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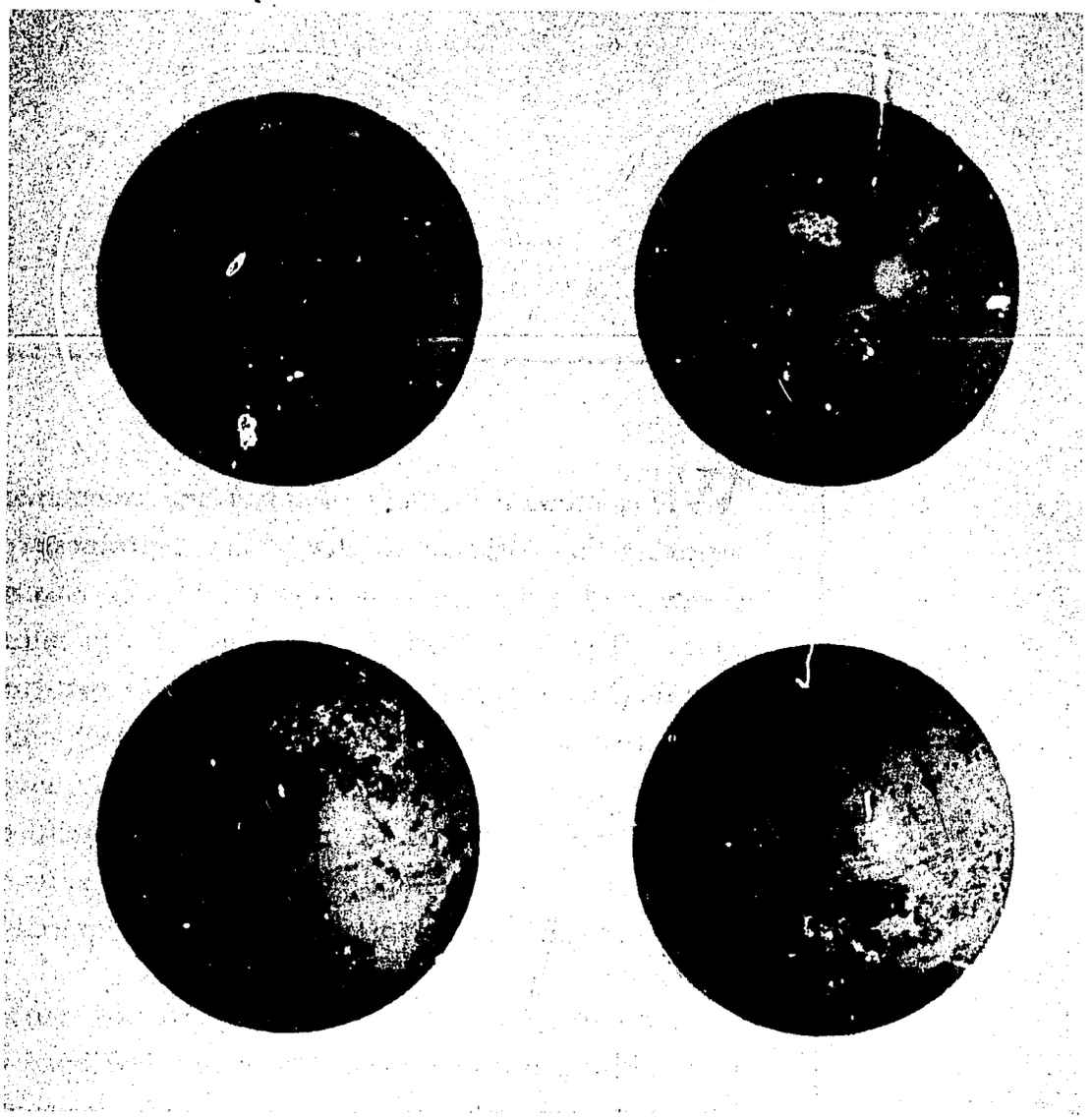

THE MAJOR AGRICULTURAL LAND TYPES IN DOMINICA, W. I. AND THEIR POTENTIAL FOR DEVELOPMENT

John D. Shillingford

DEPARTMENT OF AGRICULTURAL ECONOMICS

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A Statutory College of the State University
Cornell University, Ithaca, New York

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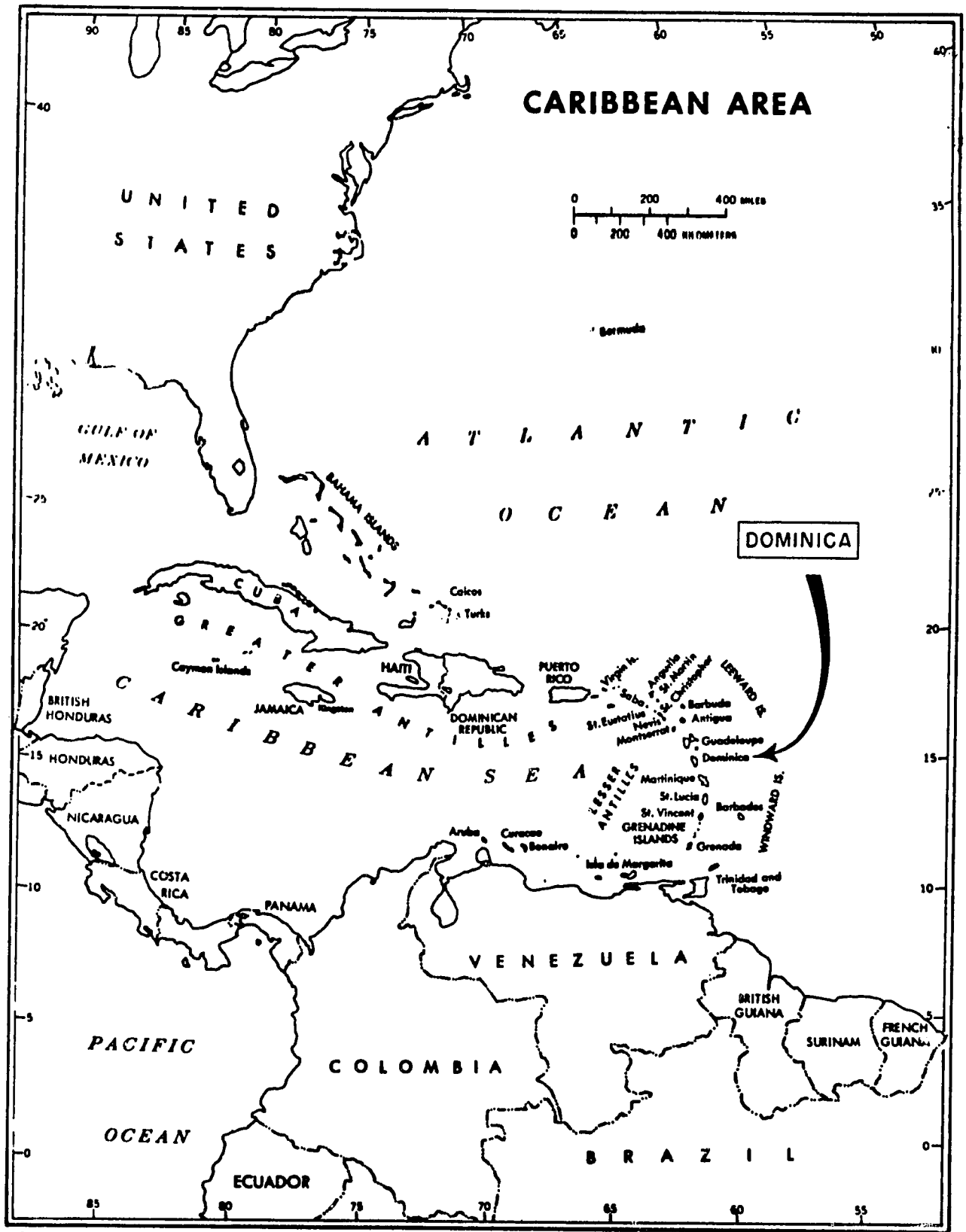

U.S. DEPARTMENT OF AGRICULTURE

NEG. ERS 2971-64(a) ECONOMIC RESEARCH SERVICE

Map I

THE MAJOR AGRICULTURAL LAND TYPES IN DOMINICA, W.I. AND THEIR DEVELOPMENT POTENTIALS[1/]

John D. Shillingford

INTRODUCTION

To the macro view of the agricultural policy maker, land is often seen as a homogeneous input, which in reality it is not. The work of soil scientists, which portrays land as an infinitely variable resource, is invaluable at the micro level; however, it does not lend itself to an easy grasp of the macro picture and is often confusing to the uninitiated. This study attempts to describe the land resources of Dominica in a comprehensible manner, with respect to differences in important morphological and performance characteristics.

Dominica is an island of 305 sq. miles (195,000 acres) in the Eastern Caribbean at latitude 15° 25" N and longitude 61° 20" W. The island was settled by the English after a protracted struggle with the Carib inhabitants who today live on a reservation on the island. After varying periods of occupation by the English and French, the island was ceded to Britain in 1850. Since then it has been administered by Britain under various forms of government. Today it is a semi-independent associated state of the British Commonwealth with Britain responsible for defense and external affairs. The island has an elected government, constituted along parliamentary lines, responsible for all internal affairs.

In 1965 Dominica had a population of over 66,000 and a population growth rate of 2.1% per annum. In 1960 the labor force was 22,477 of which 52% was employed in agriculture, half of whom were owner-operators. Unemployment was 4.3% (3).

Per capita income in 1954 was $218 (BWI) (12); in 1964 it was $407 (BWI) (Table 1), or $251 (BWI) at 1954 prices. The real growth rate was, therefore, 4.9% per annum.

The economy is dominated by agriculture which in 1964 contributed 39% of the GDP. The next largest contributor was government with 14% (14). There is a small amount of manufacturing based on agricultural raw materials. Agriculture contributes 98% of the exports of which bananas make up 70% and citrus fruits and products another 20%. The economy is export oriented and largely dependent on the banana industry.

Today the Dominican government is concerned about improving the social and economic welfare of the people. If this is to effected, much more information is needed on the island's resources, and greater knowledge about

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1/ This report is a condensation of a thesis presented by the author to the Graduate School of Cornell University for the degree of Master of Science.

Table 1. National Income, Dominica, 1964.

Sector	'000$	%
Export Crops	5,512	
Other Agriculture	3,089	39
Livestock & Fisheries	808	
Manufacturing & Mining	1,564	6
Construction and Engineering	2,530	11
Distribution	1,618	7
Finance & Insurance	574	2
Transport	846	4
Services & Hotels	1,234	5
Rent	2,924	12
Government	3,408	14
GDP at Factor Costs	24,108	100
Indirect Taxes	2,454	
Subsidies	90	
GDP at Market Prices	26,476	
Population	65,030[1/]	
Per Capita GDP at Market Prices	407	

Source: U. K. Ministry of Overseas Development, Report of the Tripartite Economic Survey of the Eastern Caribbean, H.M.S.O., London, 1967, p. 262.

1/ Dominica Statistical Office, Annual Statistical Digest, No. 2, 1966, Table 6.

agricultural land is a priority. This then was the central objective of this study (13).

Relevant information about land potential for agricultural development must be seen in terms of the production units in which the land will be used, and the institutional melee in which these units have to operate. Consequently, this study was based on (a) interviews and communication with personnel of different organizations servicing agriculture, including the Ministry of Agriculture, Department of Agriculture, Commodity Associations, Commercial Banks, and the Marketing Board; and (b) a detailed farm management survey of 21 farms based on a random selection from a purposive sample of the more progressive farms in different parts of the island. In this survey, information was obtained on costs and returns, level of inputs and yields, crops grown and cultural methods used.

Opportunities for improving agriculture are influenced to an important extent by the type of land resources available. Land is a complex substance and various aspects of it can be looked at in various ways. There are many alternatives among which choices must be made in inventorying land resources.

This study has differentiated between morphological and performance characteristics and has recognized four major components of land. Morphological characteristics are considered to be those that can be identified on inspection, such as color, texture, slope, etc. Performance characteristics are defined in such a way that they often may be inferred from morphological features but can actually be measured only when land is used as an input into a variety of productive processes and the results in each instance recorded. Performance characteristics will be described here as relationships between inputs and outputs under various conditions. If they were elaborated and fully quantified, these performance descriptions would be production functions but this study has had to stop mostly at the level of limited qualitative statements.

The components of land that are recognized here are soil, climate, topography, and location. Each of these has both morphological and performance characteristics, although for practical purposes it is most useful to speak principally of the performance characteristics of the composite of these, namely land (2).

Beyond the morphological characteristics and the physical response functions of arbitrary units of land is the farm unit. Land is used in pieces and these pieces are called farms. Land also is used in conjunction with a variety of "improvements." Land with its improvements is called real estate. This study focuses to an important extent on real estate, divided into farm units. Opportunities to modify the non-land aspects of farm real estate are recognized, however, even though the essential unity of any given farm at a given time is stressed.

A major step in this study was to classify the land of Dominica into a few broad land types that are importantly different in their suitability to farming or to given types of farming and farming practices. The units of the classification system were considered to be farms, though the system

was not tied exclusively to the particular units now extant. Attempts were made to visualize opportunities for improvements in farm sizes and layouts, restricted only by limitations in current knowledge and modified by what appear to be feasible kinds and rates of change over the next 25 years or so.

The criteria of the system were performance characteristics. Multi-dimensional production functions for a wide array of possible uses and practices were considered to be the ideal criteria, though in practice much less complete and precise descriptions had to be used. It also was often necessary to infer performance from morphology. Morphological characteristics provide the criteria for most soil, climate, topography and location classifications and this study had to rely quite heavily on those classifications. A considerable amount of morphological description is included in the pages that follow, though it is intended to be only support for the performance material.

Major emphasis has been placed on land, but the non-land aspects of farm real estate have been considered where they are important and relatively permanent. Possible future changes or additions to farm improvements are discussed where they appear important, especially when they help to portray differences among the land types.

Actual farm businesses on the various land types have been used to a large extent in this study as a basis for describing land type performance, but an effort has also been made to estimate the outcome of different intensities and other types of farming. Much of the discussion is in physical terms--physical inputs, farming practices, and yields--but money returns per acre and farm income are emphasized also. Apart from the survey, other sources of data on agricultural performance include work done by the Dominica Department of Agriculture on cost and returns.

Five major land types were identified (Map 2) and described. These were:

1. The gently sloping black clay lands of the Leeward Coast.
2. The hilly red Latosolic lands of the lower mountain zone.
3. The hilly yellow Latosolic lands of the mid mountain zone.
4. The bleached Podzolic lands of the upper mountain zone.
5. The hilly volcanic protosal lands of the south.

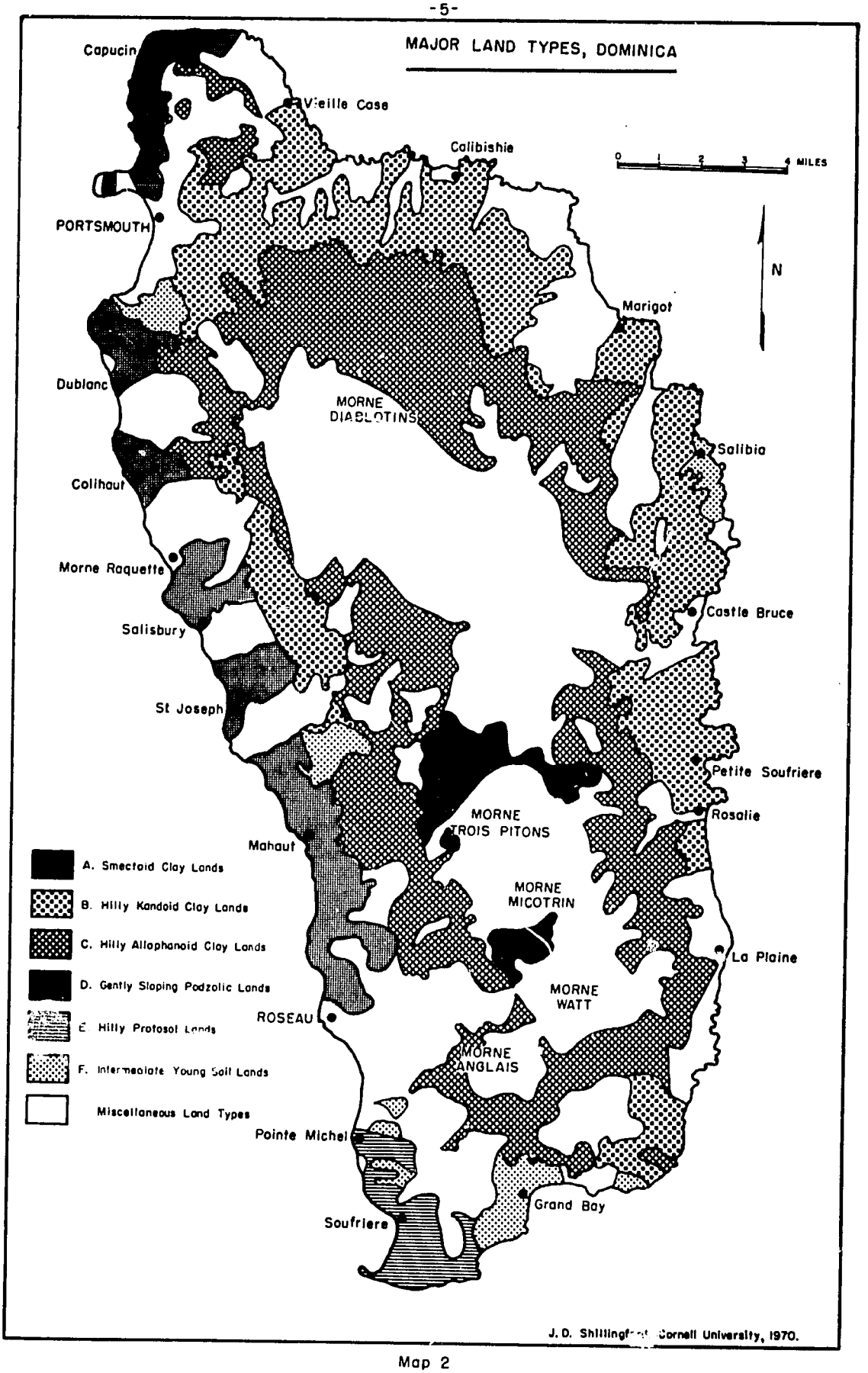
(The names given above for the land types mention only a few dominant features of each. They are not intended to be definitive.)

THE MAJOR LAND TYPES AND THEIR DEVELOPMENT POTENTIAL

A. The Gently Sloping Black (Smectoid) Clay Lands of the Leeward Coast

Morphology:

These lands are located along the Leeward coast, particularly on marine shelves above adjacent valleys. They extend 1½ to 2 miles inland and occur anywhere between sea level (Hartford) and 1,000 feet (Desjardins). Topography is variable but predominantly gently sloping and hilly


MAJOR LAND TYPES, DOMINICA
0 1 2 3 4 MILES
N
Capucin
Vieille Case
Calibishie
PORTSMOUTH
Marigot
Dublanc
MORNE DIABLOTINS
Salibia
Colihaut
Morne Raquette
Castle Bruce
Salisbury
St Joseph
Petite Soufriere
Rosalie
MORNE TROIS PITONS
Mahaut
MORNE MICOTRIN
La Plaine
MORNE WATT
ROSEAU
MORNE ANGLAIS
Pointe Michel
Grand Bay
Soufriere
A. Smectoid Clay Lands
B. Hilly Kandoid Clay Lands
C. Hilly Allophanoid Clay Lands
D. Gently Sloping Podzolic Lands
E. Hilly Protosol Lands
F. Intermediate Young Soil Lands
Miscellaneous Land Types
J. D. Shillingford, Cornell University, 1970.

Map 2

This land type has a seasonal climate but is generally hot and dry. Temperatures vary little throughout the year with an average low of 84°F in January and a high of 90°F in June. Rainfall is low, varying from 35 inches near the coast to about 85 inches inland. The region is in the rain shadow area of the island, with a dry season from December to June and essentially no rain at all for three to six months. Humidity is generally low, particularly in the dry season.

The dominant soils are black Smectoid clays (a montmorillonite clay); dark brown to black, plastic and sticky when wet, and blocky and very hard when dry. They are shallow and stony with slow internal drainage. The erosion hazard is high and the soils are often eroded. Present levels of fertility are low. Soil conservation and fertilizer application are essential for even modest crop yields (6, 8).

Vegetation consists of scrub woods and savana grass intermixed in varying proportions, with scrub dominating in all but the lowest rainfall areas. Beard thinks that much of this is a secondary formation developing after the areas were burned and cropped. These characteristics contrast markedly with those of the well watered fertile river valleys adjacent to the Black Smectoid Clay lands (1, 7).

Agricultural Performance:

Because the soils are poor and rainfall low and unreliable, farmers prefer to cultivate lands further inland and most of this land type remains uncultivated.

Where cultivation does exist, it consists of annual crops; a few farms have improved pasture. The crops most commonly grown were sweet potatoes and sugar cane. Sweet potato yields were about 5,000 lb. per acre on the two farms studied, which is probably higher than the average for the locality. The average for the island in 1961 was 3,746 lb. per acre (15). Sugar cane yields were approximately 10 tons per acre; the island average in 1961 was 15.5 tons per acre (15).

Most farmers raised some form of livestock, although they were often transferred to land types further inland. The cattle are usually kept on rough pasture and milk yields are low. Experimental production of improved pasture on the government livestock farm has proven quite successful.

Net returns[1/] per acre for the crops grown were potatoes $50 and sugar cane $100 (13).

In general land use intensity is low. Only a small proportion of available land is cultivated and the level of inputs on these cultivated lands is low. For instance, on one of the farms studied, fertilizer application was about 150 lb. nutrient per acre (12:12:17) compared with an average of 694 lb. on the Kandoid farms studied (Table 5). This figure is only given because more comparable data is not available.

1/ These are returns net of cash expenses and are mainly returns to land and labor.

Table 5. Kandoid Farms - Size and Productivity.

Farm No.	Main Crop	Yield lb./ac.	Acres Cult.	Fertilizer lb./ac.	Labor hr./ac.	Expenses $/ac.	Net Income $/ac.
10	Bananas	15,110	13	800	445	363	397
11	Bananas	11,673	17	751	400	360	277
12	Bananas	8,542	12	765	595	347	202
13	Bananas	9,200	10	461	660	145	302
Average	---	11,131	13	694	525	303	295

Agricultural Potential:

In spite of the poor soils and droughty conditions, agriculture on this land type could be improved and the total area under cultivation extended. Because the area is dry it is suited to crops adapted to drier environments, and in fact these are the crops commonly grown. They include such crops as sugar cane, peas and beans, corn, sweet potatoes, tomatoes, and many other vegetables.

Most of this land type has largely been out of production for many years due to declining fertility and the demise of sugar in Dominica. But with the development of perennial crops on more productive land types, and the fact that these crops could not be grown economically on the Black Clay lands, little effort has been made to develop an agriculture suited to this land type. However, the availability of cheap fertilizers today, should aleviate the problem of low fertility. This, together with the increased demand for the above mentioned crops makes their economic production more feasible and enhances the possibility of developing an agriculture suited to the particular soil and climatic conditions of this land type.

The sweet potatoes and sugar cane commonly grown in this area could probably be grown at much higher levels of productivity if improved varieties can be introduced and farmers encouraged to increase fertilizer use. Other annual crops which could probably be produced on this land type include tomatoes, peas and beans, egg plants, ochroes, watermelons, corn, tobacco and possibly onions. With the exception of onions and tobacco all these crops are grown throughout this area for home consumption. Onions and tobacco used to be grown but are not any more.

But to achieve success, complimentary development must take place in the institutional framework upon which agricultural production depends. These include particularly (a) marketing and a system of guaranteed prices, (b) research and extension and (c) coordination of the programs in these and related fields.

The possibility of developing some cattle production on this land type rests on the fact that (a) at present levels of technology and productivity cattle production does not seem to be capable of competing successfully with other agricultural enterprises in more favourable localities; and (b) the area tends to natural grassland vegetation and improved pastures are known to grow quite well. "Beef from the dairy herd" would seem to be the logical type of cattle enterprise. The reports by Lecky (9) and Nestel (11) provide some valuable guidelines for livestock development.

B. The Hilly Red (Kandoid) Latosolic Lands of the Lower Mountain Zone

Morphology:

These lands are located in the intermediate rainfall zone in the lower mountain region. They extend along the eastern (windward) coast from Rosalie to Vieille Case. On the western (leeward) coast they occur beyond the black clay lands in the hinderlands of St. Joseph and Salisbury (Map 1, p. 5).

The topography is hilly, made up of a series of valleys and ridges radiating towards the coast in the lower reaches of the mountain masses. Often, the tops of the ridges tend to be flat near the coast.

The climate is typically seasonal, with wet and dry seasons. The dry season is short, January and February. Rainfall varies from 100" to 170" per annum, increasing inland. Mean annual temperature is 83°F.

The soils under natural vegetation are dark brown at the surface with a brownish-red to red subsoil. Under cultivation, the top soil becomes red due to erosion and loss of organic matter. The natural fertility of these soils is moderately low, and without fertilizer decreases rapidly under cultivation. Thus, they were considered poor soils in the past. They are, however, well structured and have good water and fertilizer handling capacity, characteristics due to the dominance of iron oxide clays. The soils tend to fix P_2O_5 in unavailable forms, hence the importance of organic matter to ameliorate this effect. Organic matter maintenance and the application of fertilizer are therefore critical for satisfactory crop production.

The natural vegetation is Lower Mountain Rain Forest. Growth is luxuriant and the buttressed dominants (Gommier and Chataignier) attain heights of 70-90 feet. The lower stories tend to be sparse.

Agricultural Performance:

This land type is one of the more favored for crop production; Savanne Paille is typical. Large estates and small farms are common. Bananas are the main crop grown, accounting for 77-90% of the farm receipts on the four farms studied (Table 5). Other important crops are coconuts, citrus and food crops.

Crop yields on these lands are probably some of the highest in the island. On the farms studied banana yields ranged from 8,542 lbs. to 15,110 lbs. per acre.

Many farmers rear cattle on a subsistence basis. Recent attempts to encourage pasture production do not seem to have been successful. This is probably due to the low returns to pasture production in comparison to banana production. On the farms studied many of the paddocks had been replanted to bananas.

A large proportion of the farm land was cultivated. This averaged 79% on the farms studied. Fertilizer inputs were high, averaging 694 lb. nutrient per acre. These farms also had fairly high labor inputs and cash expenses.

Net income per acre was generally high, averaging $295; the next highest was $190 per acre on the Hilly Protosal Land type. Bananas, the main crop is usually the greatest contributor to farm income. These lands respond well to fertilizer application and yields would probably decrease rapidly in its absence. Bananas, coconuts, cocoa, citrus, and many food crops seem to be well suited to this land type.

Agricultural Potential:

The potential for development on this land type lies again in two directions, increasing the intensity of present land use, and extending the area under cultivation.

The fact that large differences existed in banana yields and that these farms represented some of the more progressive ones, indicates the existing possibilities for increasing output by intensifying production. A number of

avenues for improvement in banana production are obvious: increased levels of fertilizer use, higher plant densities, more frequent replanting, and better disease control. Similar possibilities exist for other crops. But these are the same improvements which have always been spoken of. The bottleneck seems to be more efficient extension, more relevant research and more effective liaison between these two.

There also seems to be scope for extension of the Red Latosolic lands under cultivation. Much uncultivated land exists on estates and Crown lands. These are potentially some of the most productive lands in the island and every effort should be made to open up and direct agriculture onto this land type.

One crop in particular, grapefruits could do with much more specific attention. The market for this crop is particularly favorable. A program for expanding the acreage under cultivation and for increasing the productivity of the present acreage is urgently needed.

Pasture production on this land type does not seem to be capable of competing with crop production. The realism of present cattle-on-pasture development programs should be reappraised. It would seem that a cattle-on-fodder system may fit better into the present socio-economic structure of the farm. The Holstein is probably the most suitable animal presently available, from the point of view of productivity and farmer requirement (13). However, at present levels of peasant technology, innate differences between imported stock are essentially marginal. The problem is more one of animal husbandry technology; in short it is a problem of X-efficiency rather than marginal efficiency (16). Consequently, public livestock importation policy need not discriminate between dairy breeds at this stage of livestock development.

C. The Hilly Yellow (Allophanoid) Latosolic Lands of the Mid Mountain Zone.

Morphology:

These lands lie inland of the Red Latosolic lands in the high rainfall, mid-mountain zone. Typically they occur in the Giraudel area near Morne Anglais, but are distributed in a girdle around the Central Mountain backbone. The most extensive areas are on the Northern foothills of Diablotin.

The topography is hilly, a bit more so than the hilly Red Latosolic lands. The main physical features radiate from the central mountains towards the coasts. The climate is relatively cool and wet. Mean annual temperature is about 79°F; rainfall is high, 170 to 250 inches, increasing inland. Humidity is always high and there is no drought, although a wet-dry regime exists.

The soils are the well drained Allophanoid (Yellow) Latosolics. Although highly leached, they are well structured, deep and freely drained. The surface horizon under natural vegetation is usually dark brown due to the high organic matter content. The subsoil is a brownish yellow. The natural ertility is moderately low. These soils have good water and fertilizer handling capacity. As in the case of the Kandoid Latosolics, the Allophanoid Latosolics have a high capacity to fix P_2O_5 in unavailable forms. Organic matter maintenance and adequate fertilizer application are essential for high crop yields.

The vegetation is Mid-Mountain Rainforest, the most luxuriant formation. The buttressed dominants--Gommier and Chattaiguier-- attain heights of 90 - 110 feet. These tend to be fewer than in the Lower Mountain Rain Forests but are larger. The lower story is sparse.

Agricultural Performance:

Because of the remoteness of this land type, farms tended to be few and generally small. A wide range of crops were grown. These included bananas, coffee, cocoa, cinnamon, nutmegs, bay, oranges, casava, yams and other food crops. Bananas were the main crop, and on the farms studied accounted for from 95 - 100% of the cultivated acreage; 80% of the farmland was cultivated.

Banana yields on this land type seemed to be low; on the farms studied average production was 4,674 lb. per acre. Part of the explanation was the low levels of fertilizer use, 169 lb. per acre, due possibly to the remoteness of the lands and the difficulty of transportation. Net income too was correspondingly low, $176 per acre (Table 6).

Agricultural Potential:

The Hilly Yellow Latosolic lands probably account for the greater part of the islands uncultivated land with good agricultural potential. However, most of these lands tend to be remote, are far inland, and without roads. They will afford significant scope for the expansion of agriculture in the future.

These lands are well suited to grapefruit production; bananas should do as well as lower elevations but at the higher elevations with low temperatures and heavy rain a long maturity period and high disease incidence become problems. Other crops which grow well are cocoa and coffee. Similar lands in Mauritius grow good tea.

As it is with farming on other land types, much scope exists for increasing output through greater land use intensity. Bananas for instance are probably capable of much higher economic yields. Fertilizer inputs, labor inputs, and cash expenses were all low on the farms studied, and they probably are even lower on the majority of farms, those studied being among the most successful.

D. The Bleached Podzolic Lands of the Upper Mountain Zone

Morphology:

These lands are associated with the central mountain masses and are normally found on gently sloping mountain glacis above 1,500 feet. Pont Casse and Terre Ferme are typical. The climate is cool, very wet and cloudy. Average temperatures range from 67°F to 75°F with average annual rainfall of more than 250 inches. The soils are Allophanoid Podzolics with a dark brown surface horizon and a bleached yellowish subsoil of variable depth. Drainage and root penetration are impeded by a poorly structured heavy clay subsoil or a superficial rock pan. Waterlogging is common and difficult to eradicate. The heavy rains readily wash and leach fertilizer, and phosphates are fixed in unavailable forms.

The natural vegetation is Upper Mountain Rain Forest, characterized by buttressed stems and aerial roots. The dominants are smaller than in the Mid Mountain Rain Forest and include Carapite and Bois Diable. The lower stories are also more dense. It is interesting to note that farmers consider many of the trees common to this formation, Carapite, Mangle Blanc, as indicators of poor land.

Agricultural Performance:

The construction of roads across the island has opened up and spured the development of these lands. Unfortunately, the production performance of these

Table 6. Allophanoid Farms - Size and Productivity.

Farm No.	Main Crop	Yield lb./ac.	Acres Cultivated	Fertilizer lb./ac.	Labor hr./ac.	Expenses $/ac.	Net Income $/ac.
16	Bananas	4,559	5	193	500	56	268
17	Bananas	4,474	18	150	272	138	89
18	Bananas	4,988	10	163	365	84	172
Average	---	4,674	11	169	379	93	176

lands does not support the initial enthusiasm. Bananas is the main crop grown, and inspite of high input levels (labor and fertilizer), yields are low and returns are puny (Table 7). It is possible that fertilizer levels may be too high for the productive potential of this land type at present levels of technology. Some grapefruit is also grown, but most of this is in young orchards and consequently not much can be said about grapefruit yields. Tree growth is highly variable, however, in nearly all plantings due, most probably, to the common occurence of waterlogging resulting from the combination of poor soils, a superficial rock pan, and the very heavy rainfall.

Agricultural Potential:

At the moment this seems to be very limited. These lands are unsuited for economic banana production. It is too cold, and this, together with frequent waterlogging, results in slow growth. High rainfall and humidity are the probable causes of high disease incidence. The potential for grapefruits seems checkered. Probably some new crop like tea may be suited to this land type.

One potential avenue may be in pork production where the cool climate could be a critical advantage.

There is a real concern, however, as to whether farms can be economically viable on this land type with the existing level of technology and market outlook. It would seem more beneficial to the farmer and to the economy if development were directed into more productive land types. Lang thinks that these Podzolic lands "are best left alone," and the evidence seems to support that conclusion.

E. The Protosol Lands of the South

Morphology:

This land type commonly occurs in the extreme southern part of the island in an area of geologically recent volcanic activity, from the coast to about 1,500 feet above sea level. Topography is generally hilly. The region has a hot dry seasonal climate similar to the Smectoid lands. Rainfall is low, about 100 inches, with a distinct dry season and four months of drought.

The soils are volcanic and of recent development. They are shallow, usually dark brown sandy loams of granular structure lying on deep, weakly cemented volcanic ash. Internal drainage is very rapid, but the moisture supplying capacity of the soil is low. The soils have good nutrient reserves, particularly P_2O_5, which are released slowly.

The natural vegetation is evergreen or semi-evergreen woodland, transitional between the Dry Scrub Woodland and the Lower Mountain Rain Forest. The dominant trees attain heights of 50 - 60 feet. Most of the natural vegetation has been replaced by cultivation, food forests and secondary forests.

Agricultural Performance:

Most of the farms are small and owner operated; the major crop is limes, and a small amount of bananas is grown in more favorable locations. Fertilizer inputs tended to be low but so also were lime yields. Farm returns per acre were above average, though not as high as on the Red Latosolics, where inputs and yields were relatively higher (Table 8). Performance, therefore, seemed commensurate with the low levels of husbandry. But one interesting feature is the fact that limes have been traditionally grown on this land type. This

Table 7. Podzolic Farms - Inputs and Productivity

Farm No.	Main Crop	Yield lb./ac.	Acres Cultivated	Fertilizer lb./ac.	Labor hrs./ac.	Expenses $/ac.	Net Income $/ac.
1	Bananas	1,286	4	344	1,168	1,010	(-34)
2	Bananas	6,569	12	887	522	709	(-59)
3	Bananas	5,697	7	223	313	219	65
4	Bananas	3,606	15	269	277	218	97
Average	---	4,289	9.5	431	570	539	21

Table 8. Protosol Farms - Inputs and Productivity.

Farm No.	Main Crop	Yield lb./ac.	Acres Cultivated	Fertilizer lb./ac.	Labor hrs./ac.	Expenses $/ac.	Net Income $/ac.
6	Bananas	(4,788)	11	125	615	273	109
7	Limes	4,672*	29	3	284	378	128
8	Limes	6,720	10	183	202	118	211
9	Limes	8,256	21	262	686	286	313
Average	Limes	6,528	18	143	446	264	190

* 64 lb. = 1 crate.

seems to be due to the natural conditions of climate and soil which support lime production even at low levels of husbandry. The deep volcanic ash, with its slowly released fertility reserves may play an important role here.

Some small farmers have been attempting to rear cattle on fenced pastures. As was discussed with respect to the Red Latosolic lands, it would seem more economical to zero gaze. The problem may be even more critical because farmers graze cattle in lime orchards and the lime trees seem to become diseased.

Agricultural Potential

Since most of these lands are already under cultivation, not much potential exists for expanding the cultivated acreage. But significant economic increases in output could probably be achieved by intensifying cultivation. This would include increased use of fertilizer, better terracing to conserve moisture and the thin top soil, and probably better disease control.

Increased use of fertilizer and better disease control will depend on the availability of these factors. An efficient means of providing them would seem to be through an extension of the services of the Citrus Growers Association to include lime producers.

Other Land Types

Numerous other land types exist. Some may have similar soils to those described but differ radically in topography or climate; some are different in all these characteristics but are of insignificant acreage; some of these, the Intermediate Young Soils of the Coastal Region for instance, although limited in extent, may be more productive than the best described. Further research would be necessary to delineate these less significant land types accurately.

SUMMARY

Dominica is an island in the Eastern Caribbean where government is becoming increasingly aware of its people' demands for improved welfare. To respond to these demands the island has to mobilize its resources more effectively.

Agriculture is the dominant sector of the economy and land is the major resource. Effective utilization of this resource depends on a better understanding of land and the factors affecting its productivity. To provide some of this information, the land resources were studied in an attempt to identify the major land types in the island.

The study was based on three facets:

(a) interviews with personnel of the major institutions serving agriculture;
(b) a study of the morphological characteristics of the island; and
(c) a detailed farm management survey of 21 farms located throughout the island.

The farm management study provided information on the agricultural performance of different lands, and, together with the morphological characteristics of those lands, provided a basis for land type classification. Of the many land types existing, five major land types were identified and described. These were:

1. The Gently Sloping Black (Smectoid) Clay lands of the Leeward Coast.

The soils are a heavy clay and the area is droughty. These lands were originally in sugar cane but due to low fertility and the demise of the sugar industry, they have been largely out of cultivation for many years. This land type is dry, and so unsuited for perennial crop production, but suitable for the production of many annual crops adapted to dry conditions. The availability of cheap fertilizer and the increased demand for vegetables will make the economic production of some of these crops feasible. Comparison with other land types is difficult since a completely different range of crops is grown.

2. The Hilly Red (Kandoid) Latosolic Lands of the Lower Mountain Zone.

The soils are deep, well structured and have good water handling capacity. Rainfall is adequate. These lands are some of the best in the island. They are very responsive to fertilizer and good management, and have significant potential for agricultural development. This is the land type best suited to banana production; it is also well suited to grapefruit production. A substantial proportion of the good, uncultivated agricultural land in the island is in this land type, thus affording much scope for extending realistic diversified crop production.

3. The Hilly Yellow (Allophanoid) Latosolic Lands of the Mid-Mountain Zone.

The soils are deep and well structured, but rainfall is heavy. These lands will respond well to good management, although for the crops commonly grown they are comparatively less responsive than the Kandoid Lands. Bananas are the main crop grown but suffer from the low temperatures at higher elevations. Grapefruits are well suited to these lands. This land type occupies the greatest proportion of agricultural land in the island and probably affords the greatest potential for expansion of agriculture. But the areas lack roads, a prerequisite for the utilization of the potential of these lands.

4. The Bleached (Allophanoid) Podzolic Lands of the Upper Mountain Zone.

The soils are bleached and clayey with very poor water and fertilizer handling capacity. The area is cool and humid with very heavy rainfall. Response to modern agricultural inputs and good management is low. Agricultural potential here is limited. In light of the availability of more productive lands, agricultural expansion into these areas should not be encouraged, they "are better left alone."

5. The Hilly Volcanic Protosol Lands of the South.

The soils are thin but well structured, over deep unconsolidated volcanic ash. Rainfall is seasonal with a short drought. Internal drainage is rapid and the water handling capacity is low. The area is generally too dry for bananas or grapefruit. The major crop has traditionally been limes, and due probably to the mineral reserves of the volacnic ash, continuous production at low levels of intensity has been possible. These lands are responsive to fertilizer and good management. Although most of this land type is already under cultivation, much scope exists for increased output by intensifying production.

This study has dealt only with the five major land types in Dominica. More research is needed at least to fill the gaps left. Changing technology, too, will make continuous research necessary to update the classification and to obtain a more precise knowledge of the land resources of Dominica.

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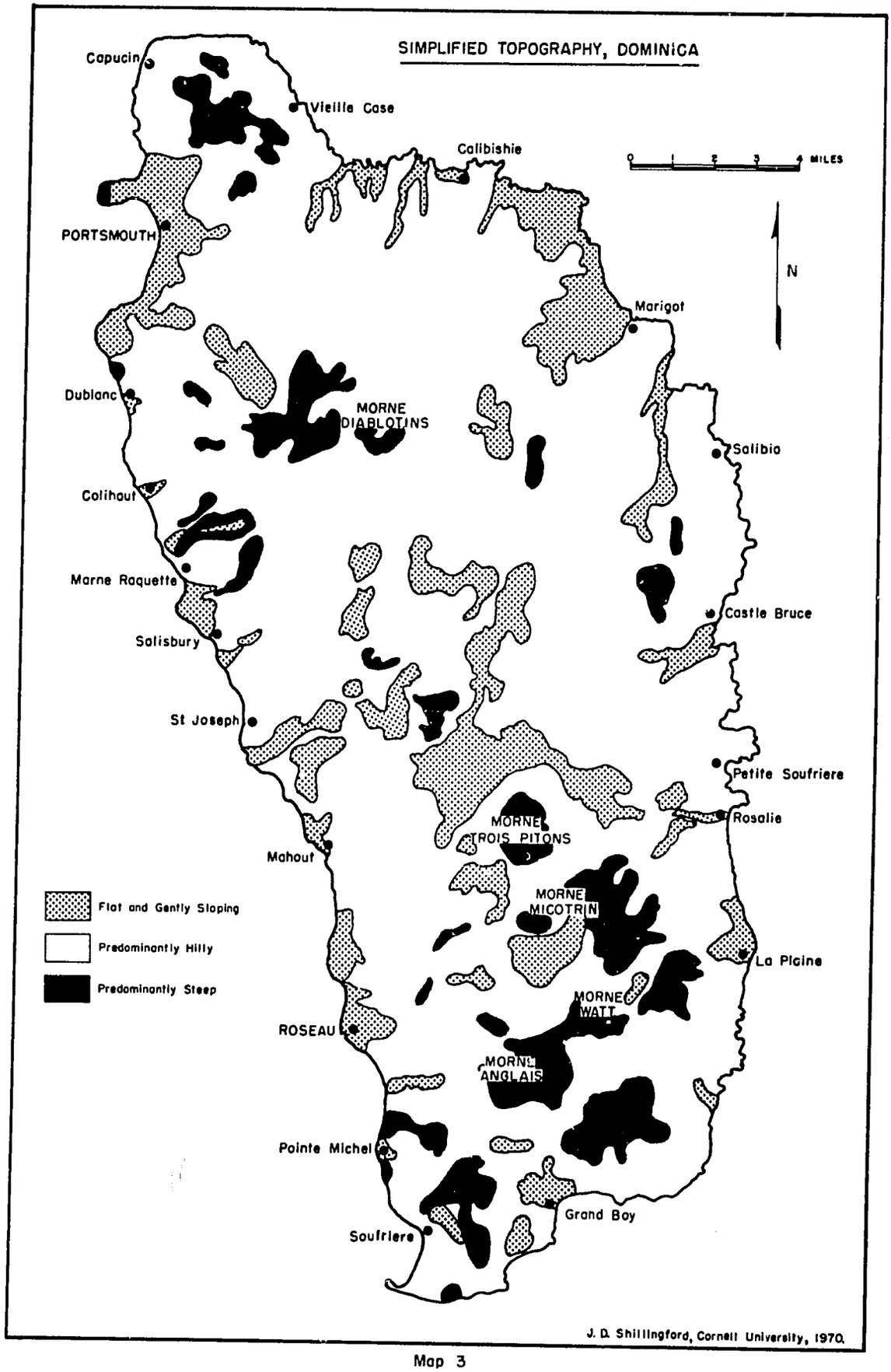
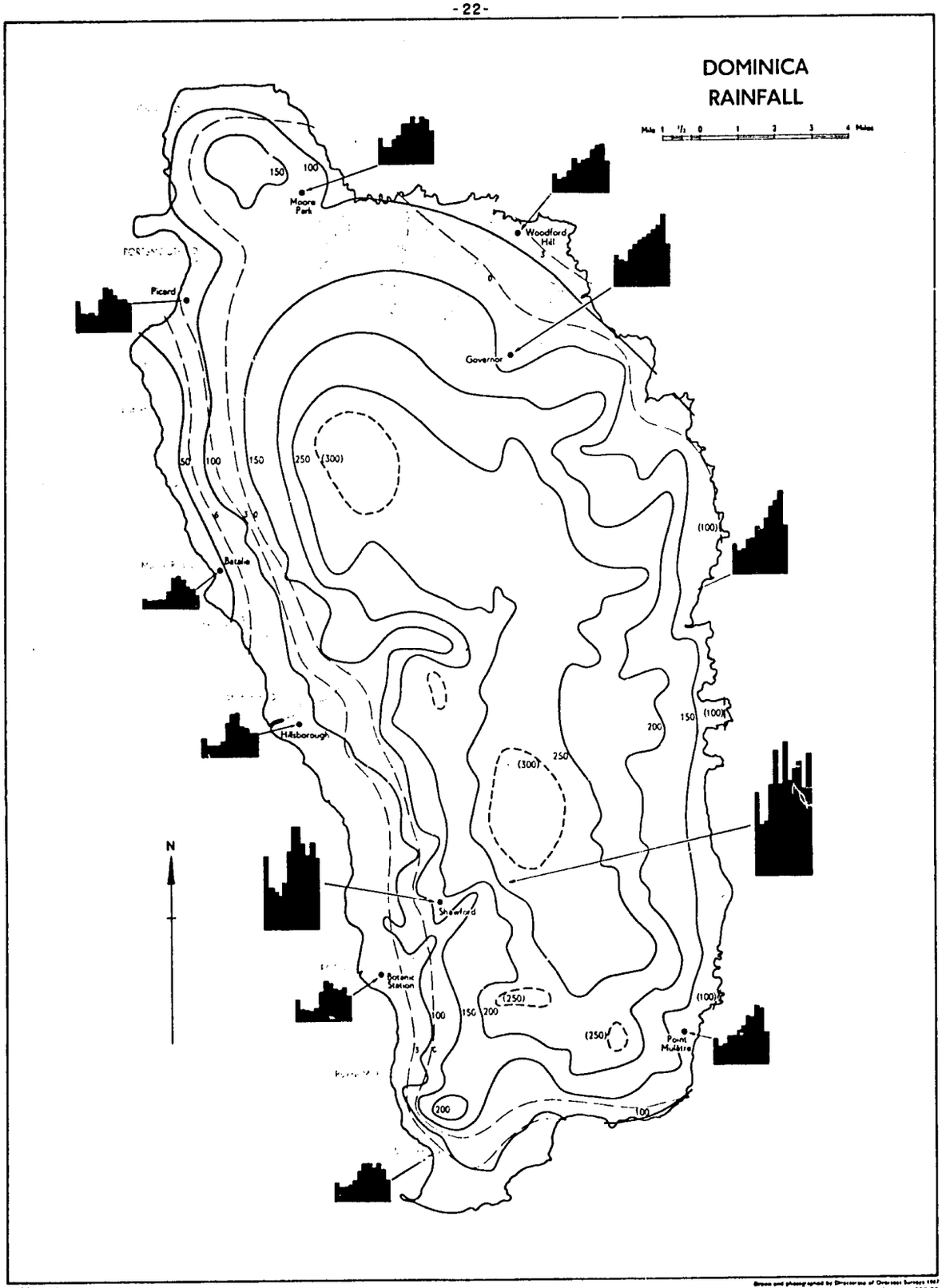
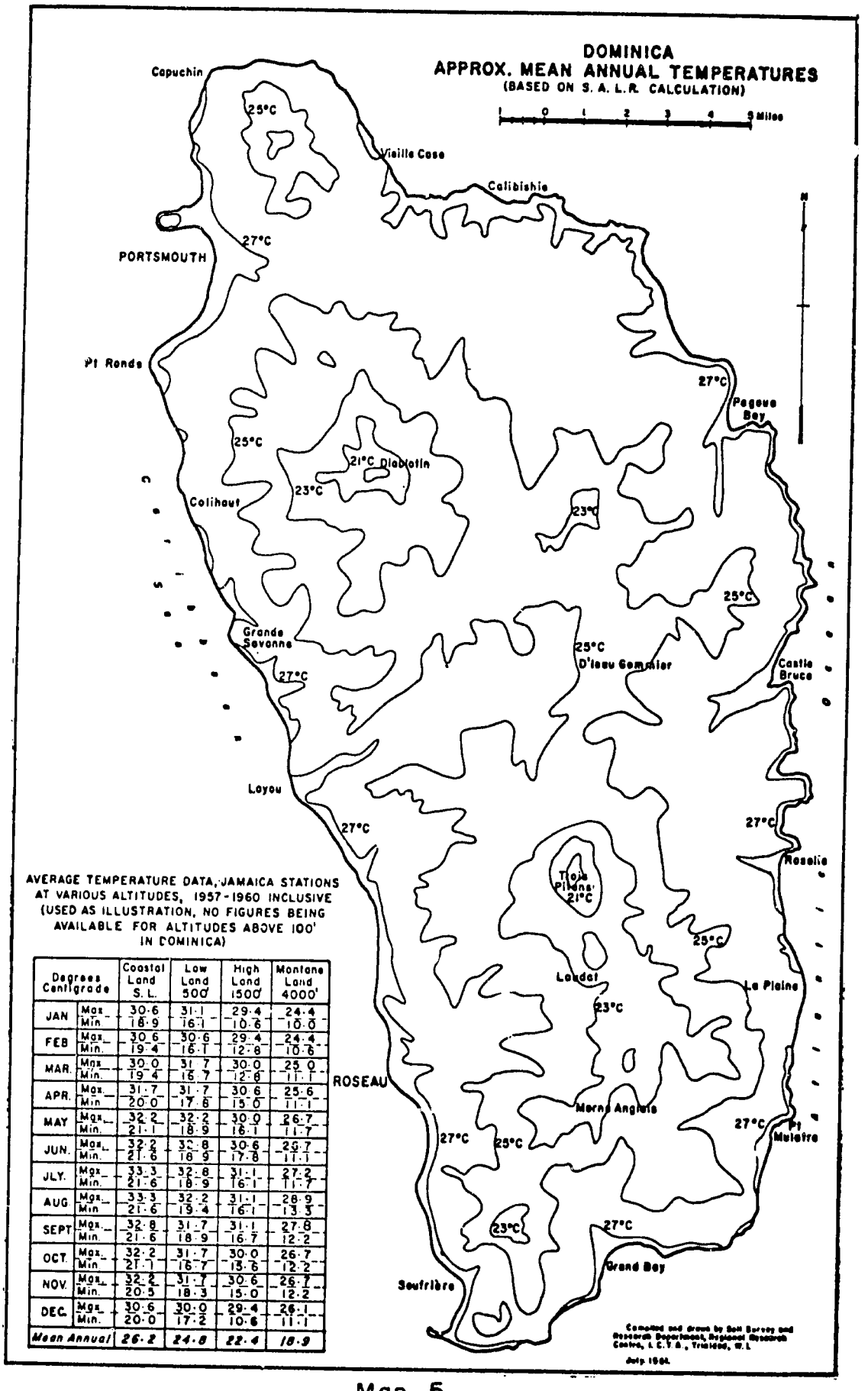
APPENDIX


SIMPLIFIED TOPOGRAPHY, DOMINICA
Capucin
Vieille Case
Calibishie
0 1 2 3 4 MILES
N
PORTSMOUTH
Marigot
Dublanc
MORNE DIABLOTINS
Salibia
Colihaut
Marne Raquette
Castle Bruce
Salisbury
St Joseph
Petite Soufriere
Rosalie
MORNE TROIS PITONS
Mahout
MORNE MICOTRIN
Flat and Gently Sloping
Predominantly Hilly
Predominantly Steep
La Plaine
MORNE WATT
ROSEAU
MORNE ANGLAIS
Pointe Michel
Grand Bay
Soufriere
J. D. Shillingford, Cornell University, 1970.

Map 3


DOMINICA
RAINFALL
Miles 1 1/2 0 1 2 3 4 Miles
Moore Park
Woodford Hill
Picard
Governor
Batalie
Hillsborough
Shawford
Botanic Station
Point Mulatre
N
150
100
50
250
(300)
(100)
200
(250)

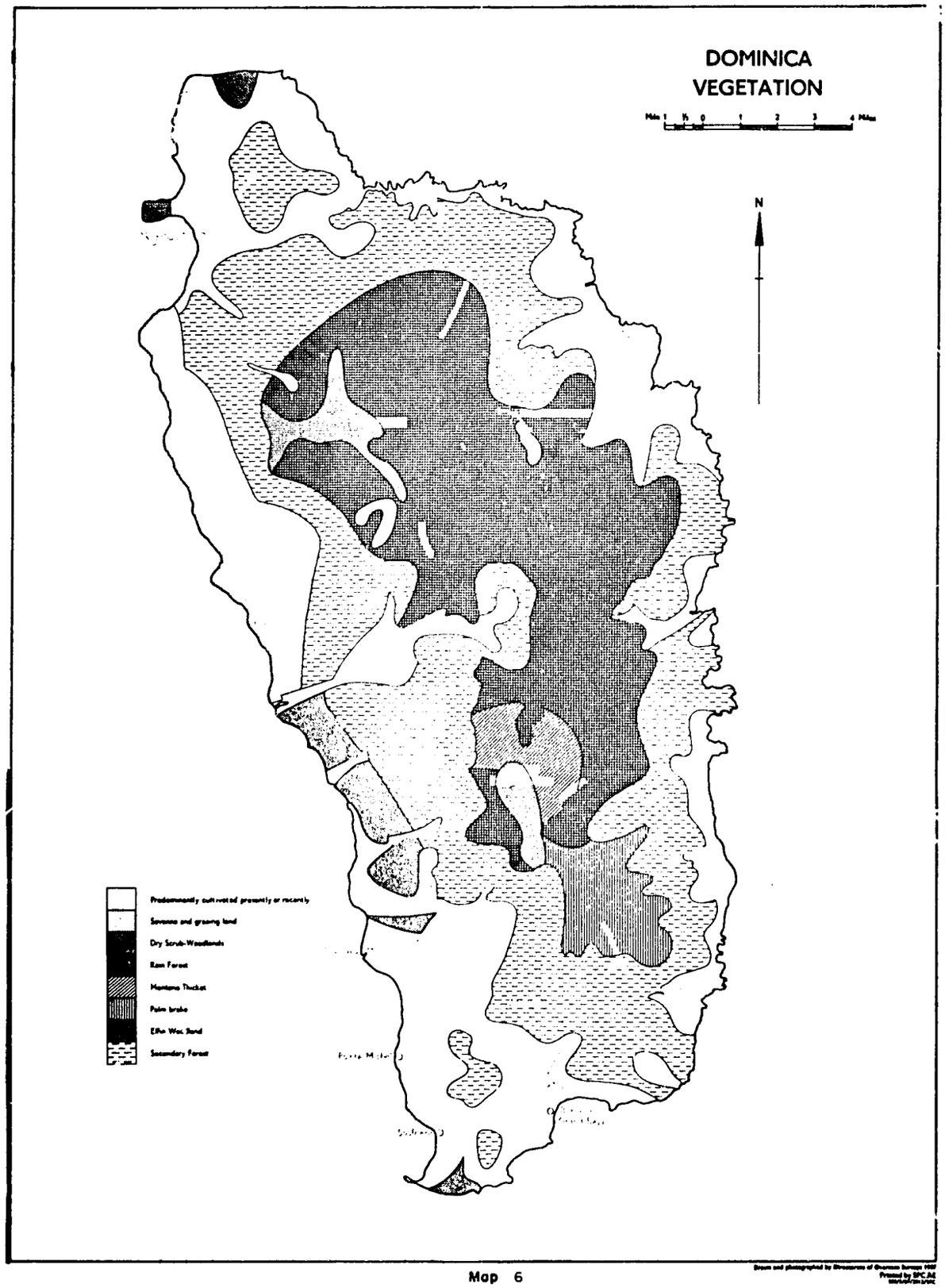
Map 4



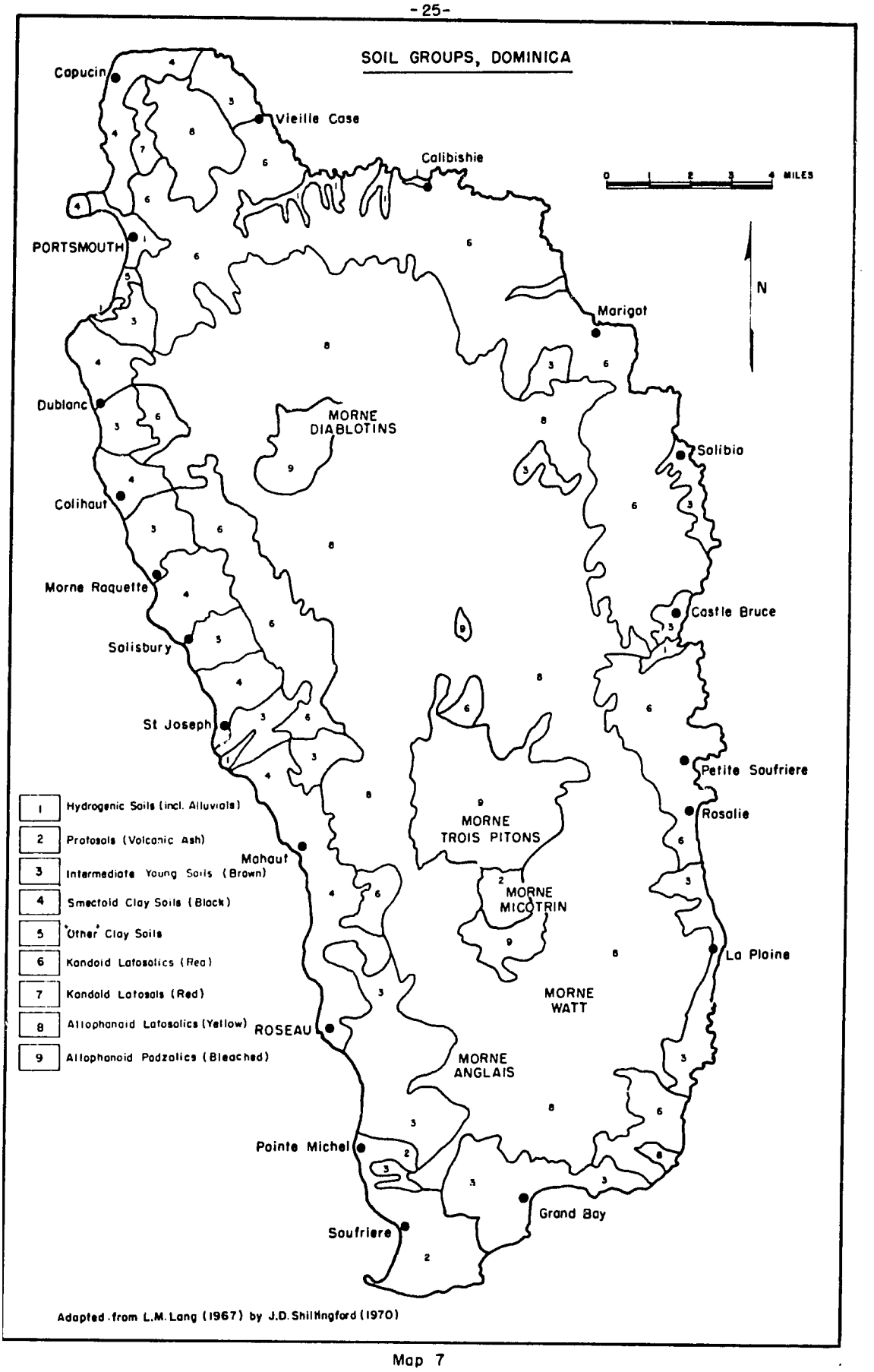
AVERAGE TEMPERATURE DATA, JAMAICA STATIONS AT VARIOUS ALTITUDES, 1957-1960 INCLUSIVE (USED AS ILLUSTRATION, NO FIGURES BEING AVAILABLE FOR ALTITUDES ABOVE 100' IN DOMINICA)

Degrees Centigrade		Coastal Land S. L.	Low Land 500'	High Land 1500'	Montane Land 4000'
JAN	Max.	30·6	31·1	29·4	24·4
	Min.	18·9	16·1	10·6	10·0
FEB	Max.	30·6	30·6	29·4	24·4
	Min.	19·4	16·1	12·8	10·6
MAR.	Max.	30·0	31·7	30·0	25·0
	Min.	19·4	16·7	12·6	11·1
APR.	Max.	31·7	31·7	30·6	25·6
	Min.	20·0	17·8	15·0	11·1
MAY	Max.	32·2	32·2	30·0	26·7
	Min.	21·1	18·9	16·1	11·7
JUN.	Max.	32·2	32·8	30·6	26·7
	Min.	21·6	18·9	17·8	11·1
JLY.	Max.	33·3	32·8	31·1	27·2
	Min.	21·6	18·9	16·1	11·7
AUG	Max.	33·3	32·2	31·1	28·9
	Min.	21·6	19·4	16·1	13·3
SEPT	Max.	32·8	31·7	31·1	27·8
	Min.	21·6	18·9	16·7	12·2
OCT.	Max.	32·2	31·7	30·0	26·7
	Min.	21·1	16·7	15·6	12·2
NOV.	Max.	32·2	31·7	30·6	26·7
	Min.	20·5	18·3	15·0	12·2
DEC.	Max.	30·6	30·0	29·4	26·1
	Min.	20·0	17·2	10·6	11·1
Mean Annual		*26·2*	*24·8*	*22·4*	*18·9*

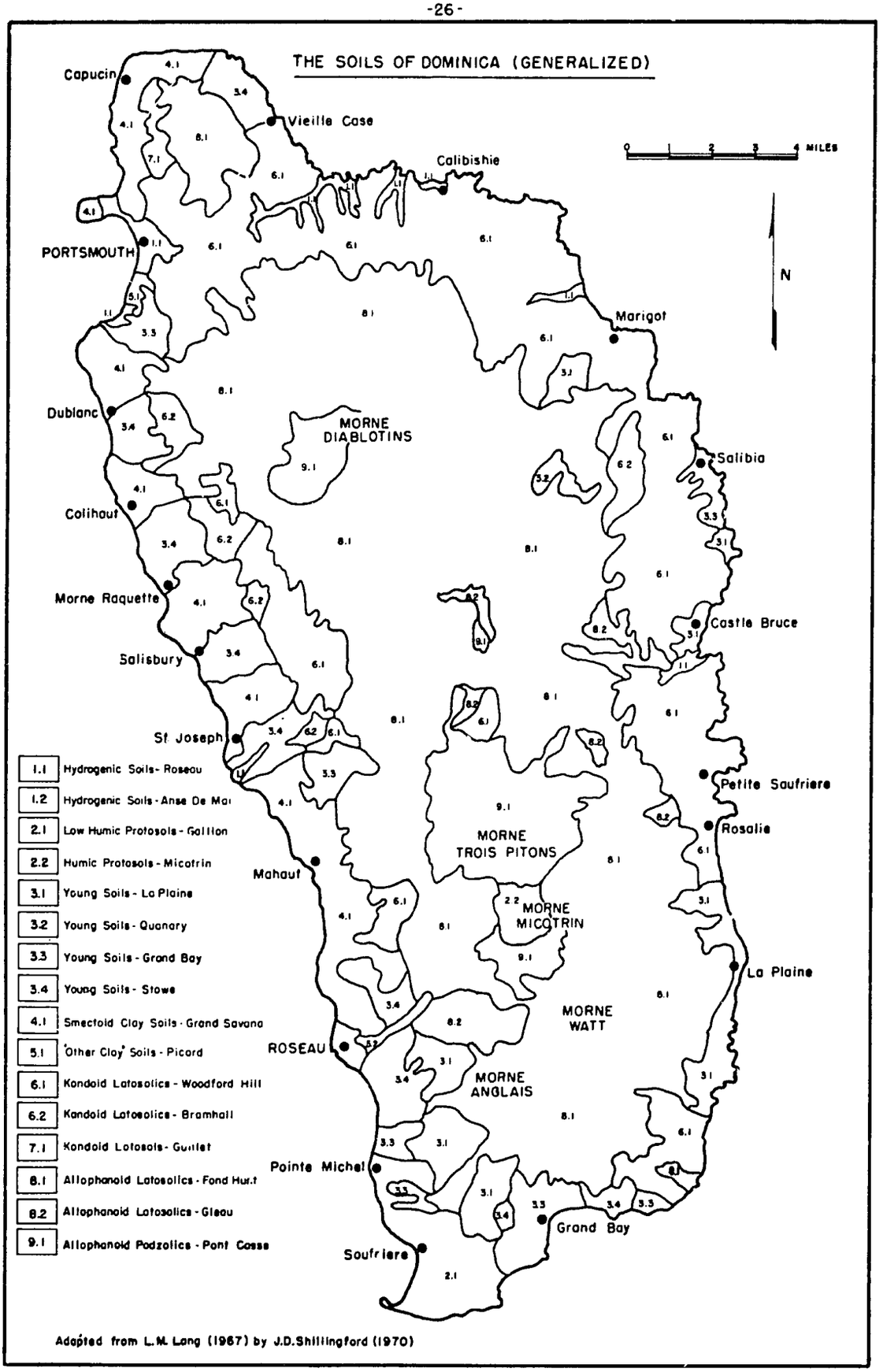
Map 5.


DOMINICA
VEGETATION
N
Predominantly cultivated presently or recently
Savanna and grazing land
Dry Scrub-Woodlands
Rain Forest
Montane Thicket
Palm brake
Elfin Wet land
Secondary Forest

Map 6


SOIL GROUPS, DOMINICA
Capucin
Vieille Case
Calibishie
0 1 2 3 4 MILES
N
PORTSMOUTH
Marigot
Dublanc
MORNE DIABLOTINS
Salibia
Colihaut
Morne Raquette
Castle Bruce
Solisbury
St Joseph
Petite Soufriere
Rosalie
MORNE TROIS PITONS
Mahaut
MORNE MICOTRIN
La Plaine
MORNE WATT
ROSEAU
MORNE ANGLAIS
Pointe Michel
Grand Bay
Soufriere
1 Hydrogenic Soils (incl. Alluvials)
2 Protosols (Volcanic Ash)
3 Intermediate Young Soils (Brown)
4 Smectoid Clay Soils (Black)
5 'Other' Clay Soils
6 Kandoid Latosolics (Red)
7 Kandoid Latosols (Red)
8 Allophanoid Latosolics (Yellow)
9 Allophanoid Podzolics (Bleached)
Adapted from L.M. Lang (1967) by J.D. Shillingford (1970)

Map 7


THE SOILS OF DOMINICA (GENERALIZED)
0 1 2 3 4 MILES
N
Capucin
Vieille Case
Calibishie
PORTSMOUTH
Marigot
Dublanc
MORNE DIABLOTINS
Salibia
Colihaut
Morne Raquette
Castle Bruce
Salisbury
St. Joseph
Petite Soufriere
Rosalie
MORNE TROIS PITONS
Mahaut
MORNE MICOTRIN
La Plaine
MORNE WATT
ROSEAU
MORNE ANGLAIS
Pointe Michel
Grand Bay
Soufriere
1.1 Hydrogenic Soils - Roseau
1.2 Hydrogenic Soils - Anse De Mai
2.1 Low Humic Protosols - Gallion
2.2 Humic Protosols - Micotrin
3.1 Young Soils - La Plaine
3.2 Young Soils - Quanary
3.3 Young Soils - Grand Bay
3.4 Young Soils - Stowe
4.1 Smectoid Clay Soils - Grand Savana
5.1 "Other Clay" Soils - Picard
6.1 Kandoid Latosolics - Woodford Hill
6.2 Kandoid Latosolics - Bramhall
7.1 Kandoid Latosols - Guillet
8.1 Allophanoid Latosolics - Fond Hurt
8.2 Allophanoid Latosolics - Gisau
9.1 Allophanoid Podzolics - Pont Cosse
Adapted from L.M. Lang (1967) by J.D. Shillingford (1970)

Map 8