

The United States imported in 1899, in addition to the imports of sugar, coffee, and tobacco, the following:

Fibers (vegetable), manufactures of, including mattings, etc.....	\$45,457,687
Nuts and fruits	18,317,201
Silk, unmanufactured.....	32,479,627
Total.....	96,254,515

The industries of Porto Rico, properly developed, could produce a large portion of the foregoing without interfering with her present exports. In addition, it could produce camphor, india rubber, spices, and other articles of which we import large quantities. Thrifty specimens of india rubber plants and of camphor plants were seen. In case of such an expansion in the production of tropical products, Porto Rico would become a large consumer of the food products exported by the United States, which would be greatly to our trade advantage over the present plan of securing these articles. No portion of Porto Rico is over 20 miles from the coast, and with good roads all products could reach an ocean port in a few hours and by the conveyances of the farm. The transportation from the ports to New York is low and with increased freights will be much reduced. A few thousand dollars judiciously expended annually in the development of the agricultural resources of Porto Rico will result greatly to our benefit, because we shall then be buying our tropical imports with our surplus products.

The appended list shows some articles, and their values, of import into the United States in 1899, all, or a portion of which, could be profitably produced in Porto Rico:

Articles imported into the United States which might be produced in Porto Rico.

Cocoa and the manufactures of	\$5,360,116
Coffee.....	55,275,470
Fibers, vegetable, and manufactures of	45,457,687
Fruits and nuts	18,317,201
Hats and bonnets, materials for	2,426,726
India rubber and gutta-percha and manufactures of.....	32,370,098
Molasses	789,576
Silk, unmanufactured.....	32,479,627
Spices.....	2,782,301
Sugar.....	94,964,120
Tea	9,675,081
Tobacco and manufactures of	11,843,357
Vanilla bean.....	1,235,412
Total.....	312,976,771

AN AGRICULTURAL EXPERIMENT STATION.

The most potent factor in accomplishing the improvement of agriculture would be a properly equipped agricultural experiment station,

with a wider range of investigation and application than is usually given to such institutions.

First. Such a station should give immediate attention to the production of larger and better crops of coffee, sugar, and tobacco, at a less cost than at present.

Second. It should encourage the production of food products to the extent of home consumption.

Third. It should promote the establishment of small farms for fruit and vegetables.

Fourth. As soon as practicable it should prosecute investigations that will lead to the improvement of farm stock with special reference to the requirements of the farms for work animals and of the markets for beef and dairy products. There is no good reason why Porto Rico should import 743,560 pounds of cheese annually at a cost of 16.4 cents per pound when there is an abundant supply of sweet grasses and rich milk on the island.

Fifth. The station should diligently prosecute investigations in forestry to reestablish the woodlands.

Sixth. It should be especially empowered and charged to introduce minor industries for the betterment of the families of farm laborers.

Seventh. An important part of the station work should be the introduction of new varieties of seeds, plants, trees, and animals which are adapted to the climate and conditions found in Porto Rico; also to see that the best seeds and fertilizers are sold to farmers. For any country to fail to keep a watchful eye on the progress of other countries and take advantage of their natural resources and the improvements they have made in the products of the soil is to fall behind in the race of life and publicly acknowledge a lack of enterprise.

OBJECT LESSONS.

It will be necessary to place the work of the station mainly in the form of object lessons and on a sufficient scale to show economic results. This will require more land than would be sufficient to establish theories or principles in agriculture.

To carry out the plan of the station the earnest cooperation of the farmers should be secured by local associations and otherwise. The station should issue bulletins at regular periods, and the officers of the station should meet the local association for discussion of agricultural topics at least once a year. At the same time schools for women could be held, giving instruction in various home industries suited to their condition.

DESIRABILITY OF SECURING THE COOPERATION OF PORTO RICAN FARMERS IN EXPERIMENT WORK.

It is highly important to secure the active cooperation of the farmers in investigations of the station and in the dissemination of information. The best plan is to organize local associations of farmers in every important rural center in the island who will cooperate in testing seeds, plants, and methods of cultivation and aid in distributing bulletins, pamphlets, etc. In nearly every community can be found planters of liberal education and travel. Some were educated in the United States and can speak English. As far as consulted, all planters were enthusiastically in sympathy with the proposed work of the station.

INSTRUCTION IN AGRICULTURE IN THE COMMON SCHOOLS.

A few simple oral lessons on the nature of seeds and plants, how to prepare the soil, and how to plant and care for the crop, with some small plats around the schoolhouse as object lessons, would be of inestimable value to the youth and far-reaching in its results. Many of the lower classes in the country appear to have no knowledge of the principles of agriculture or of its successful practice. They half stir the soil, sow the garden seeds broadcast, and let Providence do the weeding. The commissioner of education for the island expressed a desire to do all in his power to promote agricultural education in the common schools.

LOCATION OF THE STATION.

There are a number of reasons why the experiment station should be located near San Juan.

First. It is the opinion of all who have investigated the subject that object lessons under farm conditions should form an essential feature of the station. It must, then, be at the place most accessible for the people of the whole island and for persons temporarily visiting the island.

Second. The station must be located where it can have direct and prompt communication with the Department of Agriculture at Washington, because for some years it will not have equipment to do all the scientific work required, and reference must be constantly had to the several departments at Washington.

Third. San Juan is the only city upon the island which has printing establishments sufficiently equipped to issue bulletins in English and Spanish with reasonable facility.

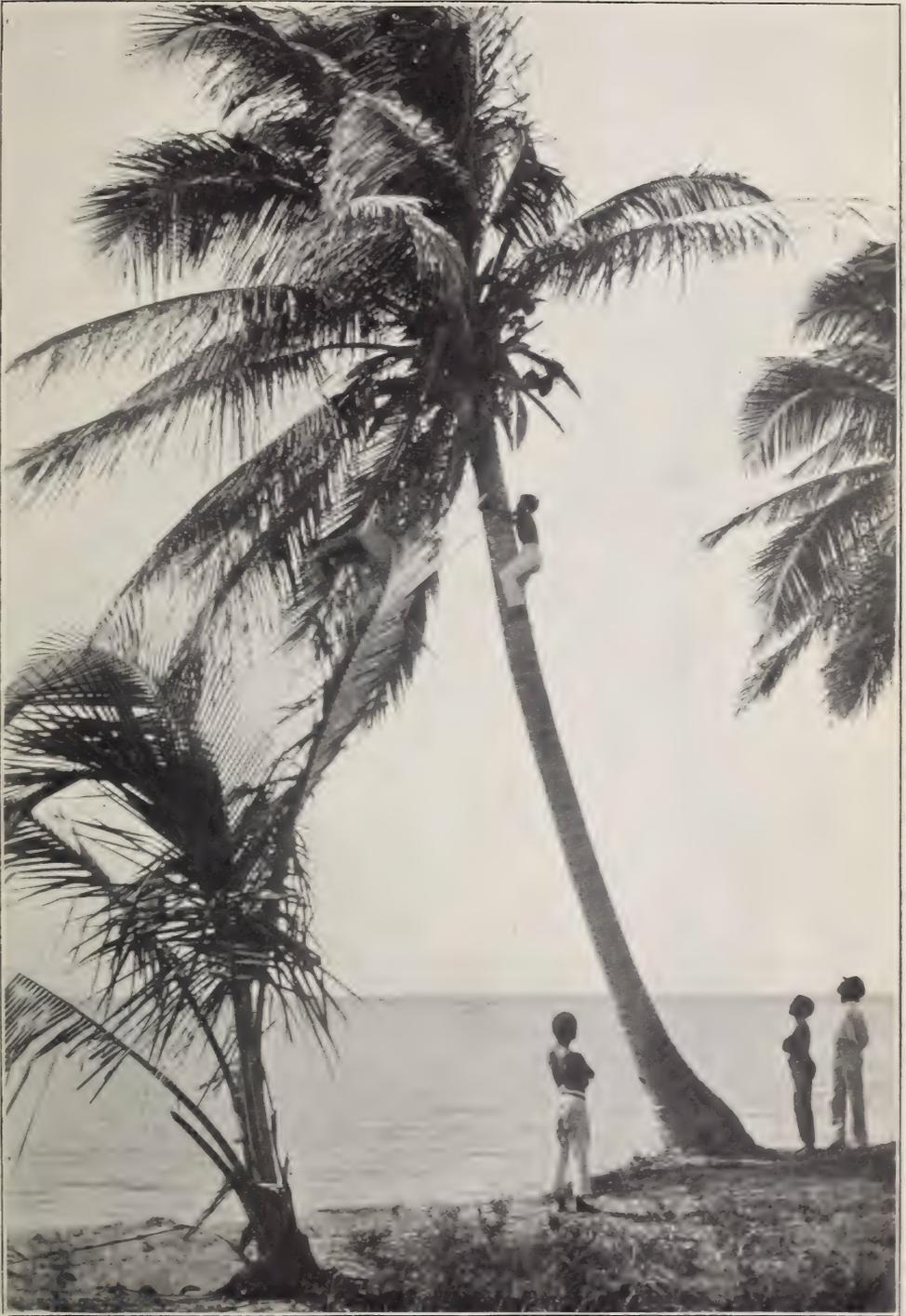
Fourth. Lands near San Juan can be purchased at reasonable prices.

FINANCIAL SUPPORT OF THE STATION.

For the current expenses of an agricultural experiment station in Porto Rico at least as much money will annually be required as is now appropriated for such stations in the States and Territories (\$15,000). The cost of the buildings needed by the station is estimated as follows:

One building for director and assistants	\$5,000
One building for offices and laboratory	3,000
One house for farm foreman	1,000
Four cottages for farm laborers	800
Barns	1,000
Total	10,800

Suitable land in the vicinity of San Juan will probably cost \$25 per acre, and at least 200 acres should be obtained for the station there, for the purchase of which \$5,000 will be required. For outlying experiments Government land on the island may be reserved. These reservations should include alluvial or level lands for sugar and rice, mountain lands for forestry, tobacco, and coffee, and sandy sea-coast lands for cocoanuts.



GATHERING COCOANUTS.



PLOWING FOR SUGAR CANE.



HAULING CANE TO MILL.



CANE MILL.



SPREADING BAGASSE TO DRY.



EXPORTING SUGAR.



HAULING MOLASSES TO MARKET.



SUGAR PLANTER'S HOUSE, ARECIBO.



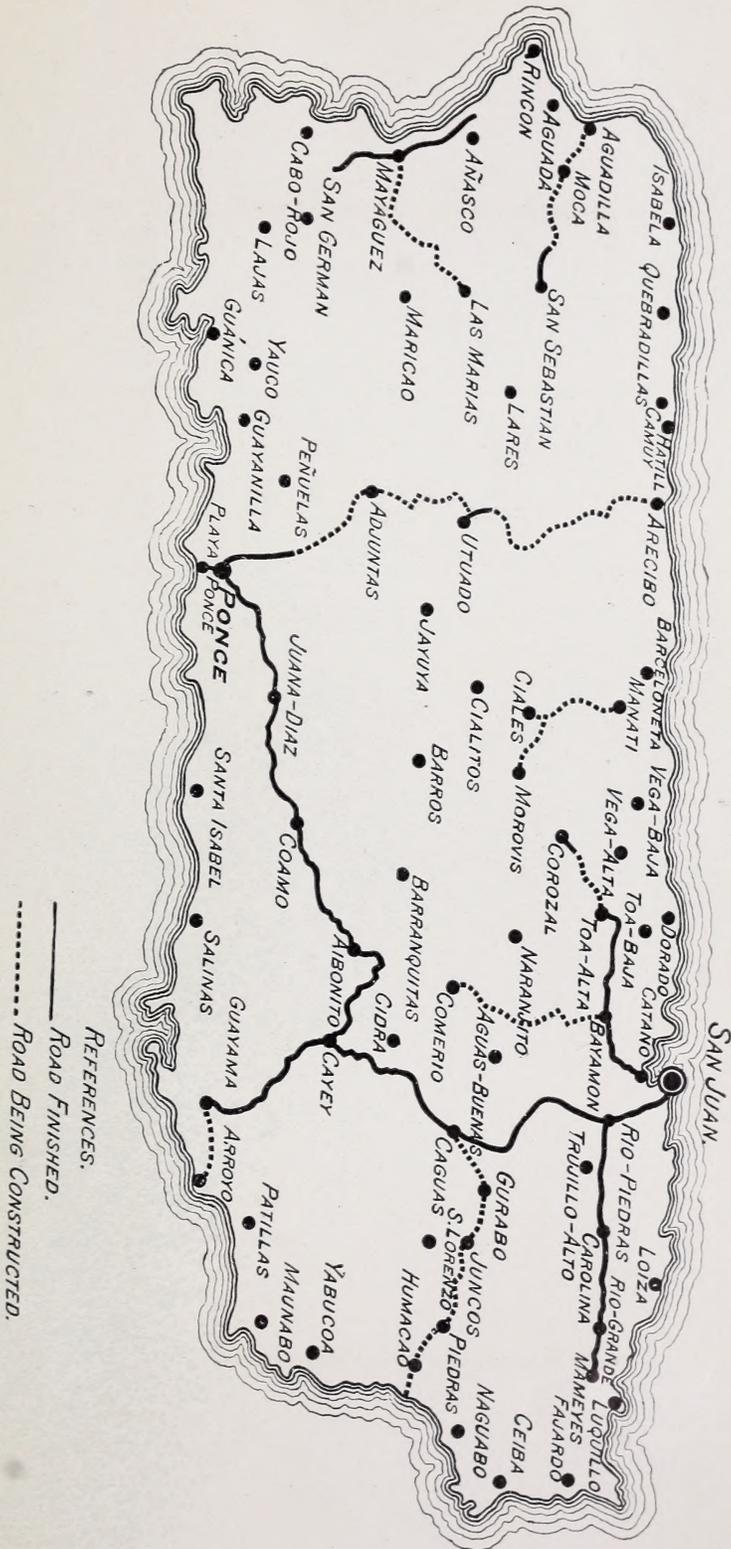
LABORER'S HUT, NEAR CARMEN.



THREE-YEAR-OLD ORANGE TREES.



LABORER'S HUT, COFFEE PLANTATION.



MAP OF ISLAND OF PORTO RICO, SHOWING STATE OF ROADS IN 1900.

