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DOMINICA FOREST AND PARK SYSTEM PLAN

by

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PLANNING FUTURE USE OF WILDLANDS

Over two-thirds of the Dominica land area is in a natural state; uncultivated, unsettled, and relatively undisturbed. A variety of ecological systems are represented, from dry scrub woodlands to montane cloud forests. The extensive virgin rain forests are inhabited by rare and endangered parrot species, huge gommier and chataignier trees, and a number of unique natural features such as waterfalls and soufrieres. While Dominica is blessed with an abundance of natural beauty and diversity, in some areas, the land and the people suffer environmental degradation caused by careless and wasteful land use practices. In some areas, very steep lands are cleared and burned for agriculture, causing rapid soil loss and stream pollution. Poorly-maintained roads also erode rapidly and contribute to water pollution. Poaching, especially of valuable parrots, is a serious problem, as is squatting on reserved forest and park lands.

In recent years, the steep forested lands of the interior have been recognized as having tremendous value for watershed protection, wildlife habitat, rare and unique natural features, recreation and tourism, and as a scientific ecological resource. The creation of Morne Trois Pitons National Park in 1975 reflects a growing concern that these ecological values were in danger of being irreversibly lost through haphazard agricultural and timber extraction development. In 1977, the Northern Forest Reserve was created from the extensive Crown Lands in the north, in order to facilitate proper development of timber resources on a multiple-use/sustained-yield basis. Thanks to recent scientific studies, we have been able to document much more closely the ecological resources of Dominica, and also make more reliable predictions of the effects of agriculture, logging, and recreational development in specific areas. The effects of these land use practices on water quality, soil conservation, wildlife, rare or unique natural features, scenic resources, and genetic diversity vary widely from one area to the next, depending upon the physical land characteristics.

One goal of the planning effort which led to this Forest and Park System Plan has been to integrate and interpret the available scientific information on soils, forest types, wildlife, and other resources to determine physical land capabilities, renewable resource limitations, and the location

of unique natural features. In general, three major land use principles have emerged from this interpretive work:

1. Physical land conditions (soils, slope, rainfall) vary widely from one area to the next in Dominica. Because of this, some areas are well suited to certain land use practices (agriculture, logging, urbanization). Where physical land conditions are incompatible with a certain land use, the result is erosion, soil deterioration, landsliding, water pollution, or other problems. As a result, land use decisions must be based upon knowledge of physical land conditions as well as economic, political, and social needs.

2. Renewable natural resources like timber and wildlife can be utilized at certain levels without causing depletion of the resource. Utilization must not, however, exceed the capacity of the forest or wildlife population to reproduce. Nor must the renewable resource base be destroyed by careless utilization practices, for example, damaging soil structure during logging or hunting during nesting season.

3. Some natural features are so unique and so limited that they require special designation and protection to prevent their being inadvertently destroyed. Such features include rare parrot habitat, limited vegetative ecosystems like mangrove swamps, waterfalls and geothermal areas, etc. There are also a number of historical and cultural sites worthy of preservation.

II. LAND INVENTORY AND INTERPRETATIONS

A. Land Use and Vegetation

Land uses and vegetative cover types for Dominica are shown in Figure 1. These detailed maps cover the island in three sections. The general land use pattern can be readily seen. Most human settlement (agricultural, urban, and village land uses) has occurred along the coasts. This reflects, in part, a long history of poor road transporation and dependence upon transport by sea. Gradually, however, connective roads have been improved and feeder road construction has brought agricultural clearing further and further into the mountainous interior. Thus, the general land use trend is toward farmers moving inland, settling on small parcels, while the larger coastal estates are converted to urban uses or are farmed less intensively by fewer and fewer paid labourers. Attempts to reverse this trend with small-farmer settlement schemes on large coastal estates have been limited, and have not noticeably relieved pressure to convert interior forest land to agriculture.

As for natural vegetation, distribution of vegetative types is strongly related to natural climatic and topographic conditions in a given area. The maps of Figure 1 show that scrub forest and savanna are found along the leeward west coast, in the driest region of the country. Littoral woodlands are restricted by natural conditions to the immediate coastline of the windswept eastern coast. Fresh-water swamps are rare, and are found mainly near Portsmouth and along the stream outlets of the north coast. Active landslide zones are not a vegetative type *per se*, but indicate a lack of permanent vegetation due to disturbance. Montane swamp forest, montane thicket, and elfin woodlands are found only in the high-rainfall interior. Montane swamp forest occupies poorly-drained upland soils, while montane thicket and elfin woodlands occupy well-drained sites. Fumerole vegetation is found only in areas of soufriere activity, most notably in the Valley of Desolation. The rain forests (riparian, mature, and secondary) are found in well-drained soils of intermediate elevation and moderate rainfall zones. Riparian rain forest

Figure 1 a

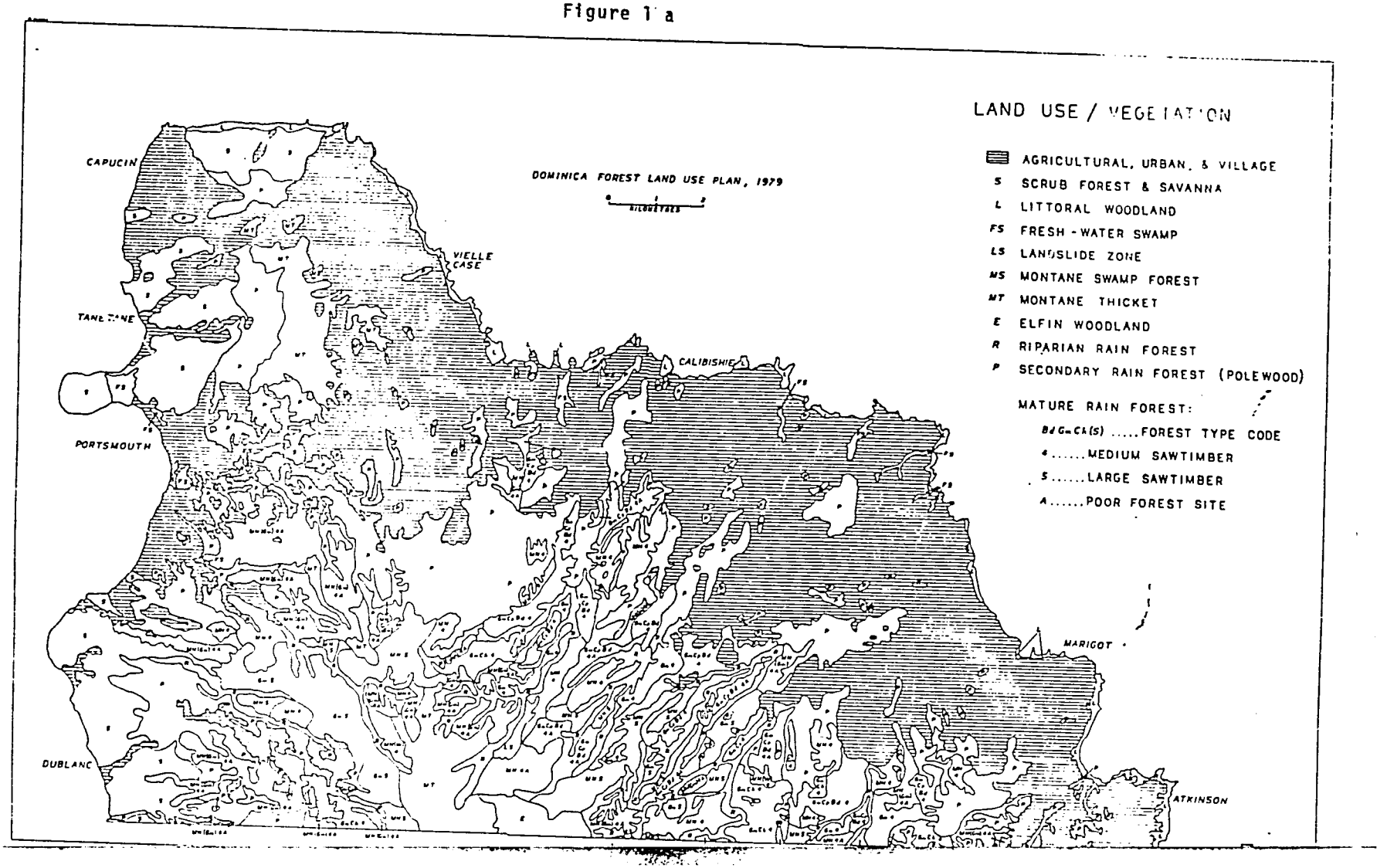
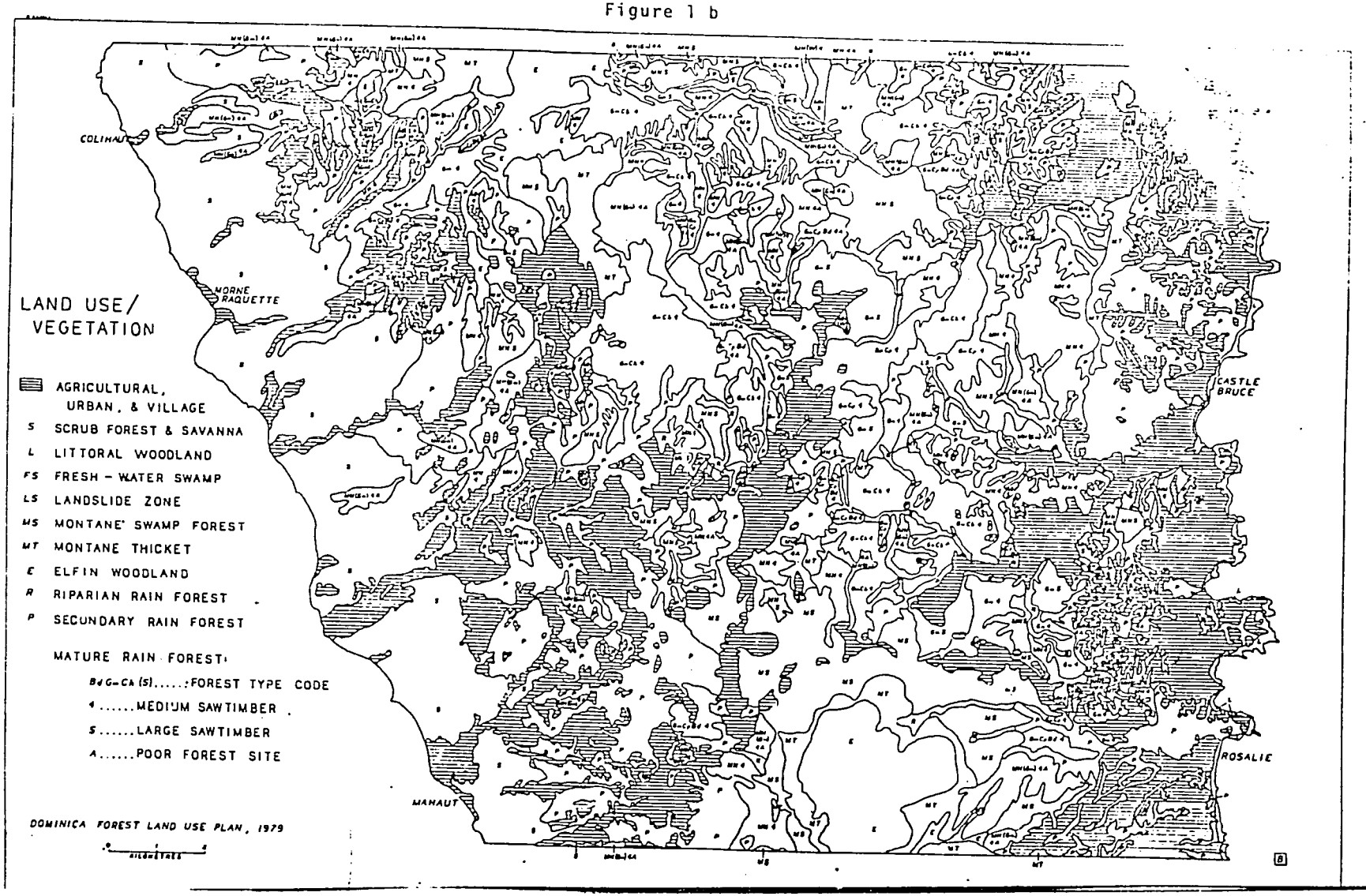

DOMINICA FOREST LAND USE PLAN, 1979
LAND USE / VEGETATION
AGRICULTURAL, URBAN, & VILLAGE
S SCRUB FOREST & SAVANNA
L LITTORAL WOODLAND
FS FRESH - WATER SWAMP
LS LANDSLIDE ZONE
MS MONTANE SWAMP FOREST
MT MONTANE THICKET
E ELFIN WOODLAND
R RIPARIAN RAIN FOREST
P SECONDARY RAIN FOREST (POLEWOOD)
MATURE RAIN FOREST:
B4G-CA(S) .....FOREST TYPE CODE
4.....MEDIUM SAWTIMBER
5.....LARGE SAWTIMBER
A.....POOR FOREST SITE
CAPUCIN
VIELLE CASE
CALIBISHIE
PORTSMOUTH
MARIGOT
DUBLANC
ATKINSON

Figure 1 b


LAND USE/
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AGRICULTURAL, URBAN, & VILLAGE
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LS LANDSLIDE ZONE
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MT MONTANE THICKET
E ELFIN WOODLAND
R RIPARIAN RAIN FOREST
P SECUNDARY RAIN FOREST
MATURE RAIN FOREST:
BdG-CA (S).....:FOREST TYPE CODE
4.....MEDIUM SAWTIMBER
5.....LARGE SAWTIMBER
A.....POOR FOREST SITE
DOMINICA FOREST LAND USE PLAN, 1979
COLIHAUT
MORNE RAQUETTE
CASTLE BRUCE
ROSALIE
MAHAUT

Figure 1 c

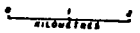
LAND USE / VEGETATION

- AGRICULTURAL, URBAN, & VILLAGE
- S SCRUB FOREST AND SAVANNA
- L LITTORAL WOODLAND
- FS FRESH-WATER SWAMP
- LS LANDSLIDE ZONE
- MS MONTANE SWAMP FOREST
- MT MONTANE THICKET
- E ELFIN WOODLAND
- R RIPARIAN RAIN FOREST
- P SECONDARY RAIN FOREST (POLEWOOD)

* MATURE RAIN FOREST:

- Bd Gm Ca (S).....FOREST TYPE CODE
- 4.....MEDIUM SAWTIMBER
- S.....LARGE SAWTIMBER
- A.....POOR FOREST SITE

DOMINICA FOREST LAND USE PLAN, 1979



is found along non-coastal stream areas, and differs in species composition from the upland rain forest nearby. Secondary rain forest is simply rain forest that has been disturbed in the past (by agricultural clearing, wind damage, logging, etc.) and is characterized by trees of smaller size and different species from mature rain forest. Mature rain forest is a stable climax forest community characterized by large dominant trees. In Figure 1, the mature rain forest area is further differentiated into different forest types, which are described in Appendix VIII and in more detail in the forest survey of Dominica by Brown (1962).

In Table 1, the land areas of these vegetation and land use types are given, and their economic/environmental values are outlined briefly. An examination of this table and the maps reveals some interesting facts; facts vital to the land use planning process. First, it is clear that some vegetation types are very limited in Dominica, so limited that they could easily be destroyed completely by careless development. On the entire island, there are only 31 hectares of fumerole vegetation, 126 hectares of fresh-water swamp, and 666 hectares of littoral woodland. The fumerole vegetation is within Morne Trois Pitons National Park, and is thus relatively safe from destruction. Both the fresh-water swamp and littoral woodland vegetation are threatened ecological types, however. Except for the swamp area adjacent to the Cabrits, all the land is privately-owned, and is subject to gradual destruction through clearing for agriculture or urban development. The fresh-water swamps are not well-suited to crops due to poor soil drainage, but coconuts are being planted in such areas nonetheless, with disappointing results. Likewise, littoral woodlands are poor cropland due to steepness and salt spray from the sea, but bananas are planted in these areas by some landowners. Thus, agricultural and urban encroachment threatens these two unique ecological areas, a fact which must be recognized in any National Park strategy.

Another interesting fact concerning vegetation is the predominance of secondary rain forest, about one-fourth the total land area of Dominica. Most of it is privately owned

Table 1

Land Area of Major Vegetation Types and Principle Economic/Environmental Values

Vegetation Type	Land Area* (hectares)	Percent of Total Area	Principle Economic and Environmental Values
Agricultural, urban, and village	23,133	29%	Agricultural crop production, grazing, housing, commercial and industrial sites.
Scrub forest and savanna	7,507	9%	Fuelwood, grazing, watershed protection, and wildlife habitat.
Littoral woodlands	666	1%	Stabilizes very steep coastal areas, acts as a barrier to crop-damaging salt spray, provides wildlife habitat, and small-diameter wood (fuel, posts, poles).
Fresh-water swamp	126	--	Excellent wildlife and aquatic habitat. A limited ecological resource in Dominica.
Landslide zone	237	--	An actively unstable area, which should be protected to avoid further land slippage.
Montane swamp forest	1,754	2%	Provides fuelwood, posts, poles, small sawtimber, wildlife habitat. An indicator of very poor agricultural soil (waterlogged Allaphanoid podsolics). Prevents soil erosion on steeper areas.
Montane thicket	3,758	5%	Provides watershed protection in high rainfall zones and wildlife habitat. Suitable for fuelwood and posts, but most of the area is inaccessible.
Elfin woodland	2,332	3%	Provides critical watershed protection for the highest rainfall zone, and wildlife habitat. Contains rare plants. Yields little usable wood.
Fumerole vegetation	31	--	Found primarily in the Valley of Desolation. A very limited ecological resource in Dominica.
Riparian rain forest	1,101	1%	Yields medium and small-diameter wood. Most important for streambank stabilization.
Secondary rain forest	20,133	25%	Medium and small-diameter wood. Provides watershed protection and wildlife habitat.
Mature rain forest	18,222	23%	Large and medium sawtimber. The only forest type suitable for endangered parrot habitat. Provides watershed protection and wildlife habitat.
	79,000 hectares		

* 1979 estimates prior to Hurricane David. Hurricane damage will affect primarily the estimated area of mature rain forest, reducing this vegetation to secondary rain forest where damage is heavy.

or climax. There is, in fact, more secondary rain forest land than mature rain forest. The long history of shifting cultivation in Dominica has created and is creating a patchwork of forest stands of various ages. These 20,000+ hectares of secondary rain forest are scattered throughout the older agricultural areas, particularly where the topography is too steep for sustained permanent cultivation. While this forest provides a number of benefits; including small-size wood, some wildlife habitat, and watershed protection; it is not regarded as a permanent conservation area. Rather, secondary forest is often viewed as a type of land fallow, a state to which the land is allowed to revert temporarily in anticipation of the next cultivation cycle. Due to the temporary nature of secondary forest and its scattered location, it cannot be considered as permanent timber-producing land at present. Nor, we shall see later, does it produce such benefits as endangered parrot habitat or ecological stability found only in mature climax rain forest.

Mature rain forest is the primary timber rescurce on the island, ranging from 195 to 528 cubic metres of usable sawtimber per hectare. Montane swamp forest and secondary rain forest will yield small amounts of timber, usually from 85 to 186 cu. metres/hectare. The other forest types; elfin woodland, scrub forest, littoral woodland, fresh-water swamp, and montane thicket; yield virtually no wood of sawlog size.

All types of natural vegetation provide watershed protection and soil stabilization benefits. There is no evidence that any one type is better than another in this regard. Each vegetation type is suited to survival in a particular climatic and soil zone, and as such, provides the most reliable watershed protection for that zone. Agricultural crops may or may not provide equivalent watershed protection, usually they do not. Natural vegetation also provides wildlife habitat, though the wildlife species differ from one vegetative type to the next. While the endangered parrots can survive only in mature rain forest, other wildlife species are often more adaptable.

Table 1 illustrates that each vegetation type provides certain economic and environmental benefits, sometimes uniquely so. Thus, in altering vegetation and land use in the process of economic development, there is a tradeoff in benefits and values.

[illegible] Land [illegible]ship

[illegible]ican land ownership is complex and poorly-documented. Few [illegible]wners have a clear land title and survey for the [illegible] they claim. Boundaries are often in dispute, and many [illegible]s are held in common by all members of a family. [illegible]quatting has been a common method of land settlement, both on unallocated government land and abandoned estates. In some areas, the Crown Lands Division has surveyed and sold plots in "agricultural settlement areas", as has the Land Management Authority. Land ownership in these areas is relatively well established. Designated government reserves, namely the Central Forest Reserve, Northern Forest Reserve, and Morne Trois Pitons National Park, have been surveyed and boundaries marked on the ground. Thus, in some areas, ownership boundaries are very clear, but are muddled in other areas.

Figure 2 is a map which summarizes land ownership. Black-coloured areas are presumed to be privately owned or claimed. Unallocated Crown Forest parcels are in white, and are numbered for reference later in this report. The Forest Reserves and National Park are labeled, and appear in white also. The method used to arrive at this information is given in the Forest Land Use Plan, where the limitations of this data are described.

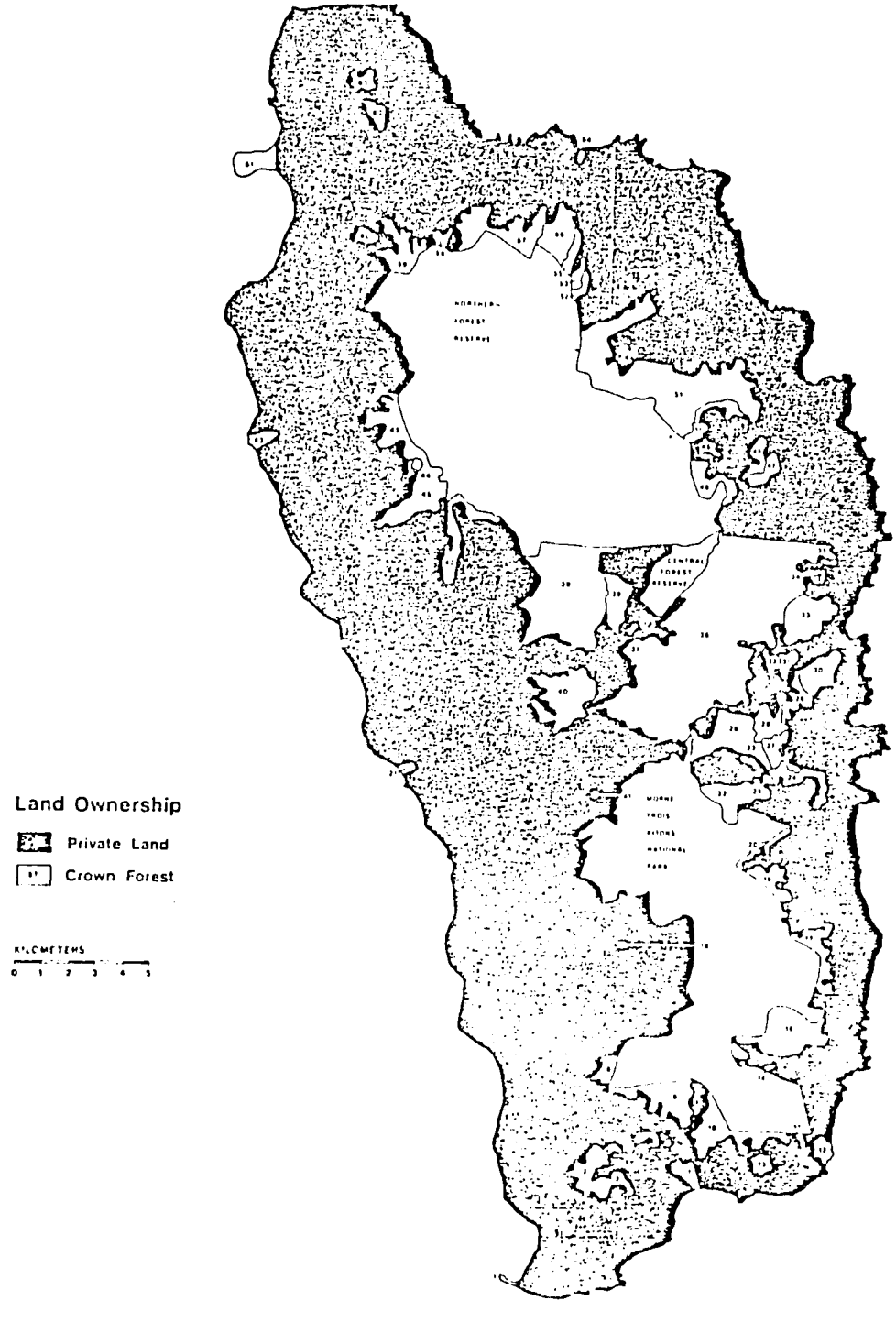
As a rule, remaining government lands are either very steep or inaccessible at present. Most government land is covered by forest of one type or another, and most of it is in the highest rainfall zones. Existing Park and Forest System unit areas are as follows:

Morne Trois Pitons National Park (including Middlcham Preserve)	6,349 hectares	8%
Central Forest Reserve	410 hectares	1%
Northern Forest Reserve	8,814 hectares	11%

Unallocated government land is of particular interest in this land use plan, because it has not yet been committed to a particular use. There are some 10,526 hectares of unallocated government land, about 13% of the island area. Finally, privately owned or claimed land represents some 52,901 hectares, or 67% of the total land area.

Figure 2

Eastern Caribbean Natural Area Management Program
Dominican Forest and Park Systems Plan



Land management objectives in the National Park are different from those in the Forest Reserves, though both are government-managed land. National Park System lands are managed primarily for preservation of natural ecological conditions. Outdoor recreation, education, and scientific study are compatible activities, but such activities as agriculture, logging, and hunting are incompatible, and are prohibited. Several secondary objectives are met by managing land in a natural state, among them watershed protection, wildlife propagation, and prevention of water pollution. While Morne Trois Pitons National Park was created because of its natural attractions, an expanded Park System might also include areas with cultural or historical significance.

Forest Reserves provide many of the same benefits as National Parks. The major difference is that timber harvest is allowed in Forest Reserves, under contolled conditions. Control of harvest activities is very important, to prevent soil erosion, water pollution, and destruction of unusual ecological habitats. Both the location of timber felling and the rate of cutting must be controlled, to avoid excessive loss of wildlife habitat area, and to prevent cutting faster than the rate of forest regrowth.

Table 2 summarizes briefly the land management objectives of National Park System and Forest Reserve lands. A complete National Park System might include different units (National Park, Nature Preserve, Natural Monument, Historical Monument, Natural Area, Recreation Area, National Seashore) that have slightly different management objectives because of the different resources found in a given land area. Clearly, many of the primary and secondary objectives listed in Table 2 are unique to government management of land, since they benefit society as a whole, but are seldom profitable in the short-term to private landowners.

Table 2

LAND MANAGEMENT OBJECTIVES OF FOREST RESERVE AND NATIONAL PARK SYSTEM UNITS

	National Park System							Forest Reserves
Objectives	National Park	Nature Preserve	Natural Monument	Historical Monument	Natural Area	Recreation Area	National Seashore	
Maintain sample ecosystems in a natural state	P	P	P		P		P	I
Maintain ecological diversity and environmental regulation	P	P	S		P		P	S
Provide education, research, and environmental monitoring	P	P	P	P	P		P	I
Preserve genetic resources	P	P	S		P		P	S
Regulate streamflow, prevent flooding	S	S	I		S			P
Control erosion and water pollution	S	S	I		S		S	P
Produce protein from wildlife, sport hunting and fishing								P
Provide timber and forage on a sustained-yield basis								P
Provide recreation and tourism opportunities	P	I	P	P	S	P	P	S
Protect cultural or historical sites				P			S	
Retain scenic beauty and green areas	P	P	P	S	P	S	P	S

P=primary objective S=secondary objective I=Included as objective where resources and other objectives permit

C. Agricultural Land Capability.

The Dominican economy is largely an agricultural one, and many Dominicans depend upon farming for their income and subsistence. Yet, less than a third of the total land area is devoted to agricultural crops. A significant reason for this is the mountainous terrain and the fact that there are large areas of land in the interior poorly suited to agricultural use. There are, however, some areas that have been developed for agriculture despite serious physical limitations (steep slopes, waterlogged soils, high rainfall). The results are predictable and well-documented: soil erosion, landslides, water pollution, and poor crop yields. If we are to avoid these problems in the future, it is important to understand the physical limitations of land for different uses. This is particularly true for unallocated government parcels, where land use decisions are yet to be made.

The natural capability of a given land area to support permanent agriculture is determined by four factors: soil type, slope, rainfall, and temperature. There are many types of soil in Dominica, some very good for growing crops, others very poor. Generally, the best agricultural soils are deep, well-drained, and of medium texture. Waterlogged soils like the Allaphanoid podzolics near Pont Casse yield poor crops, because of inadequate aeration in the root zone. Thus, there are differences in crop response to different soils; there are also differences in the erodibility of soils. Where highly erosive soils are found on steep slopes, they should not be cleared of natural vegetation, or loss of the topsoil will occur.

Steepness of slope is a major determinant of agricultural land capability. It is physically possible to grow crops on very steep slopes; numerous examples can be found in Dominica. Such a practices is usually short-lived on any given parcel, however. The problems which occur as a result of farming steep slopes are sometimes dramatic, as in the case of the Bagatelle landslide disaster, but are often more subtle. Topsoil is lost with every rainstorm and moves downhill to settle in roadbeds, ditches, culverts, and streams. Gradually, the loss of topsoil results in loss of fertility and decline in crop yields. In addition, pesticides used in farming adhere strongly to soil particles, which are eroded into the drinking water supply and pose a public health hazard.

The steeper the slope, the greater is the danger of erosion, landsliding, and water pollution from agriculture.

Due to the effects of high mountains on local weather, there is tremendous variation in rainfall from one place to the next. The high mountains in the centre of the island receive an annual average rainfall of over 500 centimetres. The highest rainfalls are associated with the higher altitudes along the north-south axis of the island. Moderate rainfall is a blessing to farmers, but the high rainfall areas of the interior suffer from two agricultural limitations. First, the wet climate encourages growth of crop diseases, one notable example being banana leaf spot. The second problem in the high rainfall zone is that soil erodes much more quickly when slopes are cleared.

Low temperatures are another factor that limits crop production. Average air temperatures decrease as one moves toward the high elevations of the interior. The result is that crops take longer to mature, making productivity per hectare per year very low.

Soil, slope, rainfall, and temperature are well documented on maps, so that it is possible to arrive at a relative rating of agricultural land capability for every hectare of land, regardless of how the land is actually being used now. Four catagories of agricultural limitations are listed in Table 3, in decreasing order of severity. The most serious limitation to agricultural use is a high erosion hazard. Due to combinations of steep slopes and erodible soils, these areas are unsuitable for any kind of agricultural use. When cropping is attempted in these areas, topsoil is lost rapidly, natural fertility is depleted, and water users downstream suffer. The end result is abandonment of the "worn out" land. The next limitations catagory is one of moderately high agricultural erosion hazard, where tree crops or forest are the only suitable uses. Other crops are simply too disruptive to the soil surface, and result in severe erosion. The third limitations catagory is not erosion-related, but one where soil and climatic conditions create very poor conditions for crops. Areas with waterlogged soils or exposed ridges fall into this catagory. The fourth catagory is the least severe, with neither severe erosion hazard, waterlogged soils, or exposure. This catagory is called poor agricultural land, and is classified so because of high rainfall and low temperatures.

Table 3

AGRICULTURAL LIMITATIONS

High Agricultural Erosion Hazard

Land not suitable for cultivation of any kind. Very poor soils on steeply sloping land that should not be cleared for agriculture, due to high risk of excessive soil loss. These are Land Capability Classes VIe and VIIe, based on Lang's soil survey of 1967.

Slopes greater than 40 degrees:
Soils 20, 22, 26IC, 57, 59.
Soils 6, 7, 12, 14, 18 (less than 432 cm. rainfall).
Soils 10 and 16 (less than 635 cm. rainfall).

Slopes greater than 30 degrees:
Soils 9, 15, 17, 19, 24, 25, 26, 28, 29, 30, 31, 32, 34, 37, 39, 40, 42, 43, 56, 69.
Soils 6, 7, 12, 14, 18 (more than 432 cm. rainfall).
Soils 10 and 16 (more than 635 cm. rainfall).

Slopes greater than 20 degrees:
Soils 1, 2, 3, 4, 5, 48, 49, 50, 52, 53, 63.

All skeletal areas.

Moderately High Agricultural Erosion Hazard

Land not suitable for cultivation of root crops, row crops, or bananas. Tree crops or forest are the only suitable uses. Climate is marginal for crops and erosion risk is moderately high. This land is of Land Capability Class Ve, based on Lang's soil survey.

Slopes greater than 30 degrees:
Soils 21, 26IC, 41, 57, 59, 60, 62, 64, 65, 70, 72, 73, 74.
Soils 6, 7, 12, 14, 18, 20, 22 (less than 432 cm. rainfall).
Soils 10 and 16 (less than 635 cm. rainfall).

Slopes greater than 20 degrees:
Soils 17, 25, 26, 28, 29, 30, 31, 32, 34, 37, 39, 40, 42, 46, 69, 76, 77, 77T, 78, 80.
Soils 6, 7, 9, 12, 14, 15, 18, 19, 20, 22 (more than 432 cm. rain).
Soils 10 and 16 (more than 635 cm. rainfall).

Slopes greater than 10 degrees:
Soils 44 and 45.

Very Poor Agricultural Land - Waterlogging or Exposure

These areas are not subject to severe erosion hazard, but conditions are such that crops grow very poorly. Waterlogged soils include Allaphanoid podzolic soils (1, 2, 3, 4, & 5) of the island's interior and lowland areas occupied by fresh-water swamp. Exposure to high winds and driving rain is indicated by the presence of elfin woodland or montane thicket vegetation. Such areas are also included in very poor agricultural land.

Poor Agricultural Land - High Rainfall

These are areas with none of the above limitations, but are poorly suited to growing crops because of annual rainfalls of over 432 centimetres. High rainfall areas also have high humidity, reduced solar radiation, and lower average temperatures. As a result, crops experience more disease problems and longer maturation periods, and soils are more readily leached of nutrients than in more moderate rainfall zones.

The four catagories of agricultural limitations are mapped in Figure 3. In this map, the non-erosive poor and very poor catagories are lumped together as one unit. Areas in white have none of the above agricultural limitations, and are presumed to be fair to excellent agricultural land. The map reveals some interesting facts. First, nearly all the land in Morne Trois Pitons National Park has a high agricultural erosion hazard, and is unsuitable for agricultural use. The Northern Forest Reserve is predominantly land with either high or moderately high agricultural erosion hazard. Thus, it appears that most of the land included in the present-day National Park and Forest Reserves does indeed require protection from agricultural encroachment, if we are to avoid serious erosion and water pollution problems.

It is also clear from Figure 3 that there are considerable areas outside existing Forest Reserves/National Park that have high agricultural erosion hazard. Some of these areas are farmed at present, and do in fact have excessive rates of soil loss that will eventually render the land useless. The most notable areas in this respect are the Morne au Diable area and the land along the southern boundary of Morne Trois Pitons National Park.

Fortunately, some of the high erosion hazard areas are unallocated government land which could be brought under protection as Forest Reserves or National Park (ex. Morne Couronne, Morne Concorde, Morne Fraser, and others.) Some of the other erosion hazard areas have been privately owned for years, and have traditionally been left in forest cover by the landowners. This is particularly true of the estates along the west coast, where erosion hazard is high along the steep river bluffs.

Table 4 summarizes the agricultural limitations situation in terms of total land areas involved. Of all the land in the country, 37 percent has a high agricultural erosion hazard, and should not be farmed at all. Another 20 percent has a moderately high erosion hazard, and is unsuitable for root crops and bananas. Of the lands already protected as Forest Reserves or National Park, 88 percent are of high or moderately high erosion hazard. Only 1 percent of this protected land could be considered fair or good for agricultural crops. Perhaps most significant for future planning are the 19,099 hectares of high erosion hazard land outside demarkated Forest Reserves/National Park. About 14 percent of this land

Figure 3

Eastern Caribbean Natural Area Management Program
Dominican Forest and Park Systems Plan

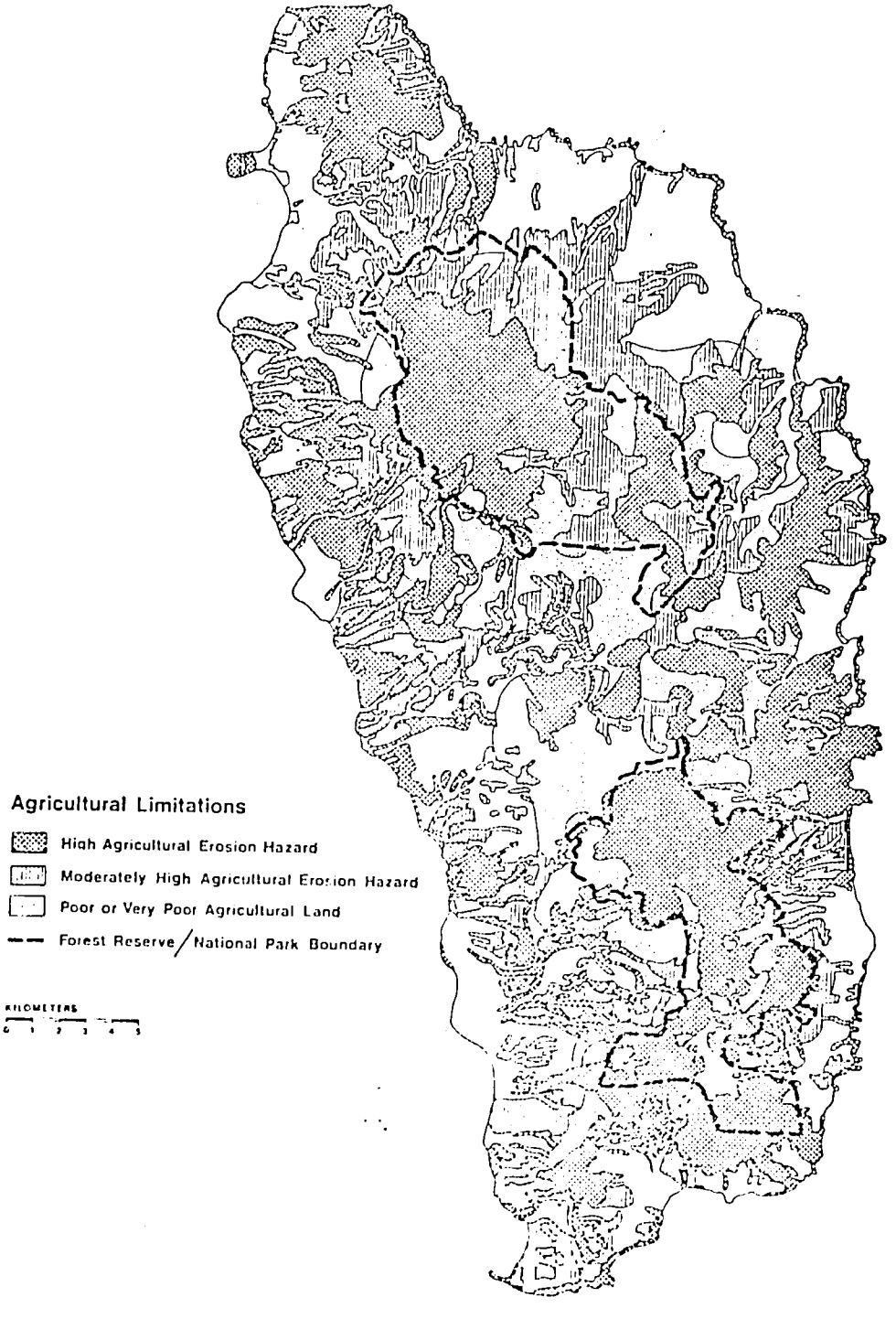


Table 4

Agricultural Limitations--Land Areas

Severity of Limitation	Area in Existing Forest Reserve or National Park * hectares	%	Area outside Existing Forest Reserve or National Park hectares	%	Total Area in hectares	Percent of Total Dominion Land Area
High agricultural erosion hazard	9858	63%	19,099**	30%	28,957	37%
Moderately high agricultural erosion hazard	3810	25%	12,288	19%	16,098	20%
Very poor agricultural land--waterlogging or exposure	438	3%	2,253	4%	2,691	3%
Poor agricultural land--high annual rainfall	1322	8%	6,721	11%	8,043	10%
None of the above limitations	145	1%	23,066	36%	23,211	30%
	15,573	100%	63,427	100%	79,000	100%

NOTE: Agricultural limitations are listed in decreasing order of severity. Where a given parcel of land is subject to more than one limitation (ex. high erosion hazard and high rainfall) the area is counted in the most severe limitation.

* Both Forest Reserves and the National Park specifically prohibit agricultural activities within their boundaries.

** Of the 19,099 hectares outside existing reserves rated high agricultural erosion hazard, approximately 2600 hectares (14%) are presently under cultivation, resulting in high rates of soil loss and stream sedimentation.

[illegible] already cultivated (resulting in high rates of soil loss) [illegible] it is threatened by future agricultural encroachment.

How then, does the present pattern of agricultural [illegible] fit with the natural limitations of the land [illegible]ce? There are some problem areas, where farming of [illegible]eep slopes is causing rapid soil erosion and water pollution. Generally, the size of the farms in these areas is small, making the relocation of farmers an arduous but necessary task. In addition to the actual problem areas, there are numerous potential problem areas. Most of the unallocated government land remaining is of a high or moderately high erosion hazard. If these areas are not brought into the Forest Reserve or National Park systems, the usual pattern of settlement will virtually guaratee widespread soil erosion, water pollution, and destruction of natural forest for the sake of very poor crop yields. On the other hand, some of the best agricultural land in the country is under-utilized. Clearly, the land use maladjustments go beyond the scope of Forest Reserve/ National Park planning to problems of land tenure, lack of economic alternatives, and social immobility. Still, by locating Forest Reserves and National Parks properly, the government can help to shape rural land use patterns, so as to avoid wasted investments in roads to unproductive areas, and the social cost of settling people on unprofitable land.

D. Logging Potential

From a timber production standpoint, not all forest land is of equal value. The best forest land for commercial timber production and logging is located in gentle terrain, on well-drained soils, and is capable of growing valuable tree species rapidly. As with agriculture, there are natural limitations which render certain areas of forest land unsuitable for commercial timber production. It is important that forest lands be evaluated in terms of logging potential so that 1) annual allowable timber harvest can be determined accurately, and 2) where other values are not overriding, the most productive commercial forest can be placed in Forest Reserves, rather than in the National Park system where cutting would be prohibited. Four types of limitations to logging are described in Table 5, and are mapped in Figure 4 (note that the island is covered in three sections).

The first and most obvious constraint to commercial logging is found in areas which are physically incapable of growing sawtimber-size trees. The highest mountain areas are covered by cloud forests, consisting of low-growing, gnarled trees and shrubs. The combination of adverse soils, high rainfall, and exposure to wind make it virtually impossible for trees to grow normally as they would at lower elevations. Similar conditions are found in the littoral woodlands of the eastern coast. Active landslide zones are also rated as incapable of growing sawtimber, due to the periodic loss of all vegetative cover. About 10 percent of the total Dominican land area is incapable of growing sawtimber due to adverse natural conditions. One can see from the logging potential maps that the largest such areas are found in the southern mountains (Morne Trois Pitons National Park), Morne Diablotins, and Morne au Diable in the north.

The second constraint to logging is steepness of slope. About 13 percent of the land area is potentially capable of growing sawtimber-size trees, but is too steep to be logged with even the most sophisticated cable logging systems. While it is doubtful that anyone would be foolish enough to attempt logging in this kind of terrain (described in Table 5), the result would be widespread erosion, high roadway maintenance costs due to land slippage, and high road construction and logging costs. For purposes of planning future timber harvest, this steep land cannot be considered part of the harvestable

Table 5

LOGGING POTENTIAL MAPS

[illegible] areas of merchantable timber can be considered loggable, [illegible] in the steep mountains of Dominica. Steep slopes limit [illegible] of access roads, operation of logging equipment, and [illegible] ability to control soil erosion from logging. In addition, Morne [illegible] Pitons National Park is closed to logging. Due to climate and [illegible] conditions, other lands are simply unable to grow merchantable sawtimber. Still other lands are occupied at present by agriculture, scrub forest, or other unmerchantable forest. These constraints are mapped and are listed below in decreasing order of severity.

Lands Incapable of Growing Sawtimber

--Montane Thicket (MT), Elfin Woodland (E), and areas where these are the the climax vegetation types.
--Littoral Woodlands (L) and Landslide Zones (LS)

Lands Too Steep for Commercial Logging

All logging methods are included here, even the most sophisticated skyline cable systems (i.e. tractor, drag cable, draft animals, high-lead cable, skyline cable, in-situ sawing). Thus, lands designated as too steep for commercial logging are too steep for any of the above systems, though the land itself is capable of growing sawtimber.

--Too steep for logging equipment: over 40 degree slope.
--Access road construction impractical and hazard to water quality: Slopes over 30 degrees unbroken by intervening ridgetops, valley bottoms, or breaks in slope.

Non-Forest, Scrub, or Montane Swamp Forest

These lands are gentle enough to be logged and theoretically could support sawlog-size timber. At present, however, the land is occupied by agricultural crops, housing, commercial sites, scrub forest, or polewood-size montane swamp forest. Logging could take place only if these lands are abandoned for many years or, in the latter two types, planted to timber trees.

National Park--No Logging

The law creating Morne Trois Pitons National Park prohibits logging anywhere within the boundaries. Most of the land in the Park is not loggable anyway, due to the above natural constraints. The few areas which could be logged if not for Park status are shown on the logging potential map. Most of this forest is low-value polewood-size timber.

Areas with Commercial Logging Potential

These lands are not constrained by any of the above obstacles to logging. Some of the land is old-growth rain forest containing large sawtimber, some is secondary forest with only polewood-size timber (which can be expected to reach larger size if left undisturbed for many years). There is no implication that all of this land should be logged, only that it is physically possible to do so. Economic factors, wildlife habitat needs, or social priorities may indicate that it is not in Dominica's best interest to log all lands with commercial potential.

Figure 4 a

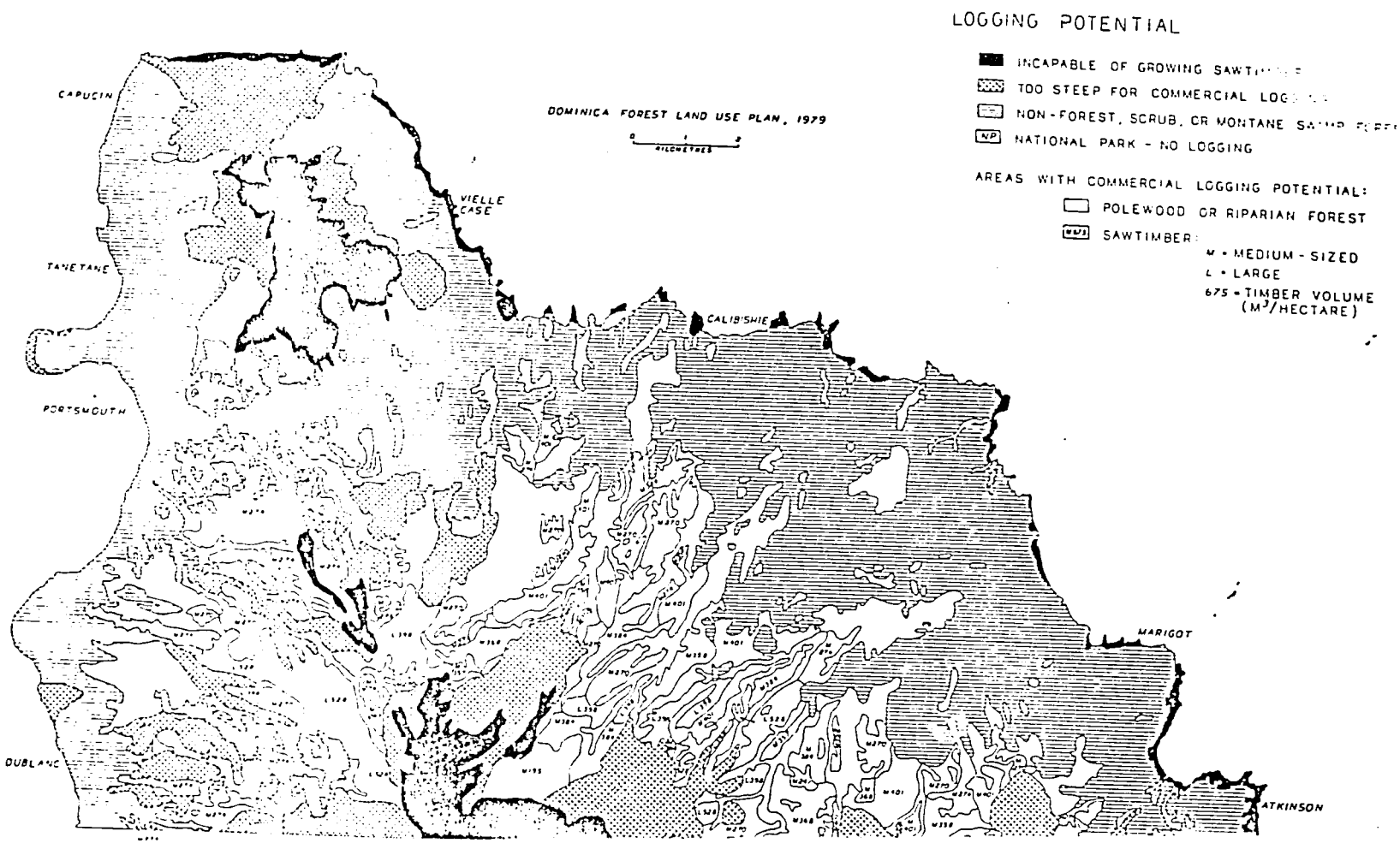

DOMINICA FOREST LAND USE PLAN, 1979
KILOMETRES
LOGGING POTENTIAL
INCAPABLE OF GROWING SAWTIMBER
TOO STEEP FOR COMMERCIAL LOGGING
NON-FOREST, SCRUB, OR MONTANE SAWTIMBER FOREST
NP NATIONAL PARK - NO LOGGING
AREAS WITH COMMERCIAL LOGGING POTENTIAL:
POLEWOOD OR RIPARIAN FOREST
SAWTIMBER:
M = MEDIUM-SIZED
L = LARGE
675 = TIMBER VOLUME (M³/HECTARE)
CAPUCIN
VIELLE CASE
TAMETANE
CALIBISHIE
PORTSMOUTH
MARIGOT
DUBLANC
ATKINSON

Figure 4 b

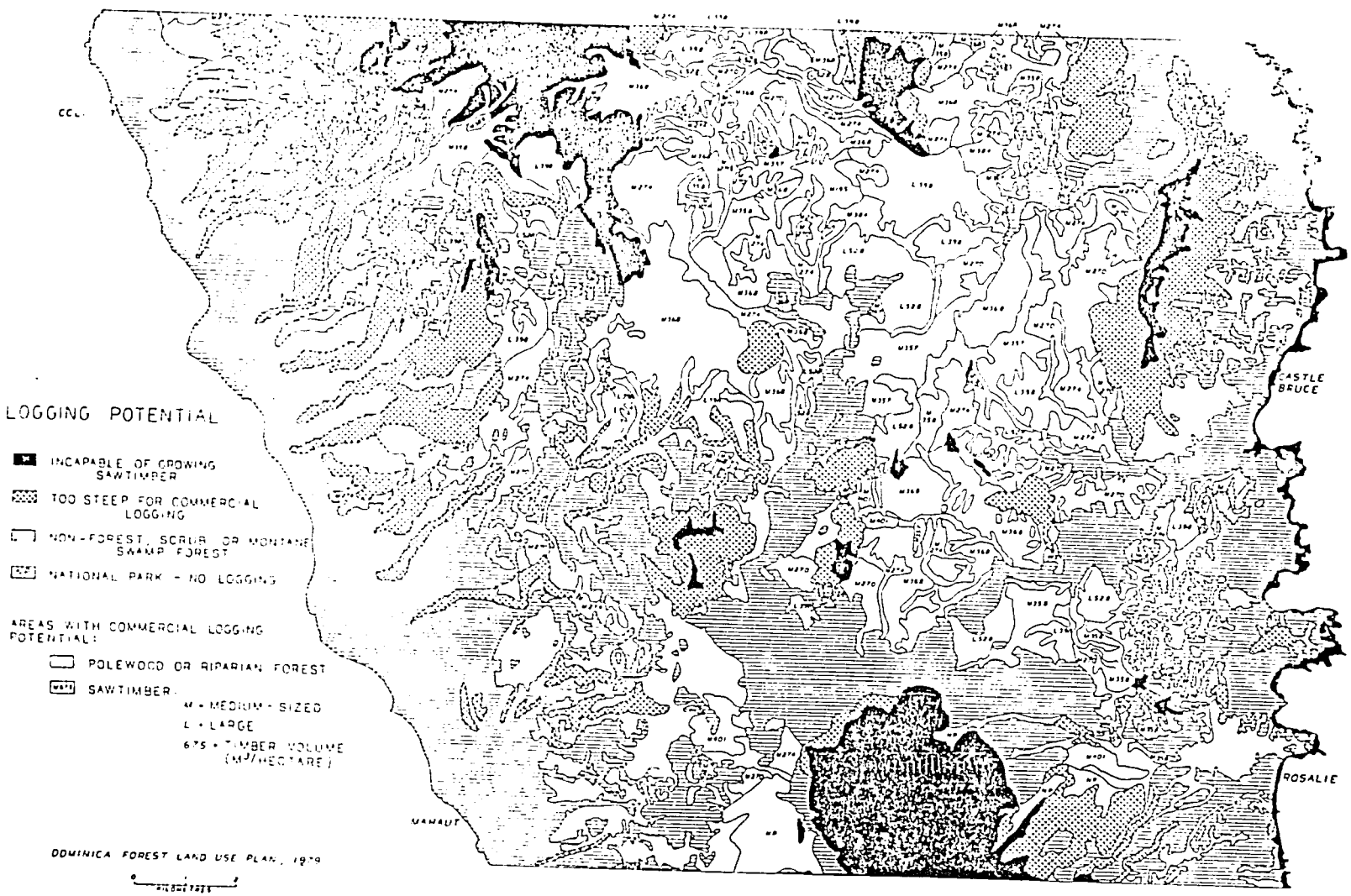
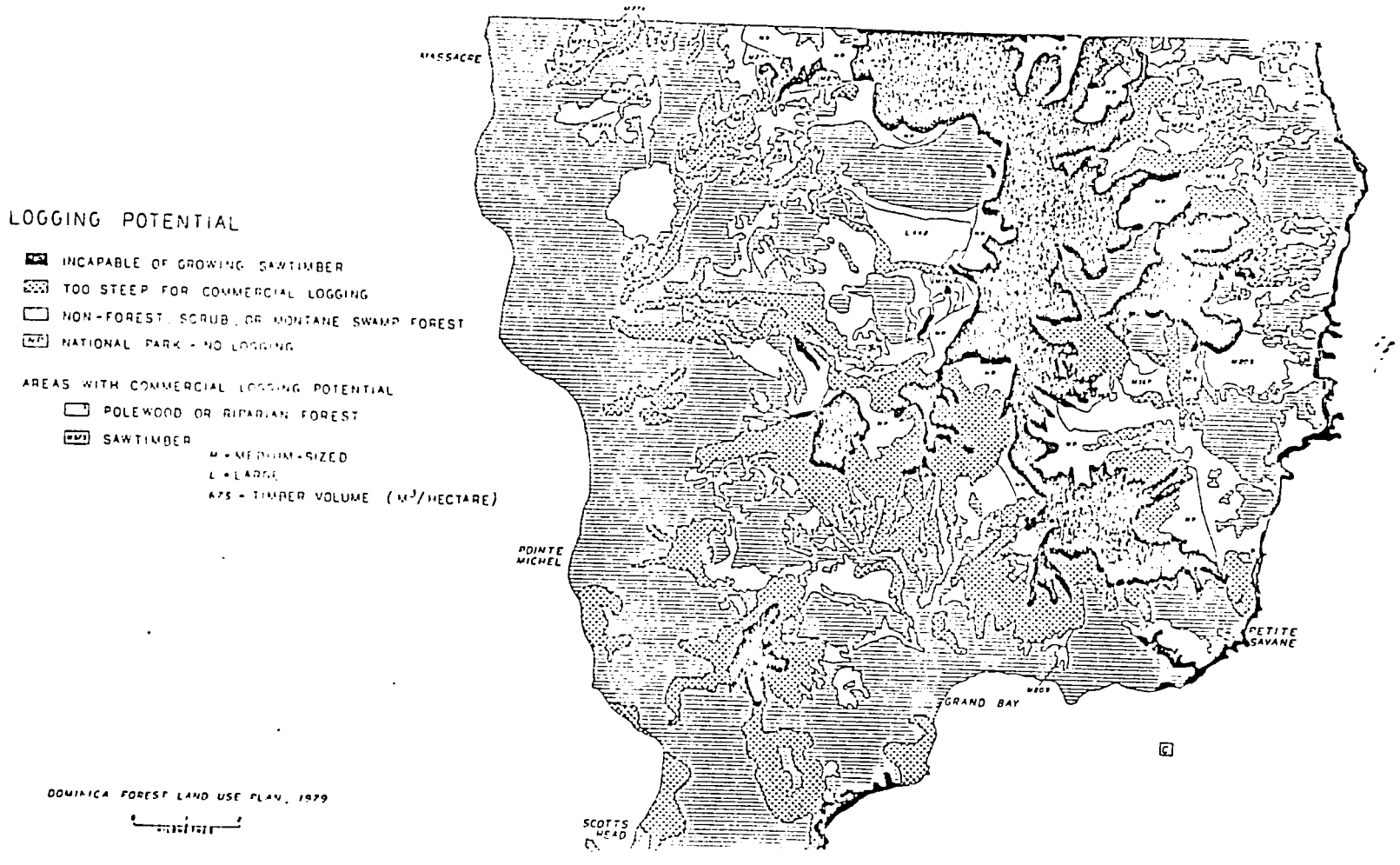

LOGGING POTENTIAL
INCAPABLE OF GROWING SAWTIMBER
TOO STEEP FOR COMMERCIAL LOGGING
NON-FOREST, SCRUB OR MONTANE SWAMP FOREST
NATIONAL PARK - NO LOGGING
AREAS WITH COMMERCIAL LOGGING POTENTIAL:
POLEWOOD OR RIPARIAN FOREST
SAWTIMBER:
M = MEDIUM-SIZED
L = LARGE
6.75 + TIMBER VOLUME (M³/HECTARE)
DOMINICA FOREST LAND USE PLAN, 1979
CASTLE BRUCE
ROSALIE
MAHAUT

Figure 4 c


LOGGING POTENTIAL
INCAPABLE OF GROWING SAWTIMBER
TOO STEEP FOR COMMERCIAL LOGGING
NON-FOREST, SCRUB, OR MONTANE SWAMP FOREST
NATIONAL PARK - NO LOGGING
AREAS WITH COMMERCIAL LOGGING POTENTIAL
POLEWOOD OR RIPARIAN FOREST
SAWTIMBER
M = MEDIUM-SIZED
L = LARGE
M75 = TIMBER VOLUME (M³/HECTARE)
DOMINICA FOREST LAND USE PLAN, 1979
MASSACRE
POINTE MICHEL
GRAND BAY
PETITE SAVANE
SCOTTS HEAD

land area. As shown in the logging potential maps, land which is too steep for any kind of commercial logging is scattered widely. The maps may be somewhat misleading unless the assumptions used are known; the slope ratings used to compile the maps assume that either skyline cables or in-situ sawing will be employed. There are other logging methods (tractor skidding, high lead cable skidding) that are incompatible in all but the most gentle harvestable terrain. Table 6 gives a brief comparison of four logging methods, including the maximum slope that can be safely logged by each method. If tractors, for example, are the only logging equipment available, the land area harvestable by this technique is considerably less than if skyline cable systems were in use.

A third catagory of logging potential shown in the maps consists of land which is physically capable of growing sawtimber and is gentle enough to be logged by some method, but is presently in some use other than forestry. These uses include agriculture, housing, and commercial sites. Other lands included in this catagory are presently covered by dry scrub or montane swamp vegetation (neither of which is considered sawtimber at maturity). These areas could conceivably be planted to timber species and would produce sawtimber, but at a very slow rate of growth. About 35 percent of the Dominican land area is non-forest, scrub, or montane swamp forest, all of which has commercial forest potential, but only after a change in land use. The maps show that this land includes the settled agricultural areas, the dry scrub forest of the east coast, and the montane forests near Pont Casse and Laudat.

Now that logging potential has been mapped, one might reasonably ask how much commercial timber land has been removed from cutting forever by being included in Morne Trois Pitons National Park. It turns out that very little land with any commercial logging potential (1110 hectares) is included in the boundaries. These areas are shown in the logging potential maps as "NP". Some of the best commercial forest in the National Park is in the Middleham Preserve, a private tract placed in trust specifically for National Park purposes that could not be logged at any rate. Most of the remainder of harvestable forest land is in small isolated tracts of immature polewood-sized timber. It is clear that future forest industry development has not suffered as a result of the establishment of Morne Trois Pitons National Park.

Table 6

COMPARISON OF FOUR LOGGING METHODS

Silvicultural Compatibility:

Logging Method	Suitable for Clearcutting?	Suitable for Light Selective Cutting?
1. Tractor skidding	yes	not recommended; damages residual trees
2. High lead cable skidding	yes	not recommended; damages residual trees
3. Skyline cable logging	yes	possible, but seldom attempted due to high costs per unit wood
4. In-situ sawing	yes	yes

****

Terrain Compatibility:

Logging Method	Optimum slope	Optimum yarding distance	Road network required	Relative soil erosion risk
1. Tractor skidding	Less than 15°	300 metres	High density	High
2. High lead cable skidding	Less than 30°	300 metres	High density	Moderately high
3. Skyline cable logging	Less than 40°	1300 metres	Medium density	Low
4. In-situ sawing	Less than 40°	Logs are not yarded	Low density	Very Low

****

Relative Cost and Technological Requirements:

Logging Method	Relative Cost/Unit Wood	Technological Requirements
1. Tractor skidding	Low	Requires heavy equipment and skills in road-construction, engine mechanics, directional felling, and tractor operation.
2. High lead cable skidding	Higher	Requires all of the above, plus skills in cable operation and cable stress mechanics.
3. Skyline cable logging	Highest	Same as above, except that the skyline cables are more complex than high lead.
4. In-situ sawing	High labor costs, low equipment costs.	Very simple equipment, low skill requirements. Chain saws increase man-hour efficiency over hand sawing, and require skills in chain saw operation and maintenance.

While Dominica is thought of as a heavily forested country and thus ripe for commercial forestry development, a full 59 percent of the land is unsuitable for commercial timber harvest. This land is either incapable of growing sawtimber, too steep for logging, already in some other use, or is protected as National Park (See Table 7 for numerical land area estimates). That leaves 41 percent, or 32,092 hectares of forest with commercial logging potential. The largest blocks of commercial forest are around the base of Morne Diablotins (the Northern Forest Reserve) and in the central portion of the island (Central Forest Reserve and unallocated government land to the east, north, and west of it). The commercially harvestable catagory includes both sawtimber stands (large trees presently) and polewood stands, which have been cut over or damaged in the past so that most trees are still too small to be cut for lumber.

In the logging potential maps, polewood and riparian (streamside) forests are shown in plain white. Sawtimber forests are also white, but with a code that shows the relative size of the trees and the average timber volume (in cubic metres per hectare). The commercial forest stands with the highest timber volume per hectare would presumably be the most profitable to cut. Table 7 gives a tabulation of the total merchantable timber volume from each type of sawtimber stand, and the total sawtimber volume (4.6 million cubic metres) for the island.

The 18,500 hectares of polewood could be expected to reach sawtimber size if left undisturbed for many years. Much of this polewood will not be allowed to grow, however, as it is found in active agricultural areas where the land is cleared periodically for short-term cultivation. Thus, it would be a mistake to include all this land in any calculations of total timber-producing land so that an annual allowable cut figure could be reached. The figures given in Table 7 are based on 1979 revisions of earlier work, and are previously unpublished.

When we say that 41 percent of the total land area has commercial logging potential, it is based on purely physical constraints. There is no implication that all this land <u>should</u> ever be logged, indeed there are overriding reasons why some of it should not. Economic factors, wildlife habitat needs, and social priorities are yet to be accounted for in this plan, and all affect forest industry development.

Table 7

COMMERCIAL TIMBER--LAND AREAS
ENTIRE ISLAND, PUBLIC & PRIVATE LANDS

Lands Incapable of Growing Sawtimber.....7,746 hectares (10%)

Lands Too Steep for Commercial Logging.....10,191 hectares (13%)

Non-Forest, Scrub, or Montane Swamp Forest.....27,861 hectares (35%)

Loggable National Park Land..... .....1,110 hectares (.1%)

Total Non-commercial.....46,908 hectares (59%)

Polewood with Commercial Logging Potential.....18,500 hectares (23%)

Sawtimber with Commercial Logging Potential.....13,592 hectares (17%)*

Total Commercial.....32,092 hectares (41%)

Land Areas of Commercial Sawtimber by Forest Type*

Logging Potential Code**	Forest Type Code	Land Area	X	Avg. Merchantable Volume per Hectare (cu. metres)	=	Total Merchantable Timber Volume
M 195	MH 4a	315 ha.		195		61,425 m^3
M 196	GmCh(S) 4a	73 ha.		196		14,308 m^3
M 209	MH (S) 4a	299 ha.		209		62,491 m^3
M 247	MH (W) 4	104 ha.		247		25,688 m^3
M 270	MH 4	1944 ha.		270		524,880 m^3
M 274	MH (Gm) 4a	2985 ha.		274		817,890 m^3
M 357	GmCp 4	564 ha.		357		201,348 m^3
M 358	Gm 4	690 ha.		358		247,020 m^3
M 367	BdGmCh(S) 4a	85 ha.		367		31,195 m^3
M 368	GmCh 4	2438 ha.		368		897,184 m^3
M 384	GmCpBd 4a	559 ha.		384		214,656 m^3
L 398	MH 5	1433 ha.		398		570,334 m^3
M 401	GmCpBd 4	783 ha.		401		313,983 m^3
L 448	GmCh(S) 5	161 ha.		448		72,128 m^3
L 528	Gm 5	1159 ha.		528		611,952 m^3
		13,592 hectares				4,666,482 m^3

Merchantable Sawtimber in primarily polewood-size stands:

18,500 hectares polewood X 135 cubic metres/hectare sawlogs (rough estimate) = 2,497,500 m^3

* These 1979 estimates are considerably more up-to-date than the 1962 estimates of W.G.E. Brown, but do not account for any damage to sawtimber from Hurricane David, 1979. Due to hurricane damage, some commercial sawtimber areas may no longer have any timber volume, and others will have reduced volumes.

**M indicates medium-sized sawtimber, L indicates large sawtimber. Numerals indicate average merchantable timber volume in cubic metres/hectare.

E. Critical Areas: Water Catchments and Rare or Unique Natural Features

The preceeding chapters have focused on two commodity-oriented land uses, agriculture and timber production. There are, however, a number of non-commodity values associated with certain areas of land. These areas are fairly limited in size, and they include such areas as watersheds that provide drinking water supplies, wildlife habitats for rare and endangered species, and rare or unusual natural features, including unique vegetation, geothermal areas, and highly scenic landmarks. Unlike agricultural land, the products of these critical areas cannot be quantified in terms of tonnes per hectares of product. The "products" produced by these critical areas are usually public benefits rather than private goods, and might be expressed in such terms as: safe reliable supplies of drinking water, public health, preservation of traditions and history, and promotion of outdoor recreation and tourism.

Domestic water catchments deserve special attention in the land use planning process. Given the minimal water treatment facilities and practices in most villages, protection of the supply watersheds from pollution is vital to the health of residents. The effects of different land use practices on water quality are outlined in Appendix I, and are summarized very briefly in Table 8. A number of pollutants find their way into streams as a result of agriculture, logging, and human settlement. These pollutants include sediment, pesticides, animal/human wastes, organic matter, and a number of other substances. There are several ways to treat water for safe domestic use, but it should be noted that the more contaminants there are in the intake water, the greater the cost of removing them in a treatment facility. Regulation of land use activities in domestic catchments is one way to minimize the chances of contamination and keep treatment costs low.

Figure 5 is a map showing both hydroelectric and domestic water supply catchment locations. Both existing and proposed catchments are shown. It is interesting to note that while Forest Reserves and the National Park were created in part for the protection of water supplies, a good many of the domestic catchments fall outside these boundaries, and are thus not formally protected

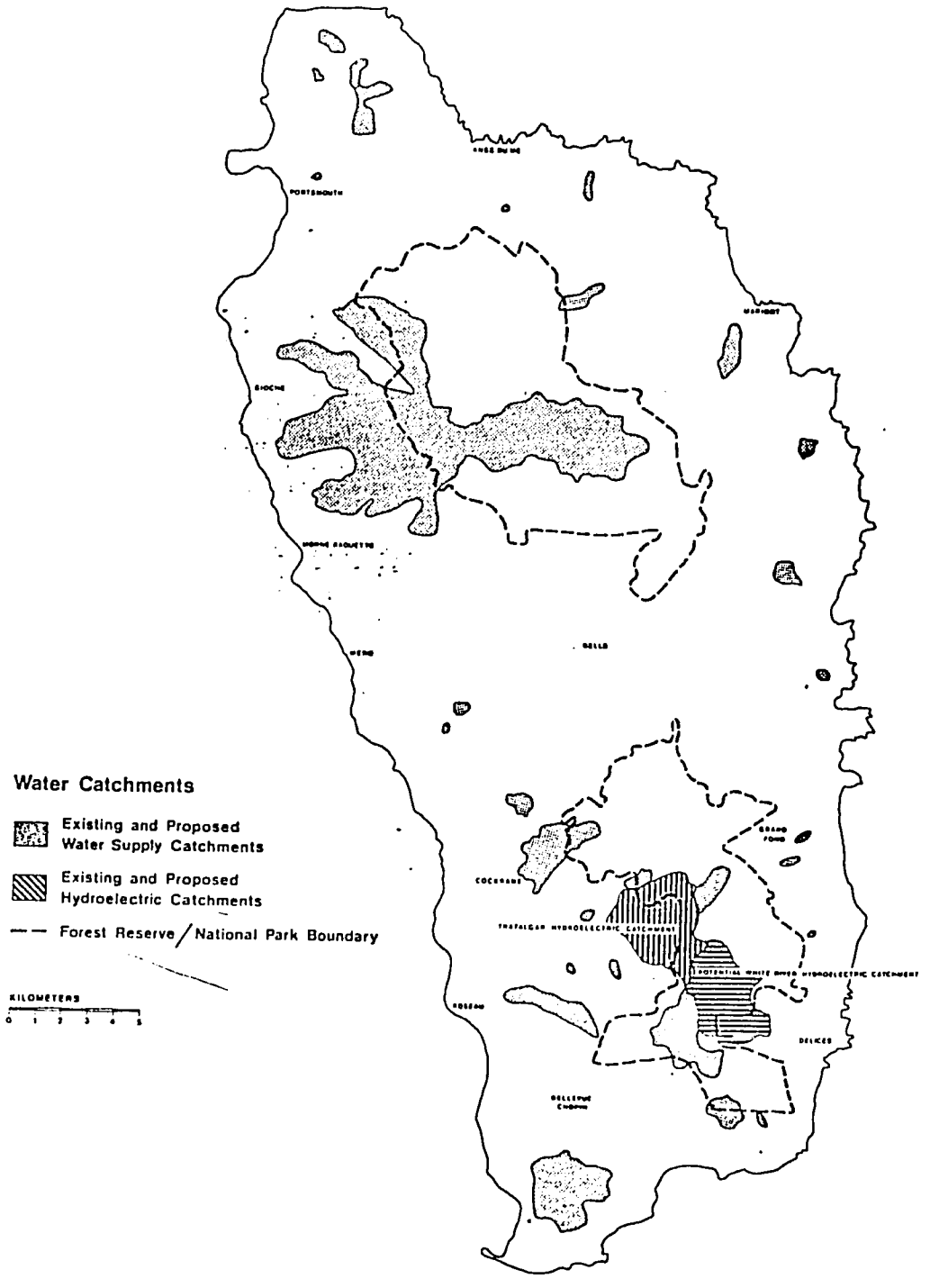
Table 8.

MAJOR WATER POLLUTANTS FROM LAND USE ACTIVITIES

Land Use Activity	Type of Pollutant that may reach stream if not controlled
Wilderness preservation, light recreational use	Bacteria from human wastes
Intensive recreational use	Bacteria from human waste Sediment from roadways and trails
Timber cutting	Sediment from roads and skid trails Bacteria from human wastes
Agriculture and grazing	Bacteria from human and animal wastes Sediment from access roads and cultivated slopes Pesticides Organic wastes
Village and urban uses	Bacteria from human and animal wastes Sediment from roads and construction Solid and organic wastes Manufacturing by-products

Figure 5

Eastern Caribbean Natural Area Management Program
Dominican Forest and Park Systems Plan



The hydroelectric catchments (the existing one at Trafalgar and a potential one on White River) are mostly inside the National Park boundary, and are thus well protected. Contaminants like pesticides and animal wastes are not a problem for hydroelectric plants, but it is important that the watersheds be well protected by vegetation to insure groundwater infiltration for steady streamflow, rather than cycles of high and low flow.

It is important that we take a closer look at domestic water catchments, to determine which ones are proposed for the future and which will eventually be phased out through water system improvements. In the long run, there is little point in pursuing land use regulation in catchments which are soon to be abandoned as water supply intakes, while catchments which will serve proposed consolidated systems (multi-village systems) should be protected in the future. Figure 6 (a,b,c) is a larger scale map showing the status of existing and proposed catchments. The catchment consolidations shown are those first proposed in 1964 by a World Health Organization team, modified slightly in later years by Central Water Authority. The consolidation plan would combine small village water systems where possible, so that water could be treated in larger, efficient treatment plants. One such consolidated system (System I) has been built on the Check Hall River, and serves the area from Mero to Pointe Michel (including Roseau). The other consolidated systems are yet to be built, although in Systems IV, VI, and IX, the proposed intake does serve now as an intake for an individual village. The proposed consolidated water systems are described in Table 9.

Due to the mountainous terrain and the number of small scattered villages, it is impossible to consolidate all the water supplies in these nine systems. Eighteen village supply intakes would be abandoned as consolidated systems are built, but another twelve village supply catchments would remain in service. Table 10 describes all the existing water catchments, and tells whether they would be retained or replaced as consolidation proceeds. The same information is displayed graphically in the Figure 6 maps. It should be clear from the maps that most of the catchments to be replaced are in the lower elevations near the coast, and

Figure 6

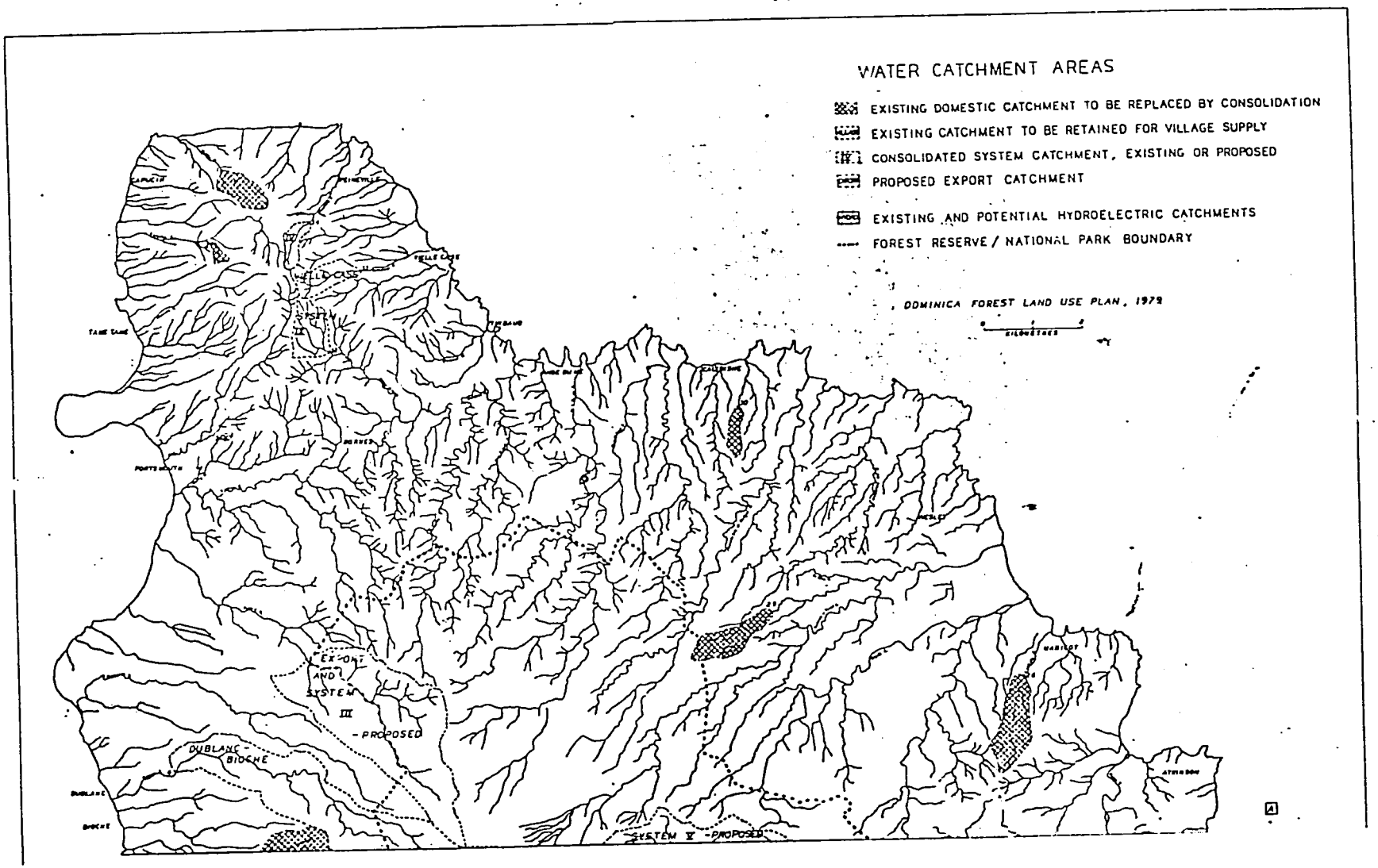

WATER CATCHMENT AREAS
EXISTING DOMESTIC CATCHMENT TO BE REPLACED BY CONSOLIDATION
EXISTING CATCHMENT TO BE RETAINED FOR VILLAGE SUPPLY
CONSOLIDATED SYSTEM CATCHMENT, EXISTING OR PROPOSED
PROPOSED EXPORT CATCHMENT
EXISTING AND POTENTIAL HYDROELECTRIC CATCHMENTS
FOREST RESERVE / NATIONAL PARK BOUNDARY
DOMINICA FOREST LAND USE PLAN, 1979
SYSTEM
EXISTING AND SYSTEM III - PROPOSED
DUBLANC - BIDCHE
SYSTEM V - PROPOSED

Figure 6 b

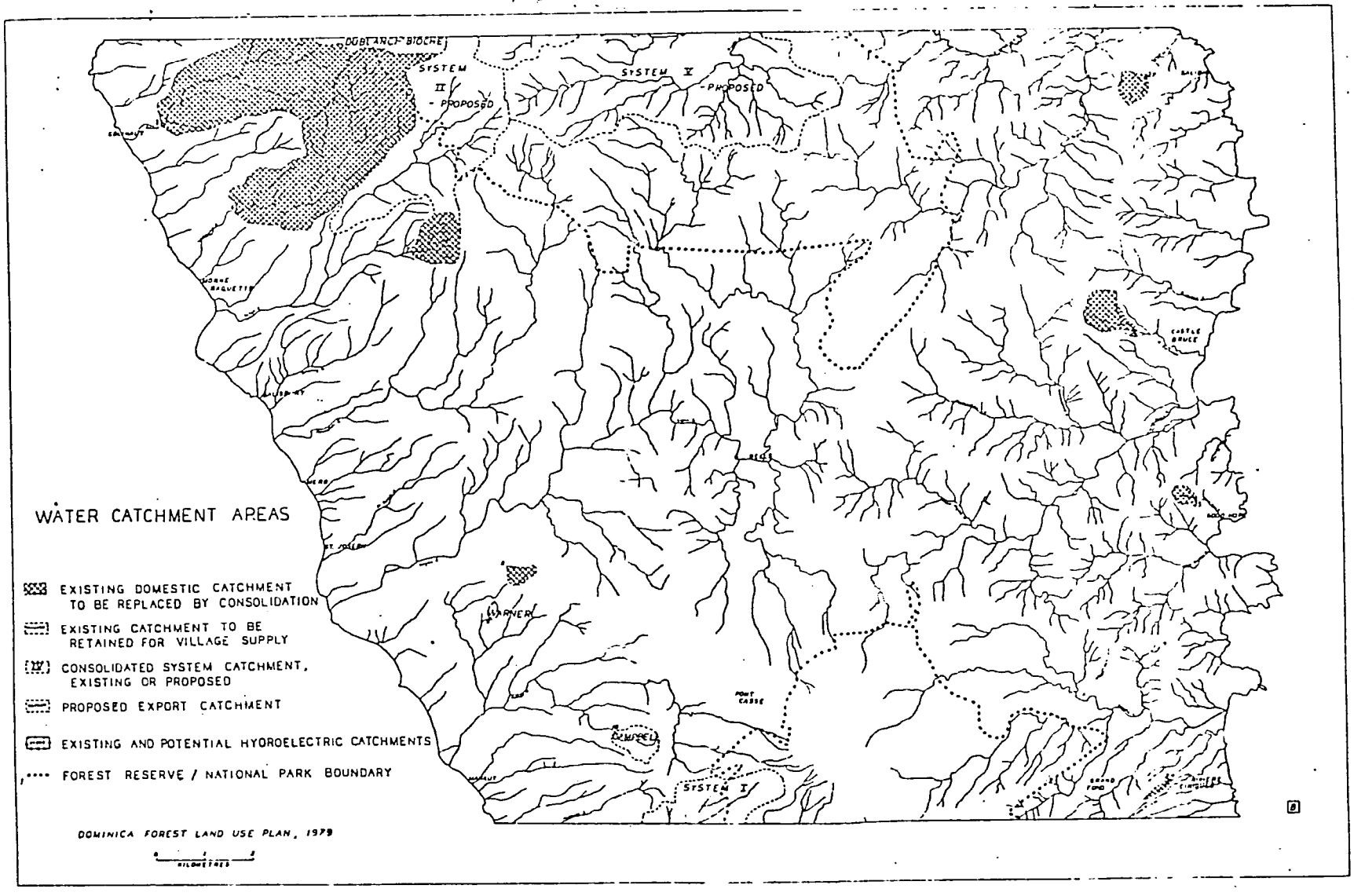
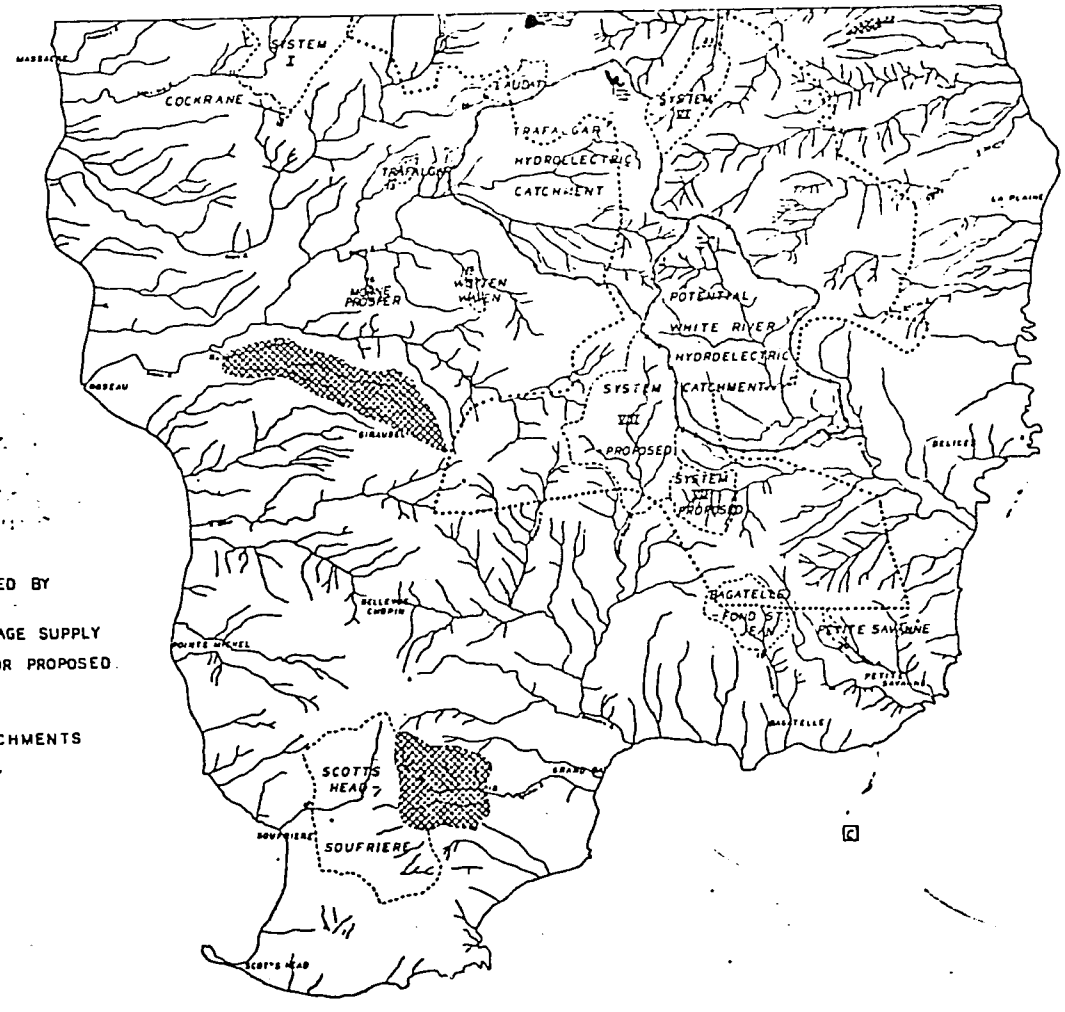

WATER CATCHMENT AREAS
EXISTING DOMESTIC CATCHMENT TO BE REPLACED BY CONSOLIDATION
EXISTING CATCHMENT TO BE RETAINED FOR VILLAGE SUPPLY
CONSOLIDATED SYSTEM CATCHMENT, EXISTING OR PROPOSED
PROPOSED EXPORT CATCHMENT
EXISTING AND POTENTIAL HYDROELECTRIC CATCHMENTS
FOREST RESERVE / NATIONAL PARK BOUNDARY
DOMINICA FOREST LAND USE PLAN, 1979
SYSTEM II - PROPOSED
SYSTEM V - PROPOSED
SYSTEM I
CASTLE BRUCE
CAMPBELL

Figure 6 c



WATER CATCHMENT AREAS

- EXISTING DOMESTIC CATCHMENT TO BE REPLACED BY CONSOLIDATION
- EXISTING CATCHMENT TO BE RETAINED FOR VILLAGE SUPPLY
- CONSOLIDATED SYSTEM CATCHMENT, EXISTING OR PROPOSED
- PROPOSED EXPORT CATCHMENT
- EXISTING AND POTENTIAL HYDROELECTRIC CATCHMENTS
- FOREST RESERVE / NATIONAL PARK BOUNDARY

DOMINICA FOREST LAND USE PLAN, 1979

0 1 2
KILOMETRES

Table 9

PROPOSED CONSOLIDATED WATER SYSTEMS

System	River	Area to be Served
I.	Check Hall	Mero to Pte. Michel (includes Roseau)*
II.	Batali	Colihaut to Salisbury
III.	Picard	Capucin to Glanvillia (incl. Portsmouth)
IV.	Demetrie	Penville & L'Autre Bord
V.	Clyde	Bense to Sineku (incl. Marigot & Wesley)
VI.	Stuarts	Castle Bruce to La Plaine, Grand Fond
VII.	Jack	Delices to Boetica
VIII.	Perdue Temps	Dubic to Tete Morne, Grand Bay, Pichelin to Bellevue Chopin*
IX.	Grand Riviere	Borne to Thibaud

System:	I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.
Projected 1993 Population	43,700	6,060	8,445	1,740	14,890	9,480	2,915	10,990	3,340
Projected Water Demand 1993 (million litres/day)	7.49	0.64	1.02	0.15	1.44	0.91	0.26	1.06	0.30
Minimum River Flow (million litres/day)	26.5	53.0	55?**	0.3	130.6	10.2	5.7	21.6	1.1
1993 Demand as Percent of Minumum Stream Flow	28%	1%	2%	50%	1%	9%	5%	5%	27%
Intake Elevation (feet)	1118	948	860	1243	855	1250	1200	850	724
Intake Elevation (metres)	340	289	262	379	261	381	366	259	221
Catchment Size (hectares)	406	704	697	32	1444	117	89	310	82
Status of Intake	in use	proposed	proposed	in use	proposed	in use	proposed	proposed	in use

* Planned service areas of systems I and VIII have been reduced since the 1964 proposal, so projected populations and water demands will be slightly lower than shown here.

** Intake location has been adjusted to coincide with proposed export intake, upstream from 1964 proposal. The minimum flow at original intake was 62.4 million litres per day.

Table 10

EXISTING WATER CATCHMENTS FOR DOMESTIC SUPPLY

Area Served	1970 Population	Year Built	Source	Intake Elev.	Catchment Size	Future Plans for Catchment
1. Capucin	242	1971	Taffia River	704' (214m.)	51 ha.	Replace by System III
2. Cottage/Toucari	593	1969	Lamothe River	630' (192m.)	10 ha.	Replace by System III
3. Portsmouth	3,296	1903	Branch of Barry River	275' (84m.)	6 ha.	Replace by System III
4. Dublanc/Bioche	724	1970	Dublanc River	340' (104m.)	582 ha.	Retain for village system
5. Colihaut	972	1943	Colihaut River	123' (37m.)	603 ha.	Replace by System II
6. Coulibistrie/ Morne Rachette	943	1959	Coulibistrie River	309' (94m.)	694 ha.	Replace by System II
7. Salisbury	1,491	1954	Branch of Batali River	1641' (500m.)	78 ha.	Replace by System II
8. St.Joseph/Layou/Mero	3,816	1952	Spring and runoff	599' (182m.)	22 ha.	Replace by System I
9. Warner	354	1972	Spring	1125' (343m.)	6 ha.	Retain for village system
10. Campbell	338	under constr.	Branch of Belfast Riv.	1188' (362m.)	47 ha.	Retain for village system
11. Mahaut/Massacre/ Roseau/Pte. Michel	26,196	1970	Check Hall River	1118' (341m.)	406 ha.	System I Catchment
11a. Roseau (supplementary)			River Douce	225' (68m.)	238 ha.	Replace by System I
12. Cockrane	282	1969	Spring	1500' (457m.)	4 ha.	Retain for village system
13. Trafalgar	364	19	Padu River	1274' (388m.)	16 ha.	Retain for village system
14. Laudat	364	1964	Morne Paix Bouche Riv.	2250' (686m.)	44 ha.	Retain for village system
15. Wotton Waven	234	1969	Branch of River Blanc	550' (168m.)	16 ha.	Retain for village system
16. Morne Prosper	455	1969	Branch of Roseau River	1120' (341m.)	3 ha.	Retain for village system

(continued on following page)

Table 10 continued

Area Served	1970 Population	Year Built	Source	Intake Elev.	Catchment Size	Future Plans for Catchment
17. Soufriere/Scotts Head	1,943	1957	Ladigue Spring	75' (23m.)	417 ha.	Retain for village system
18. Grand Bay/Dubic/ Tete Morne	4,689	1978	Berekua River	735' (224m.)	187 ha.	Replace by System VIII
19. Bagatelle/Fond St.Jean	987	in progress	Malabuka River	790' (241m.)	110 ha.	Retain for village system
20. Petite Savanne		in progress	Nyson River	977' (298m.)	12 ha.	Retain for village system
21. La Plaine	1,188	1971	Spring	749' (228m.)	1 ha.	Replace by System VI
22. Morne Jaune	322	1972	Branch of River Bibiay	933' (284m.)	12 ha.	Replace by System VI
23. Grand Fond	761	1955	Stuarts River	1217' (371m.)	117 ha.	System VI Catchment
24. Riviere Cyrique	434	1972	Riviere Cyrique	700' (213m.)	6 ha.	Replace by System VI
25. Good Hope	512	1975	Good Hope River	375' (114m.)	16 ha.	Replace by System VI
26. Castle Bruce	1,474	1973	River Senhouse	626' (191m.)	64 ha.	Replace by System VI
27. Atkinson/Salibia	805	1959	Crayfish River	428' (130m.)	31 ha.	Replace by System V
28. Marigot	2,974	1931	Crebiche River	366' (111m.)	108 ha.	Replace by System V
29. Woodford Hill/Wesley	2,999	1959	River	625' (190m.)	70 ha.	Replace by System V
30. Calibishie	1,044	1957	River	154' (47m.)	25 ha.	Replace by System V
31. Bense/Anse du Mai	809	1971	Branch-Anse du Mai Riv.	415' (126m.)	2 ha.	Replace by System V
32. Thibaud to Borne	1,517	1962+	Grand Riviere	724' (221m.)	82 ha.	System IX Catchment
33. Vielle Case	1,146	1946	Bathalzar River	566' (172m.)	64 ha.	Retain for village system
34. Penville	762	1975	Demetr[illegible] River	1220' (372m.)	[illegible]2 ha.	System IV Catchment

NOTE: Water systems damaged during Hurricane David (1979) may be altered during reconstruction, and some intake locations changed.

most have already experienced water quality degradation from agricultural use and human settlement. Many of the systems to be retained and those proposed for the future have their catchment in less settled areas, and in some cases within the boundaries of protected Forest Reserves or National Park. Clearly, consolidation would be a step forward in making use of the cleaner water found in unsettled areas. The positive effects would be negated, however, if intensive settlement is allowed in these catchments in the future.

Table 11 describes what the situation will be if water system consolidation is completed. There will be 21 domestic water catchments scattered around the island, with a total area of 5202 hectares (less than seven percent of the total island area). Of the land in catchments, only 19 percent would be inside existing boundaries of Forest Reserves or National Park. The remainder will remain subject to various forms of pollution from agriculture and human settlement, unless steps are taken to protect them. At present, some of these catchments are totally undisturbed, others are 100 percent cultivated, many are partly cultivated. Listed at the bottom of Table 11 are the existing catchments to be phased out under consolidation. Notice that only 3 percent of that total area is protected as Forest Reserve or National Park, and in most of the catchments, much of the land is now cultivated and settled.

We noted at the beginning that some type of land use regulation to prevent water pollution is cheaper and more reliable than trying to remove contaminants with sophisticated water treatment. This does not necessarily mean that all catchments should be closed to any use which might cause water pollution; where land is highly productive for agriculture or urban use, it may be worthwhile to compensate for minor levels of contamination with added water treatment. Bacterial pollutants are readily rendered harmless by chlorination. Sediment is more difficult to remove, requiring large settling basins. Pesticides are very difficult to remove, requiring in some cases activated carbon treatment, a very expensive proposition. All domestic supplies should be chlorinated, due to the fact that bacteria are found even in pristine watersheds. In fact, however, many village supplies are not chlorinated on the schedule needed for disinfection. Given this failure to carry out even the most rudimentary water treatment, it is doubly important that water catchments

Table 11

DOMESTIC WATER CATCHMENTS - LAND AREAS

Service Area		Catchment Area in ha.	Area in Forest Reserve or Natl. Park ha.	Area in Forest Reserve or Natl. Park %	Est. % of land in cultivation
Future Catchments under Consolidation Scheme:					
I.	Mero to Pte. Michel	406	97	24%	50%
II.	Colihaut to Salisbury*	704	382	54%	5%
III.	Capucin to Glanvillia*	697	444	64%	-
IV.	Penville & L'Autre Bord	32	-	-	40%
V.	Bense to Sineku*	1444	1444	100%	-
VI.	Castle Bruce to La Plaine	117	117	100%	-
VII.	Delices and Boetica*	89	89	100%	-
VIII.	Grand Bay area*	310	294	95%	-
IX.	Borne to Thibaud	82	-	-	100%
4.	Dublanc and Bioche	582	135	23%	30%
9.	Warner	6	-	-	?
10.	Campbell	47	-	-	40%
12.	Cockrane	4	-	-	?
13.	Trafalgar	16	-	-	40%
14.	Laudat	44	32	74%	-
15.	Wotten Waven	16	-	-	20%
16.	Morne Prosper	3	-	-	?
17.	Soufriere and Scotts Head	417	-	-	50%
19.	Bagatelle--Fond St. Jean	110	38	35%	10%
20.	Petite Savanne	12	-	-	90%
33.	Vielle Case	64	-	-	70%
		5202	3072	59%	
Existing Catchments to be Phased Out by Consolidation:					
1.	Capucin	51	-	-	-
2.	Cottage and Toucari	10	-	-	100%
3.	Portsmouth	6	-	-	?
5.	Colihaut	603	-	-	10%
6.	Coulibistre/Morne Rachette	694	53	8%	5%
7.	Salisbury	78	-	-	50%
8.	St. Joseph, Layou, & Mero	22	-	-	20%
11a.	Roseau (supplementary)	238	-	-	40%
18.	Grand Bay, Dubic, Tete Morne	187	-	-	70%
21.	La Plaine	1	-	-	-
22.	Morne Jaune	12	-	-	100%
24.	Riviere Cirique	6	-	-	80%
25.	Good Hope	16	-	-	100%
26.	Castle Bruce	64	-	-	20%
27.	Atkinson & Salibia	31	-	-	40%
28.	Marigot	108	-	-	70%
29.	Woodford Hill & Wesley	70	4	6%	50%
30.	Calibishie	25	-	-	100%
31.	Bense & Anse du Mai	2	-	-	?
		2224	57	3%	

* Catchment for a proposed intake, not yet in use.

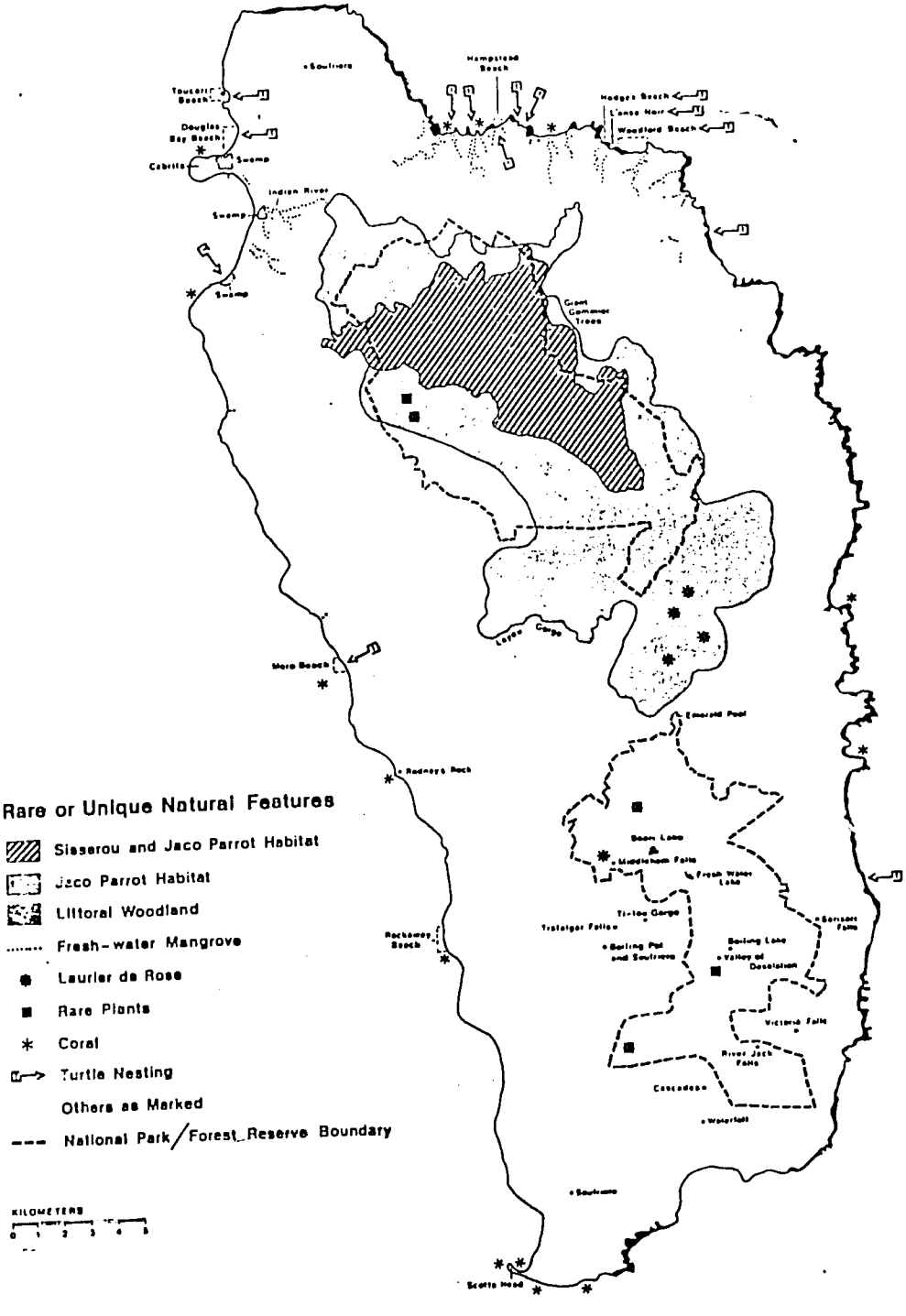
be protected to the maximum extent possible. Where catchments are within the National Park, care must be taken to avoid contamination by recreationists. Where catchments fall inside Forest Reserves, logging must be carried out carefully to avoid high rates of sedimentation. Where catchments are in unallocated government land, they should be added to the Forest Reserve or National Park system for protection. Where catchments are privately owned, the land should either be acquired by government or certain land use activities regulated (prohibitions against sewage discharges, grazing in streamside zones, pesticide spraying near streams, cultivation of steep erosive lands, etc.). Many of the land use recommendations found later in this report are based upon the need to protect critical water catchments to the maximum extent possible without necessarily denying access completely. Where water catchments play a part in the land use recommendation, it will be mentioned in the tables describing the rationale for each recommendation.

In addition to critical water catchments, there are critical areas of rare or unique natural features that warrant some kind of protection to prevent their being destroyed. These rare or unique natural features are mapped in Figure 7.

Dominica has two rare and endangered parrot species, the Sisserou and the Jaco. They are of tremendous scientific and cultural value because of their rarity. Both are found only in the rain forests of Dominica, and both are in danger of extinction, their numbers being only a few hundred individuals. The parrots depend upon mature rain forest trees for their food and nesting cavities. As the extent of mature rain forest has been reduced by agricultural clearing, the parrot populations have gradually decreased. Illegal poaching has speeded the process considerably. The remaining habitat areas of the two parrot species overlap to some extent. As seen in Figure 7, both the Jaco and the Sisserou occupy an area in the Northern Forest Reserve to the northeast of Morne Diablotins. The Sisserou parrot is very sensitive to any human disturbance, and does not occupy any area that is visited regularly by farmers, timber cutters, or hunters/fishermen. The Jaco parrot is less sensitive to human disturbance, and occupies a larger range, though still only areas covered by mature rain forest. The parrots do not

Figure 7

Eastern Caribbean Natural Area Management Program
Dominican Forest and Park Systems Plan



make use of the high-elevation elfin woodland and montane thicket areas, even though these areas are remote from man, because these vegetation types do not provide food or nesting cavities. At one time, parrots were known to inhabit the southern forests in and near Morne Trois Pitons National Park, but they are no longer seen there with any frequency, due to decimation by hunting and loss of mature rain forest cover in the south due to agricultural expansion.

Appendix I gives details of how different land uses affect the parrots, but we can summarize briefly here. Any land use change that removes mature rain forest will effectively remove that area from the parrot habitat base. Agricultural clearing and village settlement both have this effect, plus the additional effect of exposing the parrots to increase poaching and human disturbance. The adverse effects of logging on the parrots could be reduced somewhat by cutting selectively, leaving nesting trees, and allowing native species to regenerate rather than planting exotics. Even so, logging would reduce the suitability of land for parrots, due to human disturbance (particularly critical to the Sisserou), increase access for poachers, and reduction of food supplies. Except for complete wilderness preservation, light recreational use is the only other land use that is not destructive of Sisserou parrot habitat. Even so, light recreation facilities would need to be located away from prime Sisserou habitat and either species' nesting sites.

Figure 7 shows that there is a considerable parrot habitat area in the center of the island occupied by the Jaco parrots only. These area needs to be protected from agricultural encroachment and certain kinds of timber harvest (wholesale conversion of mature rain forest to younger even-aged stands of exotics) in order to remain useful as Jaco habitat. Fortunately, most of this land is unallocated government land, and is poorly suited to agricultural use (see Figure 3), so can be added to the Forest Reserve system with little loss of economic value and no human relocation. Even though logging is allowed in the Forest Reserves, timber harvest in this area must be closely regulated to prevent large-scale loss of Jaco habitat.

The combined Sisserou-Jaco habitat area is mostly within the present Northern Forest Reserve. This designation probably provides inadequate protection for the Sisserou, because timber production is one of the primary objectives of Forest Reserves. Even if logging were closely regulated so as to minimize disturbance to food and nesting resources, the impact of human logging crews in the Sisserou habitat would be devastating, and would hasten the extinction of that parrot species. For that reason and others, Morne Diablotins (which produces only a noncommercial growth of forest) and the mature rain forest habitat to the northeast of it will be recommended for special management as a Nature Preserve in the National Park system. In that way, land management objectives can be clearly spelled out and adhered to: minimal recreational development, no timber harvest, and no agricultural or settlement activities. Only if this core habitat area is preserved will the endangered parrot species have a chance to survive.

Moving on from unique wildlife to vegetation, the littoral woodlands of the east coast are a unique natural feature, though not in danger of being totally destroyed. This windswept, gnarled vegetation is highly tolerant of the salt spray from the sea, and forms a beautiful carpet of green on the steep slopes of the eastern coastline. Some of the littoral woodland has been replaced by crops on the gentler slopes, but the steepest slopes have remained undisturbed. Clearing of this vegetation for crops is often self-defeating, since crops are not as salt-tolerant and suffer from the sea spray. The littoral woodlands serve as a windbreak or buffer to prevent salt spray damage to crops further inland. The woodlands also serve to hold the steep slopes in place through the binding action of roots, and thus prevent loss of land to the sea. While cutting of littoral woodlands should be discouraged, it is not practiced to a large extent, and probably doesn't warrant special protective measures through land acquisition for that purpose alone.

Fresh-water mangroves are another unique vegetation type that is very limited in extent, and is in danger of being destroyed through agricultural clearing. The mangrove areas are found only in the north of the island along streams and wetlands. The soils are completely saturated and support

a unique form of vegetation which often includes the swamp bloodwood tree or Pterocarpus officinalis. It is common practice for this this vegetation to be cleared for coconut plantations. Due to the waterlogged soils, the coconuts do not do very well, but farmers are anxious not to "waste" any land, regardless of how poorly crops yield. Increasing agricultural pressure is causing the mangrove vegetation to disappear at an alarming rate. All the land is privately-owned, and the mangrove areas are very long and narrow, making government acquisition for preservation very difficult. The Indian River area and the immediate coastline along the north of the island may be exceptions, because the mangroves are more concentrated geographically. In areas not suitable for acquisition, government regulation might be effective in preserving this vegetation; for example, cutting of certain mangrove species might be prohibited.

Laurier de Rose is a rare tree species in Dominica, found in the mature rain forest of the central portion of the island. It produces a beautiful, fragrant wood that is easily worked and excellent for furniture. Few live mature trees can be found today, though the remains of trees that died some 50 years ago can be found here and there. The cause of death is unknown, but some catastrophic event (perhaps a disease) occurred some 50 years ago that left few Laurier de Rose alive. The remaining trees are not in any immediate danger of being cut through logging or agricultural conversion, but their future is questionable since they are found in the unallocated government land of the central part of the island. This land should be designated Forest Reserve, and stands of Laurier de Rose marked for preservation from future logging activities in the Forest Reserve. The stands do not cover large areas, and should be preserved to serve as a genetic seed source for this superb native wood.

The Figure 7 map shows the approximate locations of some other rare plants; not trees, but herbaceous plants and mosses that grow on the highest peaks of the island. These plants are known to occur on the slopes of Morne Diablotins, Morne Anglais, Morne Trois Pitons, and Morne Watt. They are in little danger of destruction by loggers or farmers, since the land is clearly unsuitable for either, but they could be inadvertantly destroyed by hikers through

trampling. It is important that hiking trails in these areas be well maintained and marked, to prevent people trampling all over the slopes in search of a way to the top. Three of the mountain peaks are in Morne Trois Pitons National Park, and thus are a focal point for recreational users.

There are a number of other unique terrestrial features not mentioned in the legend of Figure 7, but marked on the map. There are several beautiful falls and cascades. Emerald Pool, Middleham Falls, and River Jack Falls are in Morne Trois Pitons National Park. Sarisari Falls, Victoria Falls, and a number of others are just outside the Park. It may be possible to bring some of these into the Park with boundary adjustments, so they can be properly protected and made accessible to the public. Trafalgar Falls is some distance from the National Park boundary, and is already one of the major scenic landmarks of the island. Special arrangements may be necessary to protect the falls area from future degradation. Two lakes, Boeri Lake and Freshwater Lake are within the National Park, and are threatened mainly by structural modifications for hydroelectric power generation, one of the activities allowed in the Park under its enabling legislation. Ti-tou Gorge is an interesting natural attraction, although the nearby concrete and metal diversion structures for hydroelectric detract from the scenic beauty of this area. While hydroelectric power generation is certainly important to the growth of Dominica, there are numerous examples of hydroelectric structures that are much more visually obstructive than would be necessary.

There are several geothermal areas, some very impressive, others smaller and less significant. The Boiling Lake and the Valley of Desolation are the premier geothermal landmarks of the island, and are found in the National Park. There are three smaller soufrieres, one just north of Morne au Diable, several in the village of Wotten Waven, and one east of the village of Soufriere. Wotten Waven also has a small boiling mud pot that is a local attraction. None of the geothermal areas outside the National Park are large in area. They could be developed as Natural Monuments with very little land acquisition or access road construction.

Before going on to the unique marine features, there are two other terrestrial features of interest. Some of the largest, oldest gommier trees on the island are concentrated in the

forests just above Governor Estate, but outside the Northern Forest Reserve. A boundary adjustment would help to save these centuries-old trees for educational purposes and scientific study. These trees have been studied from time to time by the Institute of Tropical Forestry in Puerto Rico. Dominica has three wetlands or "swamps" of some size, one just east of Cabrits, the other two south of Portsmouth. There is a tremendous temptation to fill these swamps to provide building sites. These wetlands support unique forms of vegetation, however, that are found nowhere else on the island. They also support certain kinds of birds that would abandon Dominica forever, should the wetlands be filled. Development of these wetlands as educational/recreational resources would perhaps do as much as anything to highlight the importance of these unique natural features.

Let us go on to the rare or unique natural features of marine life along the coasts. Being a steep volcanic island, Dominica has a very limited coastal shelf on which coral and other shallow-dwelling marine life can be found. The limited coral reef areas produce a wide variety of fish, and are an interesting, beautiful resource to those who snorkel or SCUBA dive. There are also few beaches in Dominica, so those that do exist are important recreational resources. Several of the beaches serve as nesting sites for sea turtles (locations are shown in Figure 7). The turtles are being decimated at a rapid rate, due to on-beach tourism development on other islands and too rapid a turtle harvest by fishermen. Not all Dominica's beaches are suitable for swimming and recreation due to strong currents, particularly on the east and north coasts. The potential for on-beach tourism development (beach hotels) is limited by these dangerous currents. As seen in Figure 7, unique marine features are concentrated along the north coast near Calibishie. By acquiring a very minimal coastal land area, a National Seashore could be created in this area to preserve turtle nesting sites, some very scenic (but dangerous to swimmers) beaches, productive coral areas, littoral woodlands, and fresh-water mangroves. The Cabrits and Scotts Head areas have very beautiful coral formations, a diverse fish population, and are safe for swimming and diving. With this combination, they would both be excellent Marine Park areas.

The rare and unique natural features of Dominica have been described, not so that each and every one should be recommended for National Park designation, but so that land use planners can be aware of opportunities or endangered resources in any given area before land use decisions are made. In some cases, minor boundary changes can produce very beneficial results. In other cases, the presence of rare or unique natural features may coincide with agricultural limitations, absence of logging potential, or other physical limitations to suggest very strongly that National Park or Forest Reserve designation would be in the best interest of all land users.

F. Summary of Effects of Land Use Practices on Environmental Quality

Once the physical features of land (soils, topography, climate, etc.) are known, it is fairly easy to predict what will happen if a land use practice is attempted on a particular land area. There are known environmental effects associated with each land use. Some of these have been discussed in the chapters on critical areas, agricultural land capability, and logging potential. In this chapter, we will attempt to summarize the environmental effects of major land use practices in a systematic manner.

There are a number of ways to classify land use practices. For purposes of this plan, four broad catagories are recognized: natural area management practices, timber management practices, agricultural practices, and village and urban uses. Within each of these broad catagories, a number of practices can be defined that are essentially different in their environmental effects and economic payoffs:

A. Natural Area Management Practices

1. Wilderness preservation
2. Light recreational development
3. Intensive recreational development

B. Timber Management Practices

1. Road-building and maintenance
2. Light selective cutting and natural regeneration
3. Clearcutting and natural regeneration
4. Clearcutting and replanting with native species
5. Clearcutting and replanting with exotic species
6. In-situ sawing
7. Tractor skidding
8. High lead cable skidding
9. Skyline cable logging

C. Agricultural Practices

1. Road-building and maintenance
2. Shifting cultivation
3. Permanent tree crops
4. Permanent bananas
5. Permanent root crops and row crops

D. Village and Urban Uses

Each of these land use practices is described in some detail in Appendix I. Under timber management practices, numbers 2 through 5 are silvicultural techniques (determines which trees are cut and how the new stand is established), while numbers 6 through 9 are logging techniques (how cut trees are removed). In any given timber management area, one of the silvicultural techniques will be combined with one of the logging techniques.

The environmental effects of these land use practices are described in Appendix I, and fall into six classes:

a. Effects on Water Quality
b. Effects on Soil Conservation
c. Effects on Rare or Unique Natural Features
d. Effects on Wildlife
e. Effects on Scenic Resources
f. Effects on Genetic Diversity

Water quality problems were discussed to some extent in a previous chapter on water catchments. In general, one would expect increasingly more severe water quality problems as one goes down the list of land use practices. Contaminants such as bacteria, sediment, and pesticides are common in densely settled areas. In addition, there are impacts on stream temperature and dissolved oxygen that result from clearing riparian vegetation during logging, agricultural clearing, or streamside settlement. Increased stream temperatures cause dissolved oxygen levels to drop, resulting in reduced production of fish and other aquatic life. Natural area management practices generally have the least water quality impact, at most minor amounts of bacteria and sediment.

Timber management practices vary widely in their water quality impacts, but the major problem is usually sediment from access roads and skid trails. Tractor skidding has the highest potential for sediment production of any logging method. The silvicultural method (clearcutting vs. selective cutting) used is usually not a major factor in determining sediment yield. Agricultural practices may contribute sediment, pesticides, and bacteria to streams. Root crops and row crops offer the highest potential for water pollution, permanent tree crops the least, but it depends greatly upon the slope and soil type encountered in a particular area. Village and urban uses contribute the whole range of water pollutants, from bacteria and sediment to toxic chemicals. Sewage treatment is virtually unknown in Dominica and existing health laws are seldom enforced. Land use practices can be modified to reduce water pollution problems. Urban sewage can be treated prior to discharge to a stream. Buffer zones of natural vegetation along streams can signficantly reduce water pollution from logging and agriculture. Erosive logging methods and certain crops can be avoided on steeper slopes to reduce erosion. Degradation of water quality should be avoided everywhere, not just in domestic water catchments, because nearly every stream in Dominica is used for washing, bathing, and fishing at the very least. While water catchments are considered "critical areas" in this Plan, the prevention of water pollution is a key factor in the ratings already made for agricultural land capability and logging potential for the entire island.

Because sediment is a water pollutant, it is considered above. From a soil conservation standpoint, however, sediment is the result of soil erosion, a process which will render the land unproductive if allowed to go unchecked. Land use practices have other effects on soil as well as erosion. Intensive agricultural use can cause soil compaction, loss of nutrients and organic matter, and loss of soil structure, all of which render the soil less productive for crops and more prone to erosion. Similar effects can be seen in some logging operations if not carefully done. Generally, soil degradation from agriculture is least serious with tree crops, and most serious with root crops and row crops. Crops and cultural practices can be modified so as to minimize soil degradation, but since the ill effects

are long-term, the tendency of farmers is to try for maximum crop production regardless of soil deterioration. Soil erosion is a problem common to all land use practices, least severe in natural areas and most severe in unpaved village areas and lands in cultivated root crops. Deterioration of other soil properties (nutrients, compaction, organic matter) is primarily an agricultural problem; it results from agricultural use, and future agriculture depends upon the soil as a growth medium.

The effects of different land use practices on rare or unique natural features are described in some detail in the chapter on critical areas. The Sisserou parrot is perhaps the most sensitive to most land use practices; any activity other than wilderness preservation or light recreational development virtually guarantees the loss of habitat for the Sisserou. The Jaco parrot is slightly less sensitive, but even that parrot cannot survive in areas that are clearcut, converted to agriculture, or settled by man. Rare plants and vegetation types (fresh-water mangrove, laurier de rose) must be under natural area management to survive. Other resources (geothermal areas, coral reefs) are somewhat less sensitive to nearby land use practices. The effects summarized here are spelled out in more detail in Appendix I. Rare or unique natural features are considered "critical areas" in this Plan, and affect the land use recommendations to a great extent.

In addition to rare and endangered parrot species, other wildlife species are fairly sensitive to changes in land use. Undisturbed natural vegetation provides the right combination of food, shelter, and other habitat needs for both native and successfully introduced wildlife species. Any alteration of that vegetation will have an adverse effect on wildlife. As a result, timber management that relies on natural regeneration or replanting with native species is preferable to a system that uses exotic species. Agriculture is basically a wholesale conversion of native vegetation to "exotic" species, i.e. crops. Village and urban uses take the process one step further, completely eliminating most vegetation and introducing nearly constant human disturbance. Wildlife populations generally decline as native vegetation is removed and human disturbance increases. For game species, hunter success declines along with wildlife numbers. Provision of relatively undisturbed corridors for wildlife propagation and movement is one of the functions of the Forest Reserves

that are proposed in this Plan for the centre of the island.

Preservation of scenic resources is often cited as a key factor in promoting the tourism industry, given Dominica's reputation as the "nature island" of the Caribbean. While scenic beauty is difficult to quantify, it is easily recognized. Most persons agree that undisturbed forest cover is more attractive than blocks of barren or burned land on the mountainsides. On the other hand, well-tended cropland in broad valleys is often seen as attractive, and a positive contribution to landscape diversity. Roads can be an eyesore when located so that the road cuts can be seen from miles away. Roads can also enhance scenic views by providing lookouts or vistas to attractive areas. It is difficult to say that one land use activity is always more detrimental to scenic beauty than another. Village and urban areas have perhaps the greatest potential to be scenic disaster areas, but there are some well-kept village areas in Dominica that are a source of visual pleasure. While protection of natural vegetation as a scenic resource is one result of National Park and Forest Reserve designation, no areas are recommended for designation in this Plan on that basis alone.

There is tremendous genetic diversity in the undisturbed natural vegetation of Dominica, diversity that exists throughout the tropics. There are often hundreds of species of plants in a given hectare of forest, and genetic variations within each species. Genetic diversity is significant from the standpoint of scientific study, but also because the diverse gene pool provides maximum resistance to catastrophic events like disease, high winds, and insect infestations. Many of today's powerful medical drugs are derived from tropical plants; the medical uses of many additional plants are yet to be discovered. Thus, when genetic material is lost through destruction of diverse plant communities, the future loss may be great indeed. For this and other reasons, representative plant communities are recommended for preservation in this Plan. This is particularly vital for very limited vegetation types such as fresh-water mangroves. As it stands now, only vegetative communities within Morne Trois Pitons National Park are protected from modification (logging) or destruction (agriculture). Certain vegetation

types, montane thicket, elfin woodland, montane swamp forest, and fumerole vegetation, are well represented in the National Park (see Figure 1). Some other types, fresh-water mangrove, littoral woodland, and fresh-water swamp, are not found in the Park. Mature rain forest is found only in limited areas of the Park, and the full range of rain forest variation is not represented. National Park recommendations in this Plan are based in part upon the need to preserve representative sample areas for the sake of genetic diversity.

III. LAND USE AND DESIGNATION OF PARK AND FOREST SYSTEM UNITS

The environmental effects of land use practices discussed in the last chapter are fairly broadly defined, and include effects that individual landowners seldom consider in their land management decisions. For example, an individual landowner may not suffer if he causes water pollution; that cost is borne by downstream users. Likewise, an individual is unlikely to notice the incremental effect on wildlife when he destroys a few hectares of habitat, yet the cumulative effect of such clearings is reduced hunting for everyone. For the sake of public welfare, government policy seeks to modify some types of individual behavior to minimize environmental damage. Environmental policies of government include such things as hunting and fishing regulations, timber cutting regulations, public health laws, and designation of certain land areas for special purposes (National Park, Forest Reserve, agricultural settlement areas). The land use designation process has two complementary effects. First, it clarifies in law what the land management objectives of public land shall be. Table 2 describes some of these public land management objectives. Secondly, by designating land for special uses, certain land use practices are excluded which would have harmful effects in certain critical or environmentally sensitive areas. For example, Forest Reserve designation is an effective way to prevent agricultural use of land that is so steep that farming would cause severe erosion and landsliding. National Park designation is one way to prevent timber harvest in areas that are too steep for logging, have rare vegetation, or serve as endangered wildlife habitat.

Table 12 is a summary of the land use practices permitted in designated areas. Nature Preserve is the most restrictive designation, with only wilderness preservation or light recreational development allowed. The other Park System units are slightly less restrictive, allowing more intensive recreational development where appropriate. Forest Reserve designation allows controlled timber harvest, recreational, and/or wilderness use, but prohibits agriculture,

Table 12

Land Use Practices Permitted in Designated Areas

	Village and Urban Uses	Agriculture and Grazing	Timber Cutting	Intensive Recreational Development	Wilderness Preservation or light recreational development
PARK SYSTEM:					
Nature Preserve					X
National Park				X	X
Natural Monument				X	X
Historical Monument				X	X
Natural Area				X	X
Recreation Area				X	X
National Seashore				X	X
FOREST RESERVE SYSTEM			X	X	X
PRIVATE LAND	X	X	X	X	X

X = permissible land use practices

village, or urban uses. None of the listed land use practices are prohibited on private land, although certain activities are prohibited regardless of ownership (hunting out of season).

Special designation of land is an important component of government environmental policy, and is the major focus of this Plan, but it is not a panacea. For example, there is little use in protecting wildlife habitat through land designation if hunting is not controlled. Also, in a country as diverse in topography and vegetation as Dominica, it is impossible to designate hundreds of widely scattered small areas (for example, small areas too steep for agricultural use, but widely scattered in predominantly good agricultural areas). Land designation is most readily accomplished where land ownership is public and the land is relatively undisturbed. Acquisition of private land for special designation is a costly, difficult task, especially in Dominica, where parcels are very small and owners numerous. In the land use recommendations of the following chapters, public and private lands are treated separately. Government acquisition of private land is recommended only in limited areas where continuation of present land use practices is a danger to public health and safety, or the productive land base is being destroyed.

IV. LAND USE RECOMMENDATIONS

A. Public Lands

The public lands of Dominica include both designated areas like Morne Trois Pitons National Park, Central Forest Reserve, and Northern Forest Reserve; and the unallocated government land (sometimes called "Crown Lands") shown in Figure 2 at the beginning of this report. In this chapter, we shall look at these lands in terms of their natural limitations and potentials: agricultural limitations, logging potential, endangered wildlife habitat, domestic water catchments, areas occupied by rare plants or unique vegetation types, and areas with other unique natural features. Land with serious limitations for some uses or with unique characteristics worth preserving can be considered environmentally-sensitive, and may require some form of protection from incompatible land use practices.

Table 13 outlines recommended designations for these environmentally sensitive public lands. The recommended designations include:

Nature Preserve--the most restrictive designation
Other Park System Designation--Natl. Park, Natl. Monument, etc.
Forest Reserve
Release for private ownership--usually as an agricultural settlement area

The recommendations of Table 13 are of a general nature only. The actual land recommendations are worked out on an area-by-area basis, taking into account such factors as existing boundaries, adjacent land uses, natural features that would facilitate boundary location, and combinations of factors.

Public land with serious agricultural limitations cannot be recommended for release to private owners. Figure 3 shows that such lands are very widespread in the unsettled interior. Indeed, many such lands are unsettled precisely for that reason, and not because access roads are unavailable. Lands with serious agricultural limitations are best designated as Forest Reserve or as part of the Park System, both for the sake of environmental protection and for economic reasons (low crop yields and limited cultivation time in such areas do not justify expenditures of public money for access road construction and maintenance).

Table 13

Recommended Designations for Environmentally-Sensitive Public Land

KEY:
R--Recommended designation
A--Acceptable designation
N--Not recommended

	Nature Preserve	Other Park System Designation	Forest Reserve	Release for private ownership
Land with Serious Agricultural Limitations:				
High agricultural erosion hazard	R	R	R	N
Moderately high agricultural erosion hazard	R	R	R	N
Very poor ag. land--waterlogging or exposure	R	R	R	N
Poor agricultural land--high rainfall	R	R	R	N
Land with No Logging Potential:				
Incapable of growing sawtimber	R	R	A	N
Too steep for commercial logging	R	R	A	N
Endangered Wildlife Habitat:				
Sisserou and Jaco parrot habitat area	R	N	N	N
Jaco parrot habitat only	R	R	A	N
Domestic Water Catchment Areas	R	R	R	N
Areas Occupied by Rare Plants or Unique Vegetation Types:				
Rare plants	R	R	N	N
Laurier de Rose	R	R	A	N
Fresh-water swamps	R	R	A	N
Littoral woodlands	R	R	A	N
Unique Natural Features (waterfalls, soufrieres, coral reefs, etc.)	R	R	A	N

Public land with no logging potential (Figure 4) is recommended for Park System designation. In such areas where such lands are widely scattered through otherwise harvestable timberland, a Forest Reserve designation would be acceptable for the entire area. Land unsuitable for logging is not recommended for release to private owners, since the steep slopes or cloud forest vegetation found in such areas is unsuitable for agriculture or settlement.

The recommendations for endangered wildlife habitat depend on whether Sisserou parrots use the area or only the Jaco (Figure 7). In areas inhabited by the Sisserou parrot, Nature Preserve is the only designation that insures habitat preservation. Any designation that permits heavy recreational use or vegetation modification is destructive to Sisserou habitat. Most of the Sisserou habitat is in the present Northern Forest Reserve, which is practically untouched at the present time. Future timber industry development would eventually go into the Northern Forest Reserve, however, unless steps are taken to formally recognize the need to preserve the area from that kind of disturbance. This could be done administratively as part of the Forest Reserve management plan, but would have considerably greater permanence if the area were legally constituted as a Nature Preserve. For the Jaco parrot habitat area, any type of Park System designation would be suitable, or a Forest Reserve designation would be acceptable <u>if</u> timber harvest were tightly controlled, as described in the chapter on critical areas.

Domestic water catchments (Figure 6) are generally not recommended for release to private owners if the land is now publicly owned. The potential for water pollution is much greater with human settlement than any other land use practice. Designation of publicly owned catchments as part of a Park or Forest System unit is one way to avoid future water quality problems. If a water catchment contained large areas of high potential agricultural land that could be farmed without excessive runoff of sediment and pesticides, that land would be recommended for release to private owners, but none of the land now publicly owned falls into that catagory.

Areas occupied by rare plants (Figure 7) are recommended for Park System designation, but not for Forest Reserve or private ownership, due to vegetation damage associated with

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timber harvest and agriculture. Laurier de Rose areas and the unique vegetation types, fresh water swamps and littoral woodlands, should not be released for private ownership, though the latter two are already mostly privately owned. If designated as Forest Reserve, these areas would need to be administratively protected from timber harvest. Park System designation is recommended if a viable Park unit can be created. The same holds true for areas with other unique natural features.

Based on the above analysis, all the land within the existing boundaries of Morne Trois Pitons National Park is recommended for retention as National Park. The National Park contains a high concentration of rare and unique natural features worthy of preservation and interpretation to the public (see Figure 7): rare plants, Laurier de Rose trees, Boeri Lake, Fresh Water Lake, Boiling Lake, Valley of Desolation, Middleham Falls, River Jack Falls, and Emerald Pool. These natural features need to be protected from degradation, and in some cases, public access and safety can be improved in the course of National Park development. A number of domestic water catchments are protected or partly protected as National Park (see Figure 6 and Table 11): consolidated systems I, VI, VII, and VIII, and the village systems for Laudaut and Fond St. Jean-Bagatelle. Two hydroelectric catchments have their headwaters in the National Park: Trafalgar, and the potential White River hydro catchment. The undisturbed high rainfall vegetation of Morne Trois Pitons National Park provides a maximum opportunity for infiltration into the groundwater, and thus a more constant supply of water for power generation.

The concentration of natural features in need of protection suggests that Morne Trois Pitons National Park was well designated, but there is also an overwhelming lack of potential for alternative uses such as agriculture or timber production. Figure 3 graphically illustrates that most of the land within the present Park boundaries is of the highest agricultural erosion hazard, totally unsuitable for cultivation of any kind. Smaller percentages of the area are of moderately high agricultural erosion hazard, or are poor/very poor agricultural land, as defined in Section II. Small areas of land inside the Park do not have agricultural limitations, but this land is scattered in small parcels, far from roads and villages, and is surrounded by poor agricultural land. Of course, there will continue to be pressure from nearby farmers to open up sections of the National Park to agriculture, but the

result of that would be high erosion rates, water pollution from sediment, landsliding, poor crop yields, and increased law enforcement problems along the Park boundaries.

The timber production potential of Morne Trois Pitons National Park land is almost as dismal as the agricultural potential. The predominant vegetation types in the Park are montane thicket and elfin woodland, land that is incapable of growing sawtimber (see Figure 4). Most of the limited area that is capable of growing sawtimber is simply too steep for commercial logging. Montane swamp forests occupy many of the flatter areas, leaving only a small portion of land that would have some commercial timber production potential (1,110 hectares). Most of that area is polewood-size timber on poor growth sites, scattered in small parcels. The one exception is a fine old-growth gommier-chataignier forest in gentle terrain in the Middleham Preserve, which is a private parcel donated for National Park purposes only, and unavailable for timber harvest under any circumstances. Clearly, the designation of the southern Crown Lands area as National Park rather than Forest Reserve was a wise choice, a choice that institutionalized prohibitions on land use practices that are unsuited to this area at any rate.

Table 14 gives recommended designations for blocks of unallocated government land. There are 63 such blocks scattered around the island, and they are numbered according to the map of land ownership, Figure 2. This unallocated government land represents a sizeable area in the aggregate, some 10,526 hectares or 13 percent of the island area. The recommended designations are based upon a number of criteria already defined in earlier chapters of this Plan, and summarized in Table 13, including:

- agricultural erosion hazard
- logging potential
- adjacent land uses
- historical or cultural significance
- natural, easily-defined boundaries nearby
- domestic water catchments
- rare or unique natural features
- existing land boundaries

The land designations recommended for these 63 blocks fall into three broad catagories: release for private ownership, add to Forest Reserve system, or add to the Park System. Within the Park System are slightly different types of management areas, namely:

- National Park
- Nature Preserve
- Natural Monument
- Historical Monument
- Natural Area
- Recreation Area
- National Seashore

Table 14

RECOMMENDED DESIGNATIONS FOR BLOCKS OF UNALLOCATED GOVERNMENT LAND

Block #	Recommended Designation	Approx. Area in Hectares
1.	Scotts Head Natural Monument and Marine Park -A natural landmark with some historical significance. Excellent underwater coral formations. High agricultural erosion hazard. No logging potential.	.....6 ha. (terrestrial)
2.	Soufriere Forest Reserve -Includes part of the water catchment for Scotts Head and Soufriere villages. All high agricultural erosion hazard.	.....148 ha.
3.	Soufriere Forest Reserve -High agricultural erosion hazard. Designated by Land Management Authority (Geneva settlement).	.....12 ha.
4.	Soufriere Forest Reserve -High agricultural erosion hazard. Designated by Land Management Authority (Geneva settlement).	.....38 ha.
5,6, & 7.	Geneva Forest Reserves -High or moderately high agricultural erosion hazard. Designated by Land Management Authority.	.....72 ha.
8.	Morne Trois Pitons National Park (Addition) -High agricultural erosion hazard. Too steep for commercial logging. Adjacent to present National Park.	.....50 ha.
9.	Morne Trois Pitons National Park (Addition) -High agricultural erosion hazard. Nearly all too steep for commercial logging. Adjacent to present National Park.	.....228 ha.
10.	Morne Trois Pitons National Park (Addition) -High agricultural erosion hazard. Most of area too steep for commercial logging or incapable of growing sawtimber. Includes part of the water catchment for Bagatelle-Fond St. Jean. Includes a waterfall and a set of cascades. Adjacent to present National Park.	.....238 ha.
11.	Morne Trois Pitons National Park (Addition) -High agricultural erosion hazard. Incapable of growing sawtimber. Adjacent to present National Park.	.....5 ha.
12.	Morne Trois Pitons National Park (Addition) -High agricultural erosion hazard. Too steep for commercial logging. Includes scenic rugged coastline and littoral woodland.	.....47 ha.
13.	Bagatelle Forest Reserve -High agricultural erosion hazard. Area known to be of high landslide hazard. Designated by Lands & Surveys Division.	.....24 ha.
14.	Morne Trois Pitons National Park (Addition) -High agricultural erosion hazard. Too steep for commercial logging. Adjacent to present National Park.	.....4 ha.

Block #	Recommended Designation	Approx. Area in Hectares
15.	Morne Trois Pitons National Park (Addition) -High agricultural erosion hazard. Part of area incapable of growing sawtimber. Adjacent to present National Park. Includes part of potential White River Hydroelectric Catchment.	20 ha.
16.	NORTHERN & WESTERN PORTIONS: Morne Trois Pitons National Park (Addition) -Mostly high agricultural erosion hazard, some moderately high erosion hazard. All the area is either too steep for commercial logging, incapable of growing sawtimber, or low-value montane swamp forest type. Western portion is within the potential White River Hydroelectric Catchment. The area is adjacent to the present National Park, and the proposed boundary would follow natural features better than existing boundary.	168 ha.
	SOUTHEAST PORTION: White River Forest Reserve -Mostly high agricultural erosion hazard. Includes part of the potential White River Hydroelectric Catchment. One of the few remaining government holdings in the southeast of the island capable of producing a sustained yield of large-diameter timber for nearby villages. Most of the topography is suitable for logging and installation of forest improvement roads. Includes land around Victoria Falls.	176 ha.
17.	SOUTHERN PORTION: Morne Trois Pitons National Park (Addition) -Includes scenic Sarisari Falls, and the present La Plaine water supply (a spring). High to moderately high agricultural erosion hazard. Too steep for commercial logging, and some areas incapable of growing sawtimber. Adjacent to present National Park.	83 ha.
	NORTHERN PORTION: Palmiste Forest Reserve -Moderately high agricultural erosion hazard. Much of the area too steep for commercial logging. Not recommended as National Park due to boundary considerations. The area is nearly surrounded by farmable land.	45 ha.
	CENTRAL PORTION: Release for private ownership -Area is not characterized by high agricultural erosion hazard or excessively high rainfall (only slightly above 432 cm. per year). Already partly occupied by farmers.	34 ha.
18.	Trafalgar Natural Monument -The land just above the falls is of high agricultural erosion hazard and low logging potential. It should be included in the Natural Monument (the bulk of which must come from private land) for the sake of sediment control and boundary integrity.	2 ha?

Block #	Recommended Designation	Approx. Area in Hectares
19.	Morne Trois Pitons National Park (Addition)	116 ha.
	-High agricultural erosion hazard. Much of the area too steep for commercial logging or incapable of growing sawtimber. Adjacent to present National Park.	
20.	Morne Trois Pitons National Park (Addition)	18 ha.
	-High agricultural erosion hazard. Too steep for commercial logging. These steep slopes are constantly being encroached upon by farmers, and the present Park boundary across the slope is too steep to be surveyed and maintained.	
21.	Retain for Leper Home	14 ha.
	-Mostly high agricultural erosion hazard. Supports scrub forest only. Provides a buffer zone for the leper home.	
22.	WESTERN PORTION:	
	Release for private ownership	149 ha.
	-Not prone to agricultural erosion problems or excessively high rainfall (only slightly above 432 cm. per year). Inaccessible at present, but could be used for relocation of farmers who are presently using very steep lands near Grand Fond and north of Rosalie.	
	EASTERN PORTION:	
	Terre Ferme Forest Reserve	51 ha.
	-These steep lands along the major rivers are of high agricultural erosion hazard and in a few places are too steep for commercial logging.	
23.	Terre Ferme Forest Reserve	8 ha.
	-An existing forest plantation area, maintained by Forestry Division.	
24.	Eastern Forest Reserve	103 ha.
	-High agricultural erosion hazard. Designated by Land Management Authority (Newfoundland settlement).	
25.	Eastern Forest Reserve	12 ha.
	-High agricultural erosion hazard.	
26.	Eastern Forest Reserve	296 ha.
	-Mostly high agricultural erosion hazard, some moderately high erosion hazard.	
27.	Eastern Forest Reserve	108 ha.
	-High agricultural erosion hazard.	
28.	Eastern Forest Reserve	123 ha.
	-High agricultural erosion hazard.	
29.	Eastern Forest Reserve	92 ha
	-High agricultural erosion hazard.	
30.	Eastern Forest Reserve	158 ha.
	-High agricultural erosion hazard. Designated by Land Management Authority (Castle Bruce settlement).	

Block #	Recommended Designation	Approx. Area in Hectares
31.	Belle Fille Forest Reserve	42 ha.
	-High agricultural erosion hazard. Designated by Land Management Authority (Castle Bruce settlement).	
32.	Belle Fille Forest Reserve	32 ha.
	-High agricultural erosion hazard.	
33.	Laurier de Rose Forest Reserve	246 ha.
	-About half the area is of high agricultural erosion hazard. The northeast section, however, is relatively gentle, and could be released to farmers in the area. Designated by Land Mangement Authority (Castle Bruce settlement).	
34 & 35.	Laurier de Rose Forest Reserve	16 ha.
	-High agricultural erosion hazard. Designated by Lands and Surveys Division (Richmond settlement).	
36.	PORTION ADJACENT TO BLANDY SETTLEMENT:	
	Release for private ownership	46 ha.
	-High rainfall area, but not highly erosive. Recommended for release only because a ridgeline boundary for the forest reserve would be more desirable than the existing Blandy settlement boundary.	
	REMAINING PORTION:	
	Laurier de Rose Forest Reserve	3074 ha.
	-Mostly high or moderately high agricultural erosion hazard, and all the area subject to high annual rainfall. Two major river valleys are more gentle terrain, but high rainfall makes them poor agricultural land. Exclusion of the valleys from the forest reserve would dramatically increase the length of Forest Reserve boundary to be cut, maintained and patrolled. Most of the area is used by Jaco parrots, and the rare Laurier de Rose tree is found in the Fond Figues area. Includes part of the present water catchment for the Castle Bruce water system. Since the area is contiguous to the Central [illegible] Reserve (which in turn is linked to the Northern [illegible]orest Reserve) and also reaches quite close to Morne Trois Pitons National Park, retention as forest will allow free movement of wildlife species between the major habitat areas in the north and in the south. In case of overhunting in one area, this link is vital in allowing re-colonization of the depleted area.	
37.	Stone Hill Forest Reserve	4 ha.
	-An area of moderately high agricultural erosion hazard, designated by Lands & Surveys Division (Stone Hill settlement).	
38.	PORTION ALONG STREAM:	
	Stone Hill Forest Reserve	7 ha.
	-A steep riparian area of high agricultural erosion hazard. Designated by Lands & Surveys Division in plan for Stone Hill Settlement.	
	REMAINING PORTION:	
	Release for private ownership	124 ha.
	-The area is not characterized by high agricultural erosion hazard. Rainfall is high, making it poor agricultural land, but settlement is already in progress. The adjacent proposed Forest Reserve should use natural boundaries just to the west of this area.	

Block #	Recommended Designation	Approx. Area in Hectares
39.	NORTHERN PORTION:	
	Layou Basin Forest Reserve	720 ha.
	-About half the area is of moderately high agricultural erosion hazard. Rainfall is quite high over the entire area (well over 432 cm. per year), making it poor agricultural land. The area is important Jaco parrot habitat. Adjacent to existing Northern Forest Reserve.	
	SOUTHERN PORTION:	
	Layou Gorge Natural Monument	225 ha.
	-Highly scenic river gorge. Highly dissected land with extremely steep slopes. Mostly high agricultural erosion hazard. Most of the area is too steep for commercial logging. Jaco parrot habitat.	
40.	Morne Couronne Forest Reserve	287 ha.
	-High agricultural erosion hazard. Used occasionally by Jaco parrots for feeding.	
41.	Experimental Forest Plantation	1 ha.
	-An existing plantation of Caribbean pine, maintained by Forestry Division.	
42.	SOUTHERN PORTION:	
	Macoucherie Forest Reserve	96 ha.
	-High agricultural erosion hazard. Left unsold by Crown Surveyor due to steepness of slope.	
	NORTHERN PORTION:	
	Kachibona Forest Reserve	47 ha.
	-High agricultural erosion hazard. Left unsold due to steep slopes. Adjacent to present Northern Forest Reserve.	
43.	No recommendation	28 ha.
	-A non-critical area of scrub forest.	
44.	Kachibona Forest Reserve	7 ha.
	-High agricultural erosion hazard. Designated by Lands and Surveys Division(Kachibona settlement).	
45.	SOUTHERN PORTION:	
	Kachibona Forest Reserve	263 ha.
	-Mostly high or moderately high agricultural erosion hazard. Includes a significant portion of proposed System II water catchment.	
	NORTHERN PORTION:	
	Morne Diablotins Nature Preserve	138 ha.
	-High agricultural erosion hazard. All land too steep for commercial logging or incapable of growing sawtimber. Includes portions of three domestic water catchments: Colihaut, Coulibistre-Morne Raquette, and Bioche-Dublanc.	
46.	Layou Basin Forest Reserve	120 ha.
	-High or moderately high agricultural erosion hazard. Jaco parrot habitat. Adjacent to existing Forest Reserve.	

Block #	Recommended Designation	Approx. Area in Hectares
47.	Crapaud Hall Forest Reserves	76 ha.
	-High agricultural erosion hazard.	
48.	Crapaud Hall Forest Reserves	54 ha.
	-High agricultural erosion hazard. Designated by Lands & Surveys Division (Crapaud Hall settlement).	
49.	Crapaud Hall Forest Reserves	28 ha.
	-High or moderately high agricultural erosion hazard. Designated by Lands & Surveys Division (Crapaud Hall settlement).	
50.	Morne Concorde Forest Reserve	100 ha.
	-High agricultural erosion hazard. Jaco parrot habitat. Designated by Lands & Surveys Division (Crapaud Hall settlement).	
51.	EASTERN PORTION:	
	Morne Concorde Forest Reserve	641 ha.
	-High and moderately high agricultural erosion hazard. Includes the uppermost portion of Marigot water supply catchment. Includes some Jaco parrot habitat.	
	WESTERN PORTION:	
	Morne Diablotins Nature Preserve	461 ha.
	-Most of the area is both Sisserou and Jaco parrot habitat. Mostly moderately high agricultural erosion hazard. High rainfall over the entire area makes it poor agricultural land. Includes an area of very old giant gommier trees.	
	EXTREME NORTHEAST PORTION:	
	Release for private ownership	65 ha.
	-Lower rainfall and gentler topography than most of block #51. Surrounded on three sides by private land. Proposed boundary between this area and the Nature Preserve is a natural feature (river). Not within Sisserou or Jaco parrot habitat.	
52.	Morne Diablotins Nature Preserve	26 ha.
	-Sisserou and Jaco parrot habitat. Moderately high agricultural erosion hazard. An unsold portion of Northern Constantspring settlement.	
53.	Morne Diablotins Nature Preserve	26 ha.
	-Sisserou and Jaco parrot habitat. Moderately high agricultural erosion hazard.	
54.	Experimental forest plantation	2 ha.
	-An existing plantation, maintained by Forestry Division.	

Block #	Recommended Designation	Approx. Area in Hectares
55.	NORTHERN PORTION: Release for private ownership	14 ha.
	-Not excessively steep or erosive. Part of the Hampstead settlement area. Nature Preserve boundary should follow the natural boundary to the inside of this area.	
	SOUTHERN PORTION: Morne Diablotins Nature Preserve	24 ha.
	-Jaco parrot habitat. Moderately high agricultural erosion hazard.	
56..	NORTHERN PORTION: Release for private ownership	44 ha.
	-High agricultural potential: gentle slopes, moderate rainfall. Part of Penton River settlement area.	
	SOUTHERN PORTION: Northern Forest Reserve	134 ha.
	-Moderately high agricultural erosion hazard.	
57.	SOUTHEAST AND WESTERN PORTIONS: Northern Forest Reserve	220 ha.
	-Moderately high agricultural erosion hazard.	
	REMAINING PORTION: Release for private ownership	54 ha.
	-High agricultural potential: gentle slopes, moderate rainfall. Already partly occupied.	
58.	Northern Forest Reserve	25 ha.
	-Moderately high agricultural erosion hazard. Adjacent to existing Forest Reserve. Jaco parrot habitat.	
59.	Northern Forest Reserve	129 ha.
	-High and moderately high agricultural erosion hazard. Adjacent to existing Forest Reserve. Jaco parrot habitat. (Boundaries not well documented).	
60.	Brandy Forest Reserve	31 ha.
	-Moderately high agricultural erosion hazard. Jaco parrot habitat. (Boundaries not well documented).	
61.	Cabrits Historical Monument and Marine Park	121 ha.
	-Extensive stone fortifications of historical interest. Natural landmark. Coral reefs, beach, and natural swamp. Mostly high agricultural erosion hazard.	
62.	Morne au Diable Forest Reserve	43 ha.
	-High agricultural erosion hazard. Catchment area for water system IX. Unsettled portion of Moore Park settlement.	
63.	Morne au Diable Forest Reserve	40 ha.
	-High agricultural erosion hazard. Headwaters of the water catchments for Vielle Case and System IV. Includes the peak of Morne au Diable.	

The management objectives for each of these areas are outlined in Table 2. Generally speaking, Nature Preserves and Natural Areas are more preservation-oriented, while Natural Monuments, Historical Monuments, Recreation Areas, and the National Seashore are more recreation-oriented. National Park designation requires a balancing of preservation and recreation objectives. National Parks and Nature Preserves must consist of large contiguous land areas to be effective units for ecosystem preservation, the remaining management areas can be much smaller and still meet their objectives.

Of the 10,526 hectares of unallocated government land left in Dominica, 2006 hectares are recommended for addition to the Park System units, 7948 hectares for addition to Forest Reserves, and 530 hectares for release to private ownership. The remaining 42 hectares are for special uses (Leper Home, etc.). There are twelve small areas of government land adjacent to Morne Trois Pitons National Park that are recommended as additions to the Park (see Figure 8 a,b,c). These are very steep areas, highly erosive and prone to landsliding if disturbed. They were not included in the original Park boundaries, because those boundaries followed geometric patterns in the absence of clear information on land ownership or natural limitations. In areas away from Morne Trois Pitons National Park, some blocks of unallocated government land are recommended for addition to existing adjacent government reserves. Other blocks are not adjacent to any existing reserves, and are recommended as new units of the Park or Forest Systems.

The recommendations are best illustrated in Figure 8, the maps entitled "Government Reserves and Private Erosion Hazard Zones". The "Government Reserves" are those proposed for creation from land now in government ownership. No private acquisitions are shown. The hazard zones on this map will be discussed later.

Figure 8a

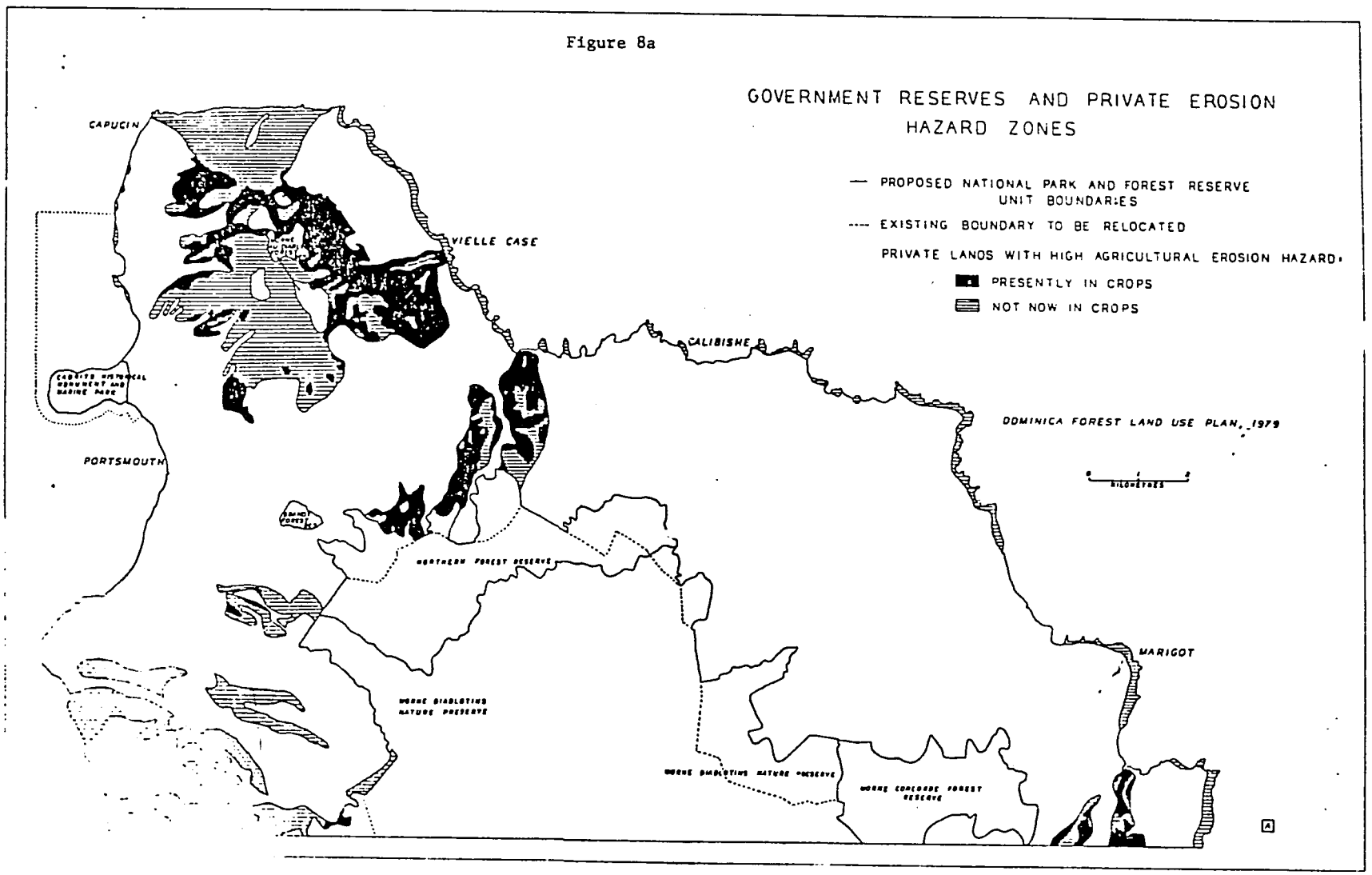

GOVERNMENT RESERVES AND PRIVATE EROSION HAZARD ZONES
PROPOSED NATIONAL PARK AND FOREST RESERVE UNIT BOUNDARIES
EXISTING BOUNDARY TO BE RELOCATED
PRIVATE LANDS WITH HIGH AGRICULTURAL EROSION HAZARD:
PRESENTLY IN CROPS
NOT NOW IN CROPS
CAPUCIN
VIELLE CASE
CALIBISHIE
PORTSMOUTH
MARIGOT
DOMINICA FOREST LAND USE PLAN, 1979
NORTHERN FOREST RESERVE
MORNE DIABLOTINS NATURE PRESERVE
MORNE DIABLOTINS NATURE PRESERVE
MORNE CONFORME FOREST RESERVE

Figure 8b

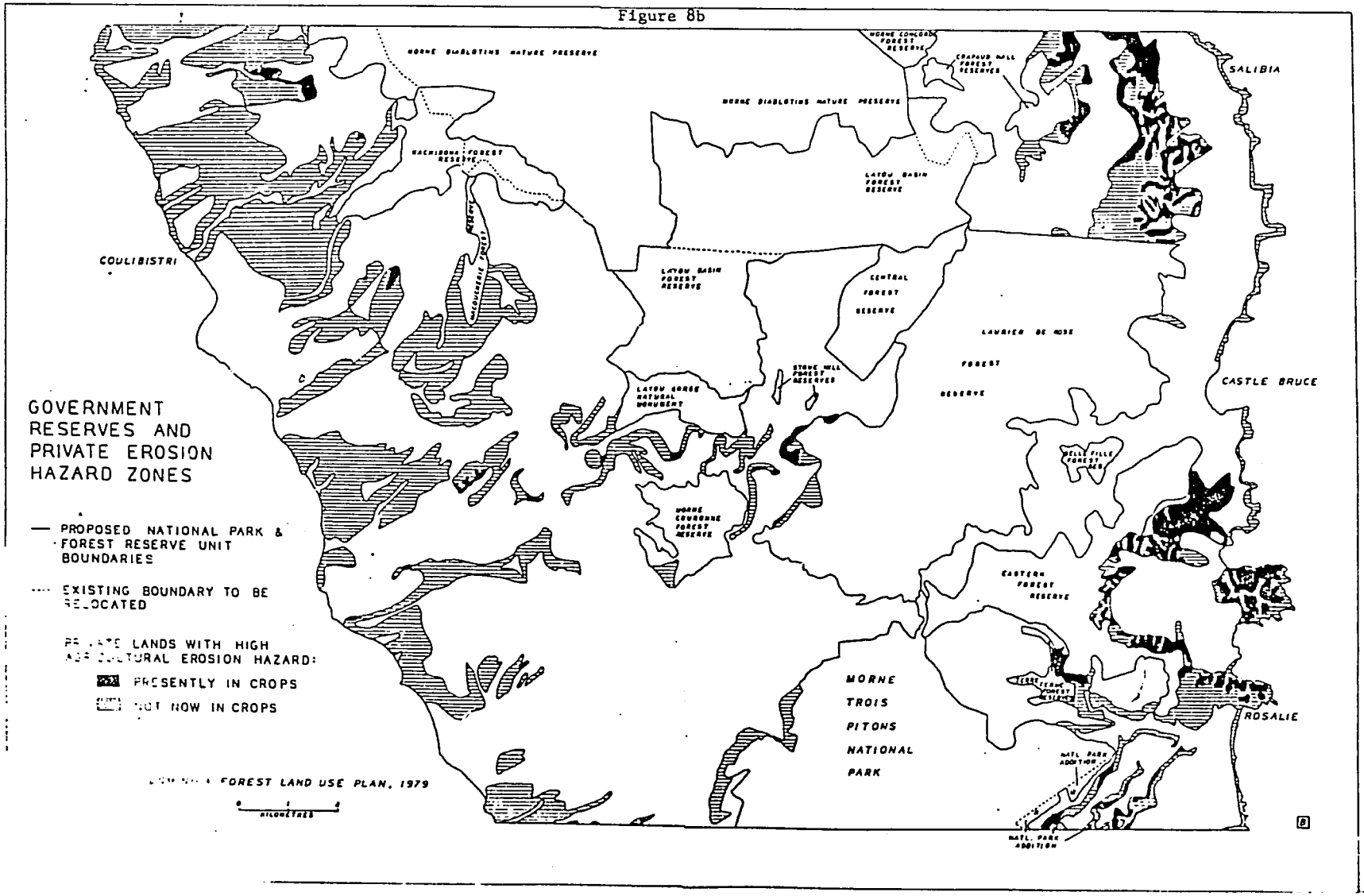
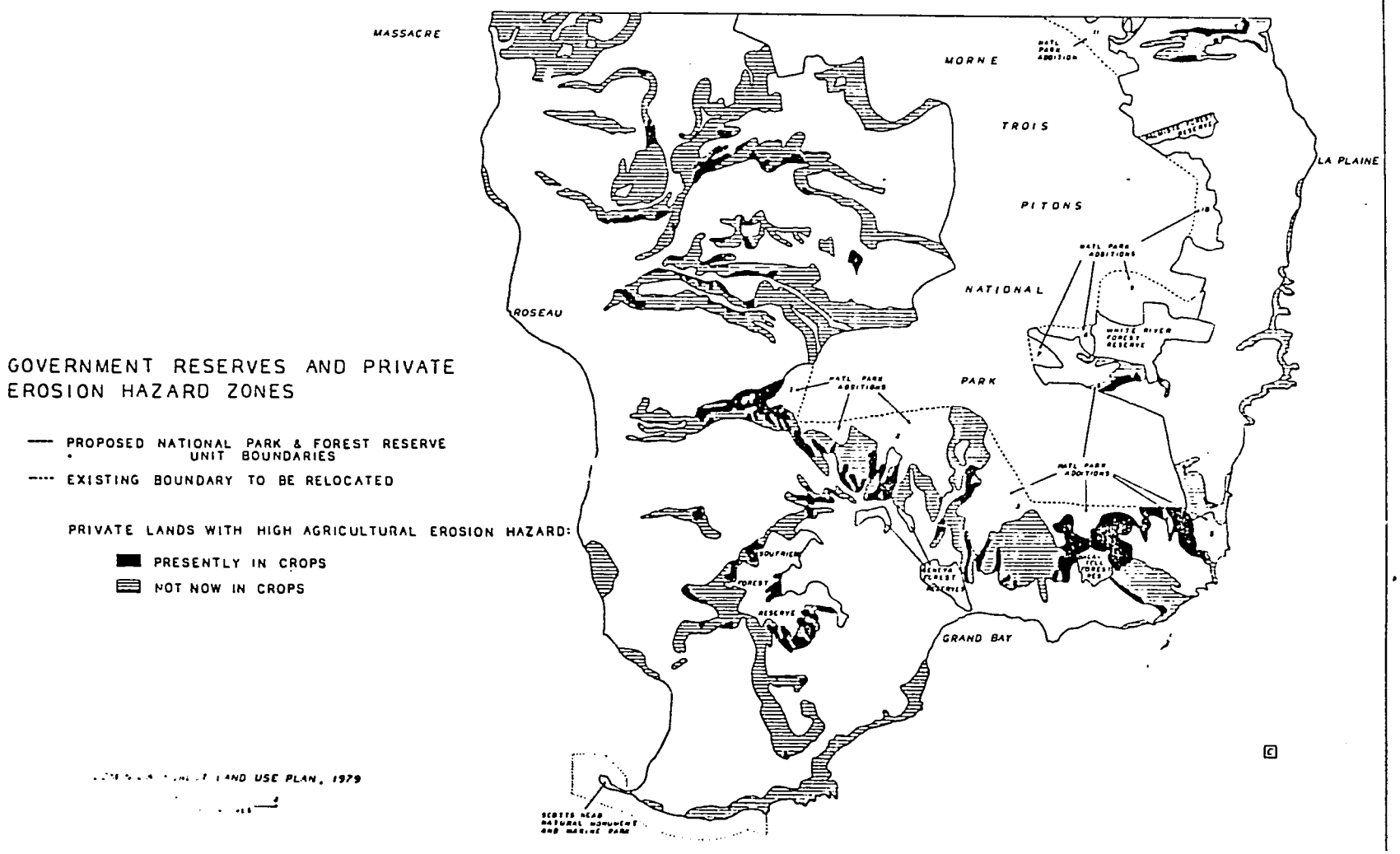

GOVERNMENT RESERVES AND PRIVATE EROSION HAZARD ZONES
— PROPOSED NATIONAL PARK & FOREST RESERVE UNIT BOUNDARIES
---- EXISTING BOUNDARY TO BE RELOCATED
PRIVATE LANDS WITH HIGH AGRICULTURAL EROSION HAZARD:
PRESENTLY IN CROPS
NOT NOW IN CROPS
FOREST LAND USE PLAN, 1979
KILOMETRES
COULIBISTRI
SALIBIA
CASTLE BRUCE
ROSALIE
MORNE TROIS PITONS NATIONAL PARK
MORNE DIABLOTINS NATURE PRESERVE
MACHIRONA FOREST RESERVE
LATOU BASIN FOREST RESERVE
CENTRAL FOREST RESERVE
LAURIER DE MOSE FOREST RESERVE
STONE HILL FOREST RESERVES
LATOU GORGE NATURAL MONUMENT
MORNE COURONNE FOREST RESERVE
EASTERN FOREST RESERVE
NATL. PARK ADDITION

Figure 8c


MASSACRE
MORNE
TROIS
PITONS
NATIONAL
PARK
LA PLAINE
ROSEAU
GRAND BAY
GOVERNMENT RESERVES AND PRIVATE
EROSION HAZARD ZONES
PROPOSED NATIONAL PARK & FOREST RESERVE UNIT BOUNDARIES
EXISTING BOUNDARY TO BE RELOCATED
PRIVATE LANDS WITH HIGH AGRICULTURAL EROSION HAZARD:
PRESENTLY IN CROPS
NOT NOW IN CROPS

It is proposed that twenty Forest Reserves be created from land that is already in government ownership. From north to south (Figure 8), these include:

Morne au Diable	Laurier de Rose
Brandy	Morne Couronne
Northern	Belle Fille
Morne Couronne	Eastern
Crapaud Hall	Terre Ferme
Layou Basin	Palmiste
Kachibona	White River
Macoucherie	Bagatelle
Central	Geneva
Stone Hill	Soufriere

The rationale for recommending each of these units is included in Table 14. Generally speaking, these areas have severe agricultural limitations, but are suitable for timber production. Some of the recommended Forest Reserve land serves as domestic water catchment. Critical natural features are included in several cases (laurier de rose in the Laurier de Rose Forest Reserve and Jaco parrot habitat in Layou Basin, Central, and Laurier de Rose Forest Reserves), but most such unique natural features are included in the more restrictive Park System.

Five Park System units are recommended to be created from existing government land. Morne Trois Pitons National Park would be slightly enlarged. Other units include (from north to south, Figure 8):

Cabrits Historical Monument and Marine Park
Morne Diablotins Nature Preserve
Layou Gorge Natural Monument
Scotts Head Natural Monument and Marine Park

The rationale for recommending each of these units is included in Table 14. This listing does not represent the final recommendation of this Plan, because only lands now owned by government are included. Both the Park and Forest System recommendations are expanded in the next chapter, when private lands are considered.

In terms of land area, the Morne Diablotins Nature Preserve represents the single largest change of land management proposed in this Plan. The Nature Preserve would be created mostly from lands within the existing Northern Forest Reserve (present boundaries are shown as dashed lines in Figure 8). Of the total proposed area of 7087 hectares, 6412 hectares would come from land now in the Northern Forest Reserve, and another 675 hectares from adjacent unallocated government land. Table 15 describes the land to be included in the Morne Diablotins Nature Preserve,

Table 15

DESCRIPTION OF LANDS TO BE INCLUDED IN MORNE DIABLOTINS NATURE PRESERVE

Total area of proposed Nature Preserve.....7087 hectares

Area from present-day Northern Forest Reserve....6412 hectares
Area from unallocated government lands.....675 hectares

Natural Features to be protected by Nature Preserve designation:

1. The only remaining Sisserou parrot habitat in Dominica.
2. A sizeable portion of remaining Jaco parrot habitat.
3. Rare plants on the slopes of Morne Diablotins.
4. Representative area of old-growth rain forest, found only in isolated patches in Morne Trois Pitons National Park.
5. Several unusually large gommier trees of old age near Governor estate.
6. Watershed protection for future domestic water catchments:
   100% of System V catchment area
   64% of System III catchment area
   37% of System II catchment area
   23% of Dublanc-Bioche catchment area
7. Watershed protection for large areas of very steep land in the highest-rainfall zone of the island. Most of the major rivers of the north have their headwaters in the proposed Nature Preserve.

Natural Constraints on Alternative Development:

1. None of the land proposed for Nature Preserve is suitable for agricultural development. Agricultural limitations are distributed as below:
   61% of area has high agricultural erosion hazard
   31% of area has moderately high ag. erosion hazard
   8% of area is poor agricultural land due to high rainfall.
   100% of area has serious agricultural limitations
2. About 3006 hectares or 42% of the Nature Preserve area has no logging potential whatever, being either too steep for logging or incapable of growing sawtimber. The remaining area is theoretically capable of being logged, but is highly dissected by streams, making access road constuction difficult and expensive.
3. Intensive recreational development, while appropriate for other units of the National Park System, is not recommended for Morne Diablotins Nature Preserve, due to its function as Sisserou parrot habitat. Sisserou parrots are highly sensitive to human activities in their breeding, feeding, and nesting areas. Intensive recreational development would bring people into these areas, and thus destroy the only remaining habitat for this rare and endangered bird species.

and the rationale for designating this land with a highly preservation-oriented designation. The restrictive Nature Preserve designation is used primarily as a device to protect the critical habitat needs of the two endangered parrot species, especially the Sisserou (see the chapter on critical areas). The proposed boundaries follow natural features in many places (rivers and ridgetops), and represent a compromise between conflicting land use needs, particularly preservation versus timber production needs. Nature Preserve designation is highly effective for meeting several secondary objectives, notably water catchment protection, habitat protection for all kinds of wildlife, and protection of rare plants.

The Layou Basin Forest Reserve area is also parrot habitat, but was not included in the Nature Preserve because it includes some of the most productive, gentle timber-producing land on the island. Through careful forest management in this area, the effects of timber harvest on the parrots can be lessened, but not altogether eliminated. The Layou Basin area represents the most difficult tradeoff situation encountered in this Plan. A full 97 percent of the proposed Layou Basin Forest Reserve is suitable for logging, representing over 680,000 cubic metres of mature sawtimber, the largest area of high-value timber anywhere on the island. It is also reasonably close to the existing Transinsular Road. Designation of that area as Nature Preserve would be unrealistic, given the economic needs of Dominica. As a compromise between conflicting needs, the area to the north of Layou Basin is designated Nature Preserve. This area includes the central core of the parrot habitat and other unique natural features worthy of preservation, and is considerably less valuable for timber production than the Layou Basin. This is spelled out at the bottom of Table 15.

Thus far, we have looked only at recommendations for land already in government ownership. It is worthwhile to look also at private lands which are in serious need of some type of government protection. The maps of Figure 5 include a representation of private lands with high agricultural erosion hazard. This is taken directly from Figure 3, and the slope/soil ratings developed in the chapter on agricultural limitations. Only the high erosion hazard zones are shown, and only those on private land. These areas are addressed in the next chapter.

B. Private Erosion Hazard Zones

High erosion hazard zones are totally unsuited to any kind of agricultural use. Since agriculture is the major activity of most private landowners, there can be environmental problems where such areas are privately owned. Acquisition and designation of such areas as Forest or Park System land is one way to prevent high rates of soil loss, landsliding, and water pollution which results from continuous farming of this land. Not all land with high agricultural erosion hazard can be recommended for government acqisition or addition to the Park and Forest Systems however. These areas are simply too numerous and widely scattered (see Figure 8 in the last chapter), making effective boundary surveying and patrol nearly impossible. Moreover, much of this high erosion hazard land is not in cultivation, and thus presents no immediate environmental threat. The high hazard lands which are cultivated are concentrated in a few problem areas: Morne au Diable area, the eastern coast near Rosalie, and the southern boundary of Morne Trois Pitons National Park.

Given the problems associated with government acquisition of private land, only key parcels of privately-owned erosion hazard zones are recommended for addition to the Park and Forest Systems. Some of the criteria (other than high erosion hazard) for choosing these key parcels include:

- adjacent to an existing or proposed Forest or Park System unit to be created from government land.
- now under cultivation and losing soil at a rapid rate.
- part of a domestic water catchment.
- has potential for a more suitable boundary location than would otherwise be possible.

These key parcels are shown in Figure 9, and are described in Table 16, along with the rationale for recommending each one. Less than 5000 hectares of private land are recommended for addition to the Forest or Park Systems, and a third of that total area is now in cultivation.

Implementation of these recommendations is likely to be a slow, arduous process, but the government should be prepared to take advantage of opportunities to acquire these key parcels either when land is sold voluntarily or through negotiations for land donation or land trade. Difficulty in obtaining key private parcels should not hold up the process of designating Park and Forest units from land now held by government, as described in the previous chapter.

Figure 9

Eastern Caribbean Natural Area Management Program

Dominica Forest and Park Systems Plan

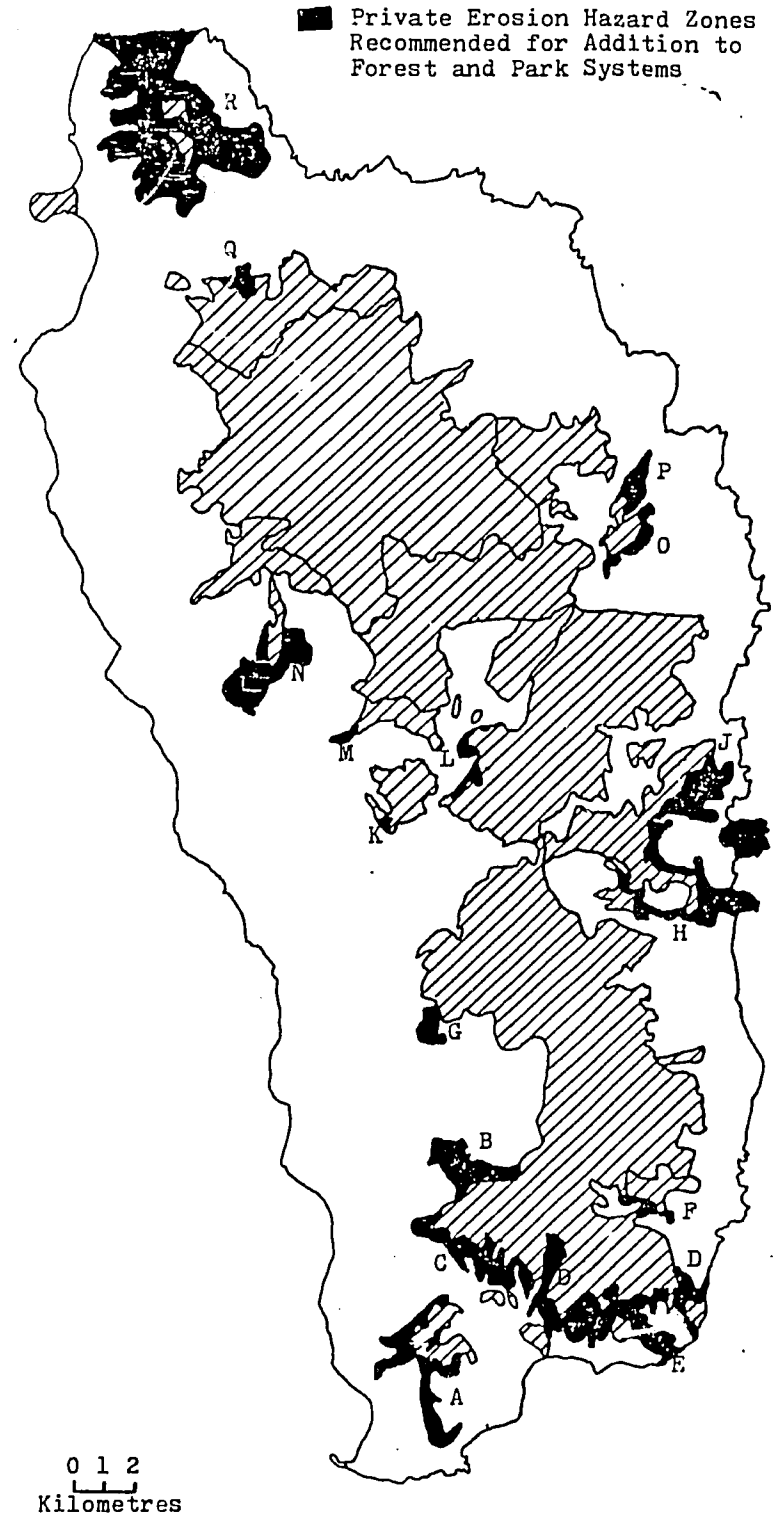


Table 16

Private Erosion Hazard Zones Recommended for Addition to Forest and Parks System

Area Code	Recommended Addition to:	Land Area in hectares	Ownership/ PROTECTION FUNCTIONS IN ADDITION TO EROSION CONTROL	Portions of Land Now in Cultivation : ha.	%
A.	Soufriere Forest Reserve	318	Parts of Soufriere, South Chiltern, Gommier, & Liberty estates, and small holdings. PART OF DOMESTIC WATER CATCHMENTS 17 AND 18.	72	23%
B.	Morne Trois Pitons Natl. Park	242	Small holdings.	3	1%
C.	Morne Trois Pitons Natl. Park	298	Parts of Gommier Stewart, Gommier Letang, Rose Hill, and Lisdara estates; part of Perdue Temps Settlement; small holdings.	119	40%
D.	Morne Trois Pitons Natl. Park	553	Parts of Perdue Temps, Stowe, & Pointe Mulatre estates; parts of Perdue Temps and Bagatelle Settlements; small holdings. INCLUDES ALL OF DOMESTIC WATER CATCHMENT 20, AND PARTS OF #19 AND CONSOLIDATED SYSTEM VIII CATCHMENT. PRESERVES A SECTION OF LITTORAL WOODLAND AND COASTLINE, NOT NOW REPRESENTED IN THE NATIONAL PARK SYSTEM.	190	34%
E.	Bagatelle Forest Reserve	120	Small holdings. PROTECTION OF LANDSLIDE-PRONE AREAS, PROVISION FOR VILLAGE WOOD SUPPLY IN AN AREA DOMINATED BY NATIONAL PARK.	33	27%
F.	White River Forest Reserve	46	Small holdings. PART OF POTENTIAL WHITE RIVER HYDROELECTRIC CATCHMENT, PROTECTION FOR VICTORIA FALLS AREA.	4	9%
	Morne Trois Pitons Natl. Park	4	Small holdings. BOUNDARY LOCATION MORE READILY PATROLLED.	4	100%
G.	Morne Trois Pitons Natl. Park	82	Parts of Stewart Hall and Providence estates, small holdings.	0	--

(Continued on next page)

Table 16

Private Erosion Hazard Zones Recommended for Addition to Forest and Parks System (continued)

Area Code	Recommended Addition to:	Land Area in Hectares	Ownership/ PROTECTION FUNCTIONS IN ADDITION TO EROSION CONTROL	Portions of Land Now in Cultivation: ha.	%
H.	Terre Ferme Forest Reserve	75	Part of Rosalie estate and small holdings. VERY STEEP RIPARIAN ZONE, WHERE SEDIMENTATION HAZARD IS INCREASED BY THE PRESENCE OF ROAD CUTS.	24	32%
	Eastern Forest Reserve	286	Part of Rosalie estate and small holdings.	94	33%
I.	Poirier Forest Reserve	142	Part of Saint Sauveur estate and small holdings. PROTECTION OF NATURAL LITTORAL WOODLANDS AND COASTAL ZONE.	76	54%
J.	Eastern Forest Reserve	224	Part of Saint Sauveur estate and small holdings. INCLUDES ALL OF DOMESTIC CATCHMENT 25.	169	75%
K.	Morne Couronne Forest Reserve	15	Part of Pinard estate. BOUNDARY LOCATION MORE READILY PATROLLED.	0	--
L.	Laurier de Rose Forest Reserve	65	Part of Riversdale estate and small holdings.	25	38%
M.	Layou Gorge Natural Monument	18	Small holdings	0	--
N.	Macoucherie Forest Reserve	360	Hobshole estate and other holdings.	0	--
O.	Crapaud Hall Forest Reserves	78	Small holdings.	26	33%
P.	Crapaud Hall Forest Reserves	108	Small holdings.	44	41%
Q.	Northern Forest Reserve...	80	Small holdings.	66	82%
R.	Morne au Diable Forest Reserve	1819	Seaman, Degazon, and Lavie Douce estates; parts of Connor, Fourchette, Reposoir, Valley, Everton Hall, Mt. Eolus, Mt. Morson, Bonne Esperance, Champs Elisees, and Providence estates; part of Moore Park Settlement; numerous small holdings. INCLUDES DOMESTIC CATCHMENTS 1, 2, 32, 33, and 34 AND A SCENIC SOUFRIERE AREA.	693	38%
		4,933 hectares		1,642 ha.	33%

V. UNIT DESCRIPTIONS

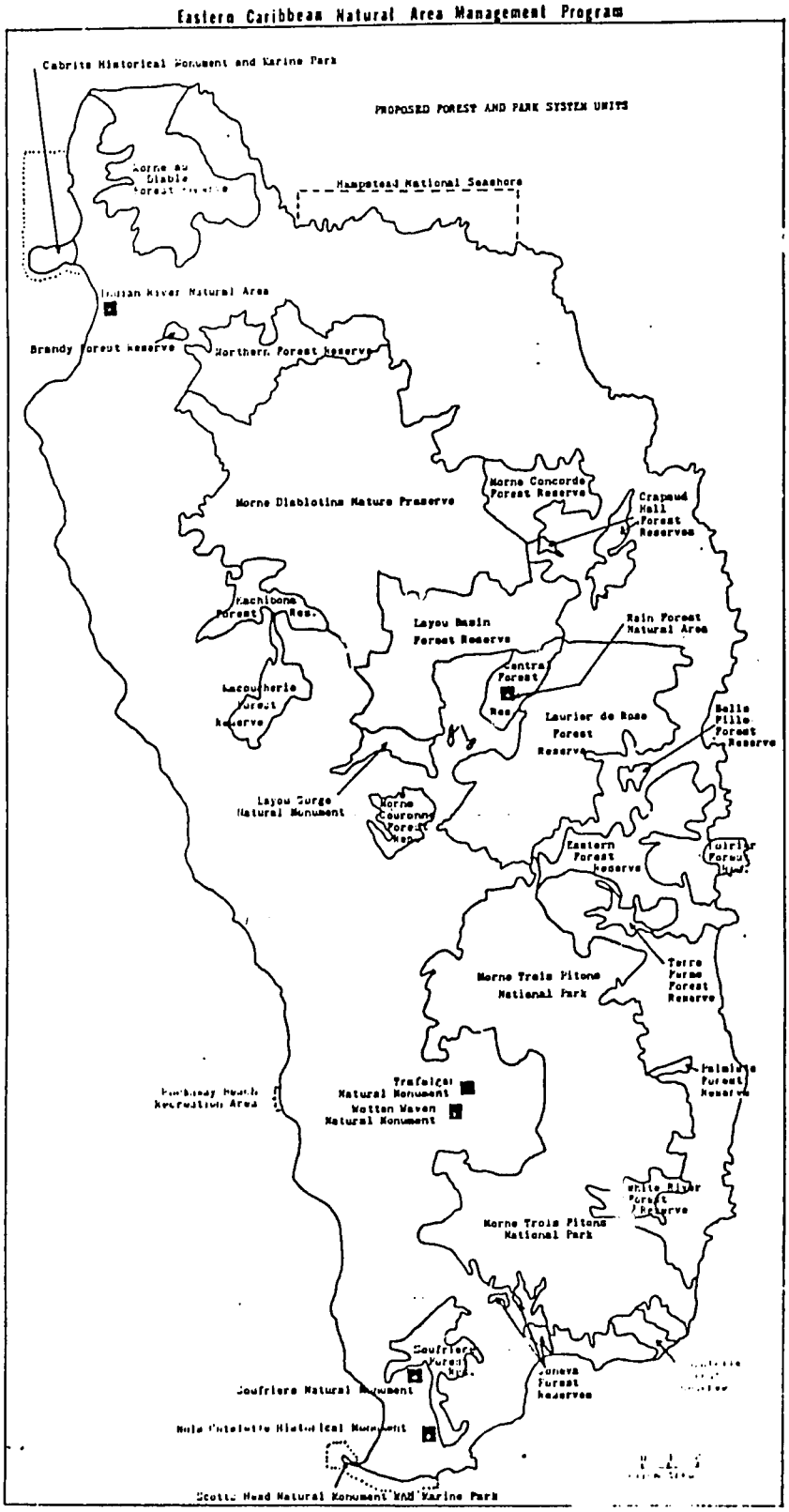
A. Park System Units

Thirteen Park System units are proposed, ranging in size from 8508 hectares for Morne Trois Pitons National Park to very small areas like the Rockaway Beach Recreation Area. The locations of proposed units are shown in Figure 10, a map of proposed Forest and Park System units. These units would be created from existing National Park land, Forest Reserve land, unallocated government land, and private land. The private land includes both the key parcels of high erosion hazard land discussed in the previous chapter and some small parcels which have high natural, historical, or cultural value. Table 17 lists the proposed Park units, their land areas, and the areas broken down by present ownership.

The Scotts Head Natural Monument and Marine Park would be created from the 6 hectares of government land just west of Scotts Head village. The area contains some military ruins and is highly accessible to the public, as well as being a landmark visible from many different points on the island. The surrounding coral reefs are one of several excellent marine areas than can be explored with minimal danger to divers. The area is heavily used at present, and Park System designation is recommended to prevent degradation through souvenir and coral collecting, spearfishing, damage to reefs from boat anchorage practices, dumping and littering, and construction of structures that detract from the scenic value of the area. The area has no value for timber production or agriculture, except perhaps for forage production, which could be one of the management objectives in order to keep vegetative growth under control.

The Bois Cotelette Historical Monument would be created from a small parcel of private land. There are a number of historical plantation buildings on this parcel that could, with proper restoration and interpretive work, serve as an excellent educational and tourism resource. Considerable expertise, financial backing, and cooperation from the landowner are needed to develop this area properly. Restoration and maintenance by a private foundation might be a suitable alternative to government acquisition.

Figure 10



Dominica Forest and Park Systems Plan

Table 17

Land Areas of Proposed Park System Units

Name of Proposed Park Unit	Total Area (ha.)	From existing Natl. Park (Morne Trois Pitons) -- ha.	From existing Forest Reserves (Northern or Central) -- ha.	From unallocated government land -- ha.	From private land -- ha.
1. Scotts Head Natural Monument and Marine Park	6			6	
2. Bois Cotelette Historical Monument	I*				I
3. Soufriere Natural Monument	I				I
4. Morne Trois Pitons National Park	8505	6349		977	1179
5. Wotten Waven Natural Monument	I				I
6. Trafalgar Natural Monument	I			2	I
7. Rockaway Beach Recreation Area	I				I
8. Layou Gorge Natural Monument	243			225	18
9. Rain Forest Natural Area	40		40		
10. Morne Diablotins Nature Preserve	7087		6412	675	
11. Indian River Natural Area	I				I
12. Hampstead National Seashore	I				I
13. Cabrits Historical Monument and Marine Park	121			121	
	16,002+	6347	6452	2006	1197+

* Indefinite land area, to be determined by further site studies. Acquisition of large land areas is not envisioned in these cases.

Soufriere Natural Monument is another proposed Park unit with minimal land requirements. This area of natural sulfur vents is fairly easily reached from the village of Soufriere, and is one of several highly-accessible geothermal areas. Access needs to be improved and visitor interpretation added, as a part of overall development of the natural and historical features of this southern part of Dominica.

A slight enlargement is proposed for Morne Trois Pitons National Park, from 6349 hectares to 8505 hectares. Several natural features would be added to the Park, Sarirsari Falls and some minor cascades and waterfalls along the southern boundary (Figure 7). Most of the land proposed for addition is extremely steep land adjacent to the present boundaries which needs protection from agricultural use and logging. Of the private land proposed for addition to the Park, nearly all of it is high erosion hazard land that is presently cultivated on a shifting cultivation basis. This private land includes catchment areas for the following water systems: Bagatelle/Fond St. Jean, Petite Savanne, Grand Bay, Pichelin, Bellevue Chopin, Dubic, and Tete Morne. The Park extension includes an extension of the Park to the eastern seacoast, due to the steepness of that area and the opportunity to include a representative area of littoral woodland in the Park.

Wotten Waven Natural Monument would include several geothermal features: hot springs along the river, a sulfur vent further up the hill, and a boiling mud pot at the top of the hill in the village of Wotten Waven. Private homes and gardens are scattered throughout the area, so development would be limited to improved parking facilities, direction signs, interpretive materials, and perhaps limited scenic easements.

Trafalgar Falls is already one of the major scenic attractions of the island, and experiences heavy visitor use. Access to the falls is across private land, an arrangement that has been suitable thus far, but might not be if land ownership changes. The access trail from the Papillon parking lot to Trafalgar Falls provides a pleasant walk through second-growth forest. Acquisition of this area for inclusion in a Trafalgar Natural Monument would insure that this access route is not blocked by private developers in the future or the forest environment destroyed by farmers. A scenic easement through this area might be nearly as effective as outright acquisition.

Rockaway Beach is the only major swimming beach in close proximity to the major population centre of Roseau. It is heavily used, both by local people and visitors. Designation as a Recreation Area of the Park System would help to clarify the national interest in maintaining and improving the area, preventing roadside dumping, and preventing disposal of solid wastes and sewage nearby. The Park Service would be given responsibility for maintaining and protecting the area from environmental damage. At present, the beach is a kind of "no man's land" in terms of responsibility for maintenance and improvement.

The proposed Layou Gorge Natural Monument includes 243 hectares of the steepest land on the island, mainly on the northern rim of the gorge. At present, access to the area is very limited. One can get glimpses of the gorge at several points along the nearby highway, and the southern rim can be reached only by an agricultural feeder road and on foot. Another way to see the gorge is to float down the Layou River, a somewhat risky undertaking. At some future time, the gorge area could be developed as a highly scenic landmark with better access. Even if this never occurred, however, the area is recommended for designation in the Park System to prevent agricultural and timber harvest attempts in this very steep, highly dissected land.

The Rain Forest Natural Area is a small area which has already been set aside for preservation within the Central Forest Reserve. It is one of the few areas where virgin rain forest can be seen in close proximity to a major paved road. Visitor trails and interpretive signs are needed to fully develop this area, which was set aside for preservation during the DOM-CAN logging operation in that area. The trail could also be linked to experimental forest plantations nearby for educational purposes. Designation as a Natural Area would simply institutionalize the present type of preservation management and clarify the educational objectives of the area.

The proposed Morne Diablotins Nature Preserve has been discussed in detail in previous chapters. It is the second largest proposed Park unit (7087 hectares) and includes within its boundaries major water catchments, endangered parrot habitat, rare plants, some very old and large gommier trees, and other natural features.

Indian River Natural Area would be created from a limited area of private land. The area is already a tourist attraction for visitors to the Portsmouth area, with its impressive fresh-water swamp and mangrove vegetation. The area is also heavily used by waterfowl not generally found in other areas of Dominica. Acquisition and designation as a Natural Area is recommended in order to prevent further degradation of this vegetation by farmers or future landfilling by developers.

Hampstead National Seashore would be one of the more difficult areas to acquire and develop for Park System purposes, but there are tremendous scenic, marine, and vegetative resources concentrated in the area which could be a focal point for tourism and recreation. This coastal land has a number of very scenic beaches, turtle nesting and feeding sites, coral reefs, fresh-water mangroves, and littoral woodlands (see Figure 7). The coastal road runs fairly close to the coast in this area, but most visitors never see the most impressive sights due to lack of roadside pulloff areas or access roads to some of the areas. Development of this area as a National Seashore would require selective acquisistion of easements for access, interpretive signs, and some land acquisition for visitor facilities and protection of certain critical mangrove areas. The area is heavily populated, making a cooperative effort with local residents absolutely necessary to the success of developing the area. The National Seashore concept is based upon highlighting the natural features of the area, without changing the area into a series of resort hotels. The potential for "beach hotel" development is somewhat limited by the dangerous undercurrents encountered by swimmers and the limited infrastructure for supporting resort facilities.

Cabrits Historical Monument and Marine Park would utilize existing government land in a combined historical area/marine park. Cabrits has an extensive array of military ruins which are in varying states of decay. While access is not particularly difficult, it could be improved by better trail location and marking of the access roads. Access to the excellent coral reef area to the north of the Cabrits is quite good already, though few visitors know about the marine resources that can be found there. Proper development of this area, complete with some restoration work

on historical structures, would require considerable historical expertise and expense. Modest improvements could be made, however, that would make the area a focal point for tourism, historical education, and outdoor recreation. The 121 hectares recommended for designation include the fresh-water swamp to the east of the Cabrits. Numerous feasibility studies have suggested that this wetland be filled for hotel development, a marina, etc. The swamp vegetation has been cut from time to time as well. There will probably continue to be land use conflicts between those who wish to preserve a fairly unique wetland and those who view it as a prime development area. One thing that has not been considered in the past is the damage to the coral reef area that would result from dredging or marina facilities on the north side.

The thirteen proposed Park System units amount to slightly over 16,000 hectares, most of which would come from land already in government ownership. Where private land acquisition is involved, Park System development may take some time, or other alternatives (development by private foundations) may be preferable. Another constraint, that of funding and staff, will require that some hard decisions be made about which areas are most important to work on first. One guiding principle must be kept in mind, however. If the natural or historical features of interest are destroyed before Park System development can take place, they cannot be brought back at some later date.

One question that arises in Park System development is: "How much is this concern for natural preservation costing us, in terms of agricultural or forest commodities foregone?" By overlaying the map of agricultural limitations (Figure 3) onto the proposed Park System units, we discover that less than 1 percent of the proposed Park System area can be considered good farmland (no agricultural limitations). Another 5 percent could be farmed without high rates of soil loss, but due to high rainfall/low temperatures, crop yields would be quite low. As for logging, about 63 percent of the total proposed Park area is unsuitable for logging. Of the remaining 37 percent, 3553 hectares are mature sawtimber see Table 18). This is to be expected, since mature tropical rain forest is the prime endangered parrot habitat protected by Morne Diablotins Nature Preserve. These 3553 hectares of harvestable sawtimber represent about 10 percent of the

Table 18

LOGGING POTENTIAL OF MAJOR PROPOSED PARK SYSTEM UNITS

Unit Name	Area Unsuitable for Logging: Too steep or unable to grow sawtimber		Area Unsuitable for Logging: Scrub or montane swamp forest		Area Which Would Have Been Suitable for Logging if not Park: Polewood or Cleared Land		Area Which Would Have Been Suitable for Logging if not Park: Mature Sawtimber	
Scotts Head Natural Monument & Marine Park (6 hectares)			6 ha.	100%				
Morne Trois Pitons National Park (8505 hectares)	6406 ha.	75%	393 ha.	5%	1363 ha.	16%	343 ha.	4%
Layou Gorge Natural Monument (243 hectares)	114 ha.	47%			30 ha.	12%	99 ha.	41%
Rain Forest Natural Area (40 hectares)							40 ha.	100%
Morne Diablotins Nature Preserve (7087 hectares)	3006 ha.	42%			1010 ha.	14%	3071 ha.	43%
Cabrits Historical Monument & Marine Park (121 hectares)	18 ha.	15%	103 ha.	85%				
	9544 ha.	60%	502 ha.	3%	2403 ha.	15%	3553 ha.	22%

total area of land in Dominica with commercial logging potential. The marginal utility of the commercial forest included in the Park System is quite low, as it is not the most productive forest, nor is it readily accessible. Referring back to Table 18, the 343 hectares of sawtimber in Morne Trois Pitons National Park are in the Middleham Preserve, a private preserve unavailable for timber harvest under any circumstances. The 99 hectares in Layou Gorge Natural Monument are on plateaus, surrounded by steep canyon walls, an impossible situation for construction of logging access roads.

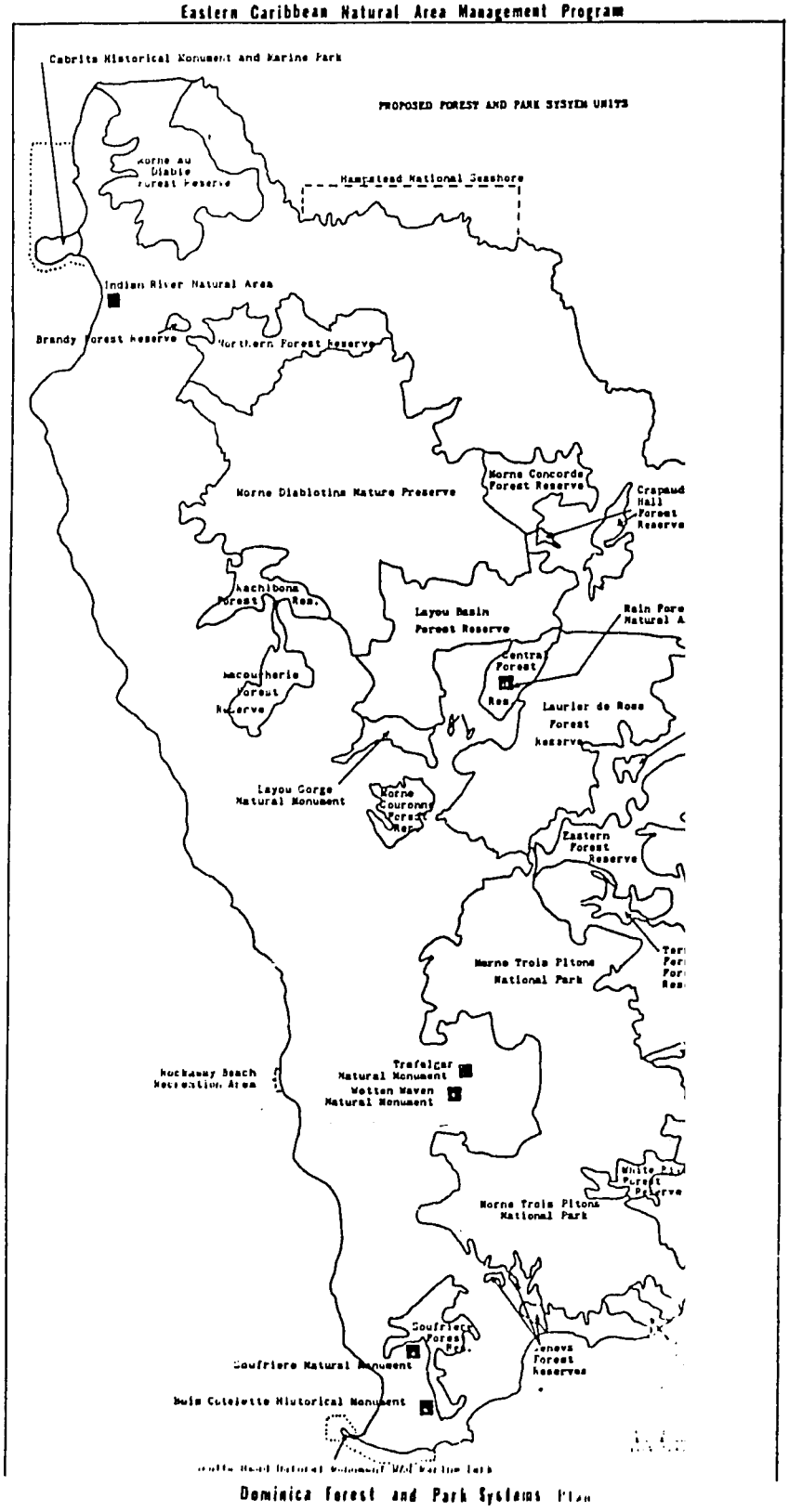
B. Forest System Units

Twenty one Forest Reserves are proposed (see Figure 11 and Table 19). Most of the Reserves are created from unallocated government land (55 percent of the total area). Existing Forest Reserve land makes up another 19 percent of the proposal, and the remaining 26 percent is from private parcels of erosion hazard zones (Table 16). All of this land has serious agricultural limitations, or it would not have been recommended as Forest Reserve. Much of the land included in these Reserves has some potential for timber production, but not all of it. Most of the rare or unique natural features of the island are included in the Park System, so the management objectives of the Forest Reserves are primarily watershed protection, timber production, and non-endangered wildlife habitat protection. Table 20 outlines the logging potential of each proposed Forest Reserve. Clearly, some of the Reserves are proposed primarily for protection of very steep land, rather than timber production, notably:

Soufriere	93% unsuitable for logging
Geneva	94% unsuitable for logging
Morne Couronne	88% unsuitable for logging
Macoucherie	75% unsuitable for logging
Crapaud Hall	83% unsuitable for logging
Morne au Diable	78% unsuitable for logging

The proposed Forest Reserves with the most immediate logging potential (large areas of harvestable old-growth timber) are Laurier de Rose, Layou Basin, Eastern, Central, Morne Concorde, and the Northern Forest Reserve. Some of the proposed Reserves have been abused in the past by farmers practicing shifting cultivation on slopes too steep to farm.

Figure 11


Eastern Caribbean Natural Area Management Program
Cabrits Historical Monument and Marine Park
PROPOSED FOREST AND PARK SYSTEM UNITS
Morne au Diable Forest Reserve
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Indian River Natural Area
Brandy Forest Reserve
Northern Forest Reserve
Morne Diablotins Nature Preserve
Morne Concorde Forest Reserve
Crapaud Hall Forest Reserve
Layou Basin Forest Reserve
Central Forest Res.
Laurier de Rose Forest Reserve
Layou Gorge Natural Monument
Morne Couronne Forest Res.
Eastern Forest Reserve
Morne Trois Pitons National Park
Trafalgar Natural Monument
Wotten Waven Natural Monument
Morne Trois Pitons National Park
Soufriere Forest Res.
Soufriere Natural Monument
Boiling Cutelette Historical Monument
Dominica Forest and Park Systems Plan

Table 19

Land Areas of Proposed Forest System Units

Name of Proposed Forest Reserve	Total Area (ha.)	From existing Forest Reserve (hectares)	From unallocated government land (hectares)	From private and privately-claimed land (hectares)
1. Soufriere	516		198	318
2. Geneva	72		72	
3. Bagatelle	144		24	120
4. White River	222		176	46
5. Palmiste	45		45	
6. Terre Ferme	134		59	75
7. Eastern	1402		892	510
8. Poirier	142			142
9. Morne Couronne	302		287	15
10. Laurier de Rose	3401		3336	65
11. Central	370	370		
12. Stone Hill	11		11	
13. Layou Basin	2238	1398	840	
14. Belle Fille	74		74	
15. Macoucherie	456		96	360
16. Kachibona	505	188	317	
17. Crapaud Hall	344		158	186
18. Morne Concorde	741		741	
19. Northern	1404	816	508	80
20. Brandy	31		31	
21. Morne au Diable	1902		83	1819
	14,456	2772	7948	3736
		19%	55%	26%

Table 20

LOGGING POTENTIAL OF PROPOSED FOREST RESERVES

Forest Reserve	Area Unsuitable for Logging		Area Suitable for Logging, Now or in the Future: Polewood or Cleared Land	Mature Sawtimber: Area	Code	Volume
1. Soufriere	479 ha.	93%	37 ha.	0 ha.		
2. Geneva	68 ha.	94%	4 ha.	0 ha.		
3. Bagatelle	87 ha.	60%	57 ha.	0 ha.		
4. White River	65 ha.	29%	50 ha.	41	M367	15,047
				66	M209	13,794
				107 ha.		28,841 m^3
5. Palmiste	29 ha.	64%	13 ha.	3 ha.	M196	558 m^3
6. Terre Ferme	73 ha.	54%	40 ha.	6	M401	2,406
				6	M358	2,148
				9	M357	3,213
				21 ha.		7,767 m^3
7. Eastern	41 ha.	3%	839 ha.	111	L528	58,608
				5	M401	2,005
				85	L398	33,830
				3	M384	1,152
				158	M358	56,564
				96	M274	26,304
				64	M270	17,280
				522 ha.		195,743 m^3
8. Poirier	56 ha.	39%	86 ha.	0 ha.		
9. Morne Couronne	265 ha.	88%	29 ha.	8 ha.	M195	1,560 m^3
10. Laurier de Rose	786 ha.	23%	795 ha.	60	L528	31,680
				48	M401	19,248
				91	L398	36,218
				649	M368	238,832
				60	M358	21,480
				156	M357	55,692
				283	M274	77,542
				473	M270	127,710
				1820 ha.		608,402 m^3
11. Central	0 ha.	--	20 ha.	71	L528	37,488
				2	M384	768
				4	M368	1,472
				199	M357	71,043
				74	M270	19,980
				350 ha.		130,751 m^3
12. Stone Hill	0 ha.	--	6 ha.	5 ha.	L528	2,640 m^3

(continued on next page)

Table 20--continued

Forest Reserve	Area Unsuitable for Logging		Area Suitable for Logging, Now or in the Future: Polewood or Cleared Land	Mature Sawtimber: Area	Code	Volume
13. Layou Basin	63 ha.	3%	251 ha.	73	L528	58,544
				399	L398	158,802
				157	M384	60,288
				710	M368	261,280
				60	M358	21,480
				64	M357	22,848
				281	M274	76,994
				42	M270	11,340
				43	M247	10,621
				95	M195	18,525
				1924 ha.		680,722 m^3
14. Belle Fille	0 ha.	--	12 ha.	62 ha.	M270	16,740 m^3
15. Macoucherie	343 ha.	75%	61 ha.	4	L528	2,112
				34	L398	13,532
				14	M270	3,780
				52 ha.		19,424 m^3
16. Kachibona	129 ha.	25%	125 ha.	16	M401	6,416
				32	L398	12,736
				135	M358	48,330
				44	M274	12,056
				24	M270	6,480
				251 ha.		86,018 m^3
17. Crapaud Hall	285 ha.	83%	31 ha.	4	L398	1,592
				14	M384	5,376
				10	M357	3,570
				28 ha.		10,538 m^3
18. Morne Concorde	173 ha.	23%	133 ha.	143	M401	57,343
				27	M368	9,936
				90	M358	32,220
				102	M274	27,948
				73	M270	19,710
				435 ha.		147,157 m^3
19. Northern	391 ha.	28%	648 ha.	31	M401	12,431
				90	L398	35,820
				24	M384	9,216
				103	M274	28,222
				117	M270	31,590
				365 ha.		117,279 m^3
20. Brandy	0 ha.	--	8 ha.	23	M274	6,302 m^3
21. Morne au Diable	1487 ha.	78%	415 ha.	0 ha.		
TOTALS:	4820 ha.	33%	3660 ha.	5976 ha.		2,060,472 m^3

Note: Volume figures for mature sawtimber are expressed in cubic metres of usable wood from the bole of sawtimber-size trees.

These include the Bagatelle, Eastern, Poirier, and Morne au Diable Reserves. These Reserves are covered mainly by second-growth polewood forest, that will eventually reach sawtimber size if placed under protection.

Table 21 summarizes the logging potential of all the proposed Forest Reserves combined. A third of the area is unsuitable for timber harvest at any time, due to slope or vegetation type. Another fourth of the area is immature timber that could be harvested as sawtimber in the future. The remainder, 41 percent, is mature sawtimber that can be harvested on a schedule at any time. This mature sawtimber is of a mixed uneven-aged rain forest type, where yearly tree mortality equals yearly new growth, so these areas will remain at their present timber volume indefinately. There are a total of some 2 million cubic metres of harvestable sawtimber in the proposed Forest Reserves, a little less than half the island total.

In the past, various estimates have been made for annual allowable timber harvest, so it may be worthwhile to address that issue for the proposed Forest Reserves. If timber management for maximum wood output were the only objective necessary in the Forest Reserves, we would use the following assumptions: -

1. Silvicultural method would universally be clearcutting followed by replanting of monocultural forest plantations. This system yields more wood per hectare per year than any other.
2. Rotation age would be 40 years for the new plantations, the minimum needed for desirable species to reach sawtimber size.
3. A combination of logging methods would be necessary to log all the harvestable areas: tractor logging for gentle terrain, skyline cable logging for steeper areas, and in-situ sawing for small odd-lot areas in any terrain. So long as the logging method were suited to the terrain and access roads were built to a high standard, sediment production would be minimal, allowing all catchments to be harvested without downstream problems.
4. The value of all harvestable timber stands is assumed to be high enough to make logging profitable, or at the very least, enough to cover the high costs of road construction and maintenance in difficult terrain.
5. Polewood stands are assumed to reach sawtimber size by the time they are needed in the harvesting cycle.

Under these assumptions, the harvestable land area in the proposed Forest Reserves would be 9,636 hectares (see Table 21). Using an area-controlled cutting rate and a rotation age of

Table 21

LOGGING POTENTIAL OF PROPOSED FOREST RESERVES--SUMMARY

		% of total area
Total Area of Proposed Forest Reserves:	14,456 ha.	
Area Unsuitable for Logging at any time:	4,820 ha.	33%
Area of Polewood or Cleared Land, Suitable for Future Logging:	3,660 ha.	25%
Area of Mature Sawtimber Suitable for Logging at any time:	5,976 ha.	41%

Loggable Sawtimber Totals

Area	% of Total Sawtimber Area	Sawtimber* Type Code	Timber Volume	% of Total Sawtimber Volume
324 ha.	5%	L528	171,072 m^3	8%
249 ha.	4%	M401	99,849 m^3	5%
735 ha.	12%	L398	292,530 m^3	14%
200 ha.	3%	M384	76,800 m^3	4%
1390 ha.	23%	M368	511,520 m^3	25%
41 ha.	1%	M367	15,047 m^3	1%
509 ha.	8%	M358	182,222 m^3	9%
438 ha.	7%	M357	156,366 m^3	8%
932 ha.	15%	M274	255,368 m^3	12%
943 ha.	16%	M270	254,610 m^3	12%
43 ha.	1%	M247	10,621 m^3	1%
66 ha.	1%	M209	13,794 m^3	1%
3 ha.	--	M196	588 m^3	--
103 ha.	2%	M195	20,085 m^3	1%
5976 hectares			2,060,472 cubic metres**	

* In assessing logging potential, each forest type has been assigned a code to simplify volume calculations. The letter "L" indicates a large-sawtimber stand, "M" indicates a stand of medium-sized sawtimber. The numerals give the estimated average timber volume in cubic metres per hectare.

** Total sawtimber volume within proposed Forest Reserves represents about 44% of the harvestable sawtimber volume for the entire island. All figures given here are calculated prior to Hurricane David in 1979, and thus may be higher than present conditions.

40 years, the annual allowable cutting area would be about 240 hectares. Since the average volume of mature sawtimber stands in the proposed Reserve areas is 344 cubic metres per hectare, the annual volume harvested would about 82,500 cubic metres of sawtimber during the first cutting cycle of 40 years. If we assumed that all the harvestable sawtimber on private lands were available for harvest and would be replanted as above (a very generous assumption indeed), we could just about double the annual harvest to 160,000 cubic metres of sawtimber. This would be the absolute maximum that any wood processing plant should be built to handle, though 100,000 cubic metres per year would be more reasonable, since not all private lands are available for timber production. These calculations are very straightforward and deceptively simple, given the fact that the primary assumption on which they are based is faulty.

Maximum output of wood is not the only management objective that must be met in the Forest Reserves. The Reserves must also serve as wildlife habitat, a source of specialized forest products, and they must be diverse enough in species composition to resist catastrophic disease and insect outbreaks. Because of this, the wholesale conversion of all Forest Reserve land to monocultural plantations (assumption #1 above) is out of the question. Three of the Forest Reserves; Central, Layou Basin, and Laurier de Rose, serve as a habitat area for Jaco parrots and other forms of wildlife. Both the parrots and other species of wildlife (including game species) require a mixed hardwood forest to supply year-round food and shelter requirements. A forest of mixed composition can be maintained through selective cutting or clearcutting with natural regeneration, but the production in wood per hectare per year is considerably smaller than with plantation management. The three Reserves which are critical for wildlife and must be managed as mixed hardwood forest (Central, Layou Basin, Laurier de Rose) contain nearly half the total proposed Forest Reserve land area, and more than half of the harvestable volume of sawtimber.

The calculations of annual allowable cut also assume that all the harvestable area would be cut during the cutting cycle (assumption #3). This would require use of sophisticated and relatively expensive-to-operate skyline cable systems to log the many steeper areas without severe soil loss.

All the areas logged commercially thus far (by DOM-CAN and others) have been on the limited area of forest land gentle encough for tractor logging or high lead skidding. Since the economics of timber harvest in Dominica are known to be marginal even in gentle terrain, it is questionable whether use of more costly skyline equipment would be economically feasible. On the world scale, there are vast areas of tropical hardwoods of equal or greater value than that found in Dominica, and these forests grow on terrain much gentler and cheaper to log than in Dominica. If wood is cut to be sold on the world market, the chances are slim that skyline-harvested wood could compete in price. On the other hand, if we were to include in the annual allowable cut only forest land that is gentle enough to be harvested by relatively inexpensive methods, it would amount to perhaps a tenth of the "commercially harvestable" area defined in this Plan.

The problem of economics creeps in again if we assume that the value of wood removed will cover the cost of roadbuilding and maintenance (assumption #4). The experience of logging ventures in Dominica so far has been that roadbuilding and maintenance costs are far above estimates. There are several reasons, but one of the major reasons is the steep terrain and the many bridges and culverts required in this highly dissected and well-watered land. Road costs are also higher in the rain forest soils of the interior than in other soils. These rain forest soils are very deep and have low structural strength. Extensive roadbed preparation and surfacing are necessary to keep logging roads passable. It is possible, indeed quite likely, that roadbuilding costs can exceed the value of the timber removed. This has been the experience of established private forestry corporations working in very similar terrain and rain forest soils in the Philippines, and they are cutting wood much higher in value than the common species in Dominica. In Dominica, the problem of high road costs has been masked because agricultural settlement is allowed to occur wherever a logging road has been built. Thus, the logging operation subsidizes agricultural settlement by creating the access. Clearly, this cannot continue, if there is to be any kind of sustained timber production.

Given the situation just described, one can see the difficulty of trying to arrive at an annual allowable cut . Numerous forest industry development studies have been done for Dominica, and all kinds of proposals have been made for timber extraction industries. Many of these proposals use annual allowable cut figures that are based on some of the faulty assumptions just described. Our assessment is that these studies are overly optimistic, and do not take into account some very important environmental and economic factors. Incremental development of an indigenous forest industry is the surest way to avoid costly mistakes, both economic and environmental, but the tendency is to propose the largest processing plant possible to achieve "economies of scale". These economies of scale are rather short-lived, however, if the wood runs out before the end of the cutting cycle because of faulty allowable cut assumptions.

C. Summary of Proposed Park and Forest Systems

Table 22 provides a summary of all the land use and land management changes proposed in this Plan.

Table 22

Land Ownership and Management Changes under Proposed Plan

PRESENT LAND OWNERSHIP AND MANAGEMENT:

Morne Trois Pitons National Park (including Archbold Preserve)	6,349 ha.	8%
Central Forest Reserve	410 ha.	1%
Northern Forest Reserve	8,814 ha.	11%
Unallocated government land	10,526 ha.	13%
Privately-owned or claimed	52,901 ha.	67%

PROPOSED DISPOSAL OF GOVERNMENT LANDS:

Morne Trois Pitons National Park

All 6,349 hectares remain in the Park.

Central Forest Reserve

370 hectares remain in Central Forest Reserve.
40 hectares enter the Rain Forest Natural Area.

Northern Forest Reserve

816 hectares remain in Northern Forest Reserve.
6412 hectares enter Morne Diablotins Nature Preserve.
1398 hectares enter Layou Basin Forest Reserve.
188 hectares enter Kachibona Forest Reserve.

Unallocated Government Land

7948 hectares enter Forest Reserves.
675 hectares enter Morne Diablotins Nature Preserve.
977 hectares enter Morne Trois Pitons National Park.
354 hectares enter other Park System units.
530 hectares are released for private ownership.
42 hectares remain special-purpose or non-critical government land.

PROPOSED ACQUISITION OF PRIVATE LANDS:

-Slightly over 1,197 hectares are incorporated into Park System units.
-3,736 hectares are incorporated into Forest Reserve units.
-Slightly under 47,968 hectares remain in private ownership.

SUMMARY OF PROPOSED LAND OWNERSHIP AND MANAGEMENT:

Park System:		
Morne Trois Pitons National Park	8,505 ha.	11%
Morne Diablotins Nature Preserve	7,087 ha.	9%
Layou Gorge Natural Monument	243 ha.	--
Other Park System Units	167 ha.	--
Forest Reserve Units	14,308 ha.	18%
Special-purpose Government Land	42 ha.	--
Private Land	48,648 ha.	62%

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Appendix I

EFFECTS OF LAND USE PRACTICES ON ENVIRONMENTAL QUALITY

A. NATURAL AREA MANAGEMENT PRACTICES

1. Wilderness Preservation

The land remains essentially unaltered from its natural state. Natural processes of ecological succession, including periodic natural disturbances (wind damage, disease & insect attacks, naturally-occurring landslides, etc.) are allowed to run their course without human intervention. Human occupation is limited to brief visits, for purposes of scientific study, nature appreciation, or recreation. Access roads are prohibited, but hiking trails allow limited human access. Logging, removal of vegetation, agriculture, dwelling construction, hunting, and sometimes fishing are prohibited. Construction of reservoirs, pipelines, radio towers, and utility corridors are strongly discouraged within the boundaries.

a. Effects on Water Quality--Wilderness preservation maintains optimal conditions for high water quality and preservation of native aquatic life. Natural vegetative cover controls soil erosion and stabilizes streambanks. Riparian vegetation keeps stream water cool and promotes high aquatic productivity. Hiking trails can, however, cause local stream sedimentation if they are poorly designed or poorly maintained. Also, bacterial contamination of water may result if large numbers of wilderness users are not provided with toilet facilities or they ignore proper waste disposal guidelines.

b. Effects on Soil Conservation--With the exception of possible soil erosion from trails cited above, wilderness soils remain undisturbed and undegraded.

c. Effects on Rare or Unique Natural Features--Wilderness preservation is critical for the protection of certain rare and endangered species, such as the Sisserou parrot. The Sisserou are highly sensitive to the presence of human beings in their feeding and nesting areas, and will not use otherwise-suitable habitat if it is heavily used by people. Thus, the endangered Sisserou parrot depends upon a sizeable area of wilderness for its survival. The Jaco parrot is less sensitive to human presence, but also requires old-growth tropical rain forest (which remains intact under wilderness management) for survival. Certain rare plants are quite small and are found only in certain locales, so are best preserved from accidental destruction by wilderness designation. Other unique natural features (waterfalls, swamps, soufrieres, etc.) do not require wilderness designation for protection necessarily. Overly restrictive management of such non-critical features may supress visitation and prevent legitimate economic benefits from being realized.

(Wilderness Preservation, continued)

d Effects on Wildlife--Native wildlife species always benefit from wilderness preservation, since they have evolved so as to take advantage of indigenous natural conditions. Undisturbed natural vegetation provides the right combination of food, shelter, and other habitat needs for native species. In many cases, introduced wildlife species also thrive in a wilderness setting. Restrictions on hunting allow residual wildlife populations to exist within wilderness areas, which then re-colonize overhunted areas. Lack of access roads helps minimize human disturbance of wildlife, particularly important during mating and reproductive periods.

e. Effects on Scenic Resources--Wilderness preservation insures that the scenic resources are in no way changed. Restrictions on access road construction and vegetation clearing may preclude developments designed to make use of the scenic resources (scenic drives and overlooks), however.

f. Effects on Genetic Diversity--Wilderness preservation insures that existing genetic resources are not destroyed. Plants and animals which may be of value in future scientific or medical uses are saved from unintentional destruction. Genetic diversity is maintained, thus minimizing the risk of widespread losses due to wind damage, new diseases or insects, drought, or other periodic events which are selectively destructive of certain species or varieties.

2. Light Recreational Development

This is less restrictive management than wilderness preservation, in that certain facilities are permitted for the safety and comfort of visitors. It is anticipated that such areas would attract and accomodate more visitors than those areas where strict wilderness preservation is followed. Permitted facilities include hiking trails, picnic shelters, latrines, backcountry campsites for backpackers, and simple interpretive facilities. With the exception of backcountry campsites some distance from roads, overnight use is not permitted. A limited mileage of access roads is acceptable. As under wilderness management, logging, vegetation removal, agriculture, dwelling construction, hunting, and sometimes fishing are prohibited. Most of the development in Morne Trois Pitons National Park is proceeding along the lines of the light recreational development described here.

a. Effects on Water Quality--Since trails are subject to more use than in wilderness areas, they pose a greater risk of stream sedimentation, and must be diligently maintained. Bacterial contamination risk is also increased with more visitors, although proper latrines are easier to construct and maintain, because access roads are allowed. Since recreational facilities occupy only a small proportion of the total wildland area, water quality problems are restricted to limited areas. Access roads can be a major source of stream sediment, if not properly built and maintained. Road construction across steep slopes can trigger landslides and channel surface water to increase erosion. Unsurfaced roads contribute sediment to nearby streams long after initial construction.

(Light Recreational Development, continued)

b. Effects on Soil Conservation--With the exception of possible erosion from roads and trails cited above, the large areas of undisturbed natural vegetation prevent both soil erosion and depletion of natural soil fertility.

c. Effects on Rare or Unique Natural Features--The human presence associated with light recreational development precludes use of these areas by Sisserou parrots. The Jaco parrots are not affected to a great degree, so long as visitor facilities are not concentrated in the better nesting areas (old growth gommier and chataignier forest). Rare plants tend to be found on the mountain peaks, so trails to these areas should be well-defined, to prevent visitors from trampling vegetation in search of a way to the top. Natural features such as waterfalls, soufrieres, swamps, etc., would benefit from improved access associated with light recreational development.

d. Effects on Wildlife--Since hunting is prohibited and natural vegetation remains intact, wildlife species generally prosper in areas of light recreational development. The effects of human presence affect different species to differing degrees. The Sisserou parrot is a case of extreme sensitivity. Most wildlife species are able to adapt to the limited effects of humans in light recreational development zones.

e. Effects on Scenic Resources--Generally, scenic beauty is little affected by light recreational development. However, a common source of scenic degradation in such areas is poor road location. Roads which cut across long steep slopes tend to be highly visible, and detract from the natural landscape when viewed from other points. On the other hand, a well-located road can create scenic vistas for travelers. The art of integrating landscape architecture into road design is a relatively new field in North America, and has not been attempted in Dominica.

f. Effects on Genetic Diversity--Since little natural vegetation is disturbed in the process of developing light recreational facilities, genetic diversity is maintained, as with wilderness preservation.

3. Intensive Recreational Development

Intensive recreational development is appropriate where features of interest attract large numbers of visitors. Visitor safety, interpretation, and protection of the natural feature are foremost objectives. Adequate toilet facilities and park protection personnel are absolutely necessary. Depending upon the number of visitors and the character of the natural feature, other facilities might include parking lots, surfaced trails, permanent visitors center, overnight camping facilities, riding stables, refreshment stand, and the like. The latter facilities are sometimes best provided by private persons outside the park boundary, to prevent destruction of the natural character of the area. Intensive recreational development is generally appropriate for historical monuments, natural monuments, or recreation areas.

(Intensive Recreational Development, continued)

a. Effects on Water Quality--Intensive recreational developments vary widely in their effects on water quality, depending upon the type of facilities installed and the quality of design and maintenance. Large numbers of visitors create a high potential for water pollution if not properly managed. Vault toilets or septic tanks are needed to prevent human wastes from reaching streams or groundwater. Well-designed and surfaced trails, parking lots, and roads are needed to prevent stream sedimentation. Stables and riding trails must be located well away from streams to prevent animal waste pollution. Litter must be controlled through education and provision of trash containers. Riparian vegetation should not be disturbed when constructing visitor facilities.

b. Effects on Soil Conservation--Roads, trails, and parking lots are the potential sources of soil erosion. If natural vegetation must be cleared over large areas to facilitate visitor access and viewing, a ground cover of grasses and forbs should be maintained to prevent soil erosion. Soil compaction from foot travel is a common problem in intensive recreational developments. Various methods of visitor control and heavy-use-area rotation can help control this compaction, which will eventually lead to rapid erosion and runoff problems.

c. Effects on Rare or Unique Natural Features--Intensive recreational development often centers around a given natural feature of interest to visitors. Care must be taken, however, that the facilities built for visitors do not destroy the integrity of the area. Uncontrolled access can cause destruction of rare plants by trampling or vandalism. Intensive recreational development is incongruous with parrot habitat use. Sisserou parrots will not go near heavily-visited areas, and Jaco parrots will avoid such areas to a lesser extent.

d. Effects on Wildlife--A few wildlife species will be attracted to intensive recreation areas by the prospect of feeding in garbage cans or being intentionally fed. This is undesirable, in that it may alter natural feeding patterns and increase the risk of injury to humans. Most wildlife species avoid intensive recreational areas, as the human activities interfere with their feeding, nesting, or breeding habits. Thus, such areas must be considered lost from the wildlife habitat area of most species.

e. Effects on Scenic Resources--A well-planned and maintained recreational development can be an asset, making the scenic resources of an area available to large numbers of people. A poor recreational development generally detracts from scenic beauty. Problems in this regard include litter, signs that are too large and obtrusive, roads and buildings that do not blend with natural features, and other eyesores common to human occupation.

f. Effects on Genetic Diversity--Natural vegetation may or may not be the most suitable for an intensive recreational area. For example, grassland or forest plantation may be preferable to scrub forest for reasons of public access and viewing. Normally, if vegetation is modified, it is not done over large areas, so the effect on overall genetic diversity is minor.

B. TIMBER MANAGEMENT PRACTICES

1. Road-building and Maintenance

Commercial timber extraction requires a network of permanent and temporary roads to extract the bulky logs or sawn wood. The extent and configuration of the road network needed depends upon the type of extraction equipment used and topography. Experience in Dominica indicates that the rain forest soils are of very low low structural strength, making some sort of surfacing necessary on logging roads if they are to be functional.

a. Effects on Water Quality--Logging roads are the major source of sediment from logging activities. The risk of sedimentation from roads increases as the steepness of topography increases. In mountainous country, road cuts tend to divert and concentrate the erosive force of runoff water. Wherever roads cut across streams and gullies, there is high risk of sedimentation, unless bridges and culverts are designed to handle peak flows. Surface water will rapidly erode the road surface itself, if the road grade is too steep and cutoff trenches are not installed. Proper engineering and maintenance of logging roads are absolutely necessary to keep sedimentation to an acceptable minimum. In areas of slopes over 30 degrees, unbroken by ridges or valleys, it is all but impossible to build roads that will meet acceptable water quality standards. There are many such areas in Dominica.

b. Effects on Soil Conservation--Erosion from logging roads is described above. Roadbed soils are always highly compacted, but this is anticipated in roadbed design.

c. Effects on Rare or Unique Natural Features--Excluding removal of vegetation from the roadbed itself, the major impact of road-building on rare or unique natural features is to make them accessible to man's depradations. A road built through Sisserou parrot habitat would render the area useless to Sisserou, due to noise and activity which the parrot cannot tolerate. Most rare or unique features, however, are endangered more by the logging or agriculture that road-building encourages than by the road itself.

d. Effects on Wildlife--If roads are heavily-used, they can act as effective barriers or impediments to wildlife movement. Some animals will be killed by vehicles while trying to cross the road, others will avoid the road completely. If the area in question is open to hunting, road construction will certainly increase the impact of hunters on the wildlife populations, by making it easier for hunters to scout the area.

e. Effects on Scenic Resources--Logging roads are often a temporary eyesore at close range, and may permanently damage the scenic resource if they are poorly located and designed. There are many techniques available for minimizing the scenic impact of logging roads, however.

f. Effects on Genetic Diversity--The effects of the roadbed itself are negligible, but since the roads are built for logging, the effect will depend upon the type of silvicultural method used in forest management.

2. Light Selective Cutting and Natural Regeneration

This silvicultural method is well suited to continuous production of large-diameter wood from the mixed tropical rain forest. Only a few trees per hectare are cut, and the openings left in the forest canopy are limited. The remaining uncut trees serve as a seed source for new trees, and they provide partial shade, so that desirable shade-tolerant species will become established immediately.

a. Effects on Water Quality--Silvicultural method is not the determining factor for water quality effects; the logging method is what determines sediment yields. Maintenance of a nearly continous crown cover by selective cutting may, however, prevent solar warming of streamwater, which would reduce aquatic productivity.

b. Effects on Soil Conservation--Erosion is discussed above. Risk of soil compaction is less with light selective cutting than with clearcutting, simply because fewer logs are handled. Maintenance of a nearly continuous forest cover will prevent some of the temporary breakdown of soil organic matter which occurs when soil is exposed to the sun and weather (as in clearcutting or agriculture). Loss of soil nutrients through wood removal is negligible, so long as leaves and upper branches are left on the site to rot.

c. Effects on Rare or Unique Natural Features--Selective cutting should be avoided in areas where the laurier de rose is found, so as to avoid damaging these rare trees physically, or by changing growing conditions. Cutting should be avoided in areas known to harbour other rare plants, for the same reason. Selective cutting is to be avoided in Sisserou parrot habitat, due to effects of human activity on the parrot. In Jaco parrot habitat, trees which are known or are likely to contain nesting cavities should not be selected for cutting or disturbed by felling nearby.

d. Effects on Wildlife--The effect of selective cutting on wildlife (excluding parrots) is fairly limited, so long as cutting is not so heavy as to alter species composition or structure of the rain forest environment. Access roads are more likely to affect wildlife in such areas than selective cutting itself.

e. Effect on Scenic Resources--Light selective cutting is practically imperceptible from a distance. Even when viewed from the cutting area, it is often difficult to tell that an area has been cut. Thus, the effect on scenic resources is considerably less than with clearcutting.

f. Effects on Genetic Diversity--One of the real dangers of selective cutting is that only the most valuable species and genetically-superior trees will be chosen for cutting. Over a long period of such cutting, the forest changes in composition to include only those species and genetic strains that were allowed to reproduce because they were left uncut by loggers. By the same token, timber stands can be improved by cutting according to prescriptions of a forester trained in timber stand improvement. Thus, control in selective cutting is very important.

3. Clearcutting and Natural Regeneration

Clearcutting is the silvicultural method most likely to be used in areas worked by commercial logging ventures. Light selective cutting will not yield enough wood to pay the cost of logging road construction into new areas. Shelterwood or heavy selective cutting have been shown to be practically impossible in natural tropical rain forest, due to heavy residual damage during logging. In clearcutting, patches or strips of land are completely cleared of standing timber. Usable timber is hauled away, while tops, branches, and immature trees are cut and left lying on the ground.

Where natural regeration is used, no seeds or seedlings are intentionally planted after logging. Seeds blow into the clearcut area from nearby uncut forest, or drop from cut limbs and branches in the logging area itself. Some species will sprout new trees from the cut stump. Generally, the species composition of this first growth is different from that of the mature rain forest just cut. Certain species thrive on the full sunlight of the clearcut area, and these will grow very quickly. After a time, these fast-growing (but often low-valued) trees provide enough shade so that shade-tolerant rain forest trees can begin to grow underneath them. The shade-tolerant trees will eventually overtake their predecessors, and establish the high rain forest once again. The process of succession in regenerating rain forest naturally is very time-consuming, but the end product is a very stable native forest community.

a. Effects on Water Quality--The method of log extraction is more significant in determining water quality effects than the fact of partial or complete tree removal. A well-executed clearcut is no more likely to cause sedimentation than a selective cut. The determining factor is the degree of soil and litter layer disturbance during logging. An undisturbed layer of herbaceous plants and decayed vegetable matter will stop the erosive force of rain as well as the tree canopy once did. If the soil and litter layer are severely disturbed during logging, however, erosion and sedimentation will occur at high rates. Natural regeneration is preferable to other methods of reforestation in such disturbed areas, because herbaceous vegetation will re-occupy the site within months and provide a protective soil cover. Manual replanting usually prolongs the period of soil exposure, and results in more sedimentation.

b. Effects on Soil Conservation--Erosion and sedimentation are discussed above. With natural regeneration of clearcuts, the soil is seldom exposed for very long, so breakdown of organic matter in the soil is very limited. Some soil nutrients may be lost by removal of wood, but most of the nutrients tied up in the trees are in the leaves and branches, which are left in the forest to decay and recycle nutrients.

c. Effects on Rare or Unique Natural Features--Clearcutting would have a devastating effect on laurier de rose, freshwater mangrove, and rare herbaceous plants. Both Jaco and Sisserou parrots are displaced by such activity for a very long period, since their nesting cavities are found only in very old rain forest trees, which are destroyed in clearcutting. If left undisturbed for several centuries thereafter, the parrots might re-inhabit older secondary forest, but the displacement period is rather extreme.

(Clearcutting and Natural Regeneration, continued)

d. Effects on Wildlife--Clearcutting followed by natural regeneration temporarily destroys the habitats of many native forest-dwelling creatures, but most affects birds that feed on certain tree species or nest in certain high places in a mature tree canopy. The time required to re-inhabit such an area will vary widely from one species to the next, depending upon feeding, breeding, and nesting habits.

e. Effects on Scenic Resources--Clearcutting is generally very unsightly when viewed close at hand, and remains so for a few years, until regeneration begins to hide the logging slash. For this reason, clearcutting is generally avoided in areas of high visual impact, i.e. immediately adjacent to major roads. From a distance, the visual effects of clearcutting depend upon the size of the cut and the shape of the cut. Large cuts tend to attract the attention of viewers. Blocks which are cut in geometric shapes (squares, rectangles, strips, etc.) stand out as extremely unnatural in appearance. Small, irregularly-shaped cuts are less obtrusive. Experience in North America and Europe indicates that popular opposition to clearcutting is aroused more by their <u>appearance</u> than by any other factor.

f. Effects on Genetic Diversity--Assuming that there are adequate seed trees nearby, natural regeneration helps insure that the genetic makeup of the forest is not altered to any great extent. It is important that the clearcut be complete. If given the opportunity, loggers will often leave trees standing that were not usable. These trees are often either genetically inferior or of low-valued species. If the Forestry Division does not require that these be felled, they will often re-seed the clearcut with inferior trees. Careful study of natural regeneration is needed to determine what species are likely to behave in this manner.

4. <u>Clearcutting and Replanting with Native Species</u>

This silvicultural technique requires that workers go in immediately after logging and replant selected species of trees native to Dominican rain forest. In a given area only one or two species are planted, because mixtures of more than two species are difficult for planters to handle. Artificial regeneration allows foresters to choose species of high value or fast growth, depending upon future wood needs. This technique is normally restricted to shade-intolerant species, due to the lack of shade in a clearcut. The use of native species rather than exotics insures that the trees planted are well-suited to local climatic conditions. Maintenance costs are high for the first few years, due to the necessity of cutting back vegetation that competes with the planted trees.

a. Effects on Water Quality--Soil erosion and sedimentation depend upon the degree of disturbance to surface soil and litter during logging, a function of logging technique, rather than clearcut vs. partial cut. Manual replanting may be more risky from an erosion standpoint than natural regeneration, because competing vegetation must be cut back periodically, thus exposing the disturbed soil to erosive forces of rainfall for an extended period.

(Clearcutting and Replanting with Native Species, continued)

b. Effects on Soil Conservation--In addition to the effects of logging itself, the process of replanting and subsequent maintenance cleanings may lead to a minor amount of soil compaction, due to continued human trampling. Also, the soil may suffer from loss of organic matter (due to periodic exposure during cleanings) and loss of certain nutrients if logging slash is burned to facilitate planting.

c. Effects on Rare or Unique Natural Features--Clearcutting is an inappropriate activity in areas with rare or unique natural vegetation. Sisserou and Jaco Parrots are permanently displaced by this silvicultural method; since planted trees are likely to be of high value for timber, and would never be allowed to reach over-maturity. Parrot nesting cavities are found only in very old, overmature trees. As for parrot feeding habitat, it is true that native species are more likely to provide food for parrots than exotic tree species, but monocultural or bi-cultural plantations would provide food only during the limited fruiting season of the particular species planted.

d. Effects on Wildlife--Native wildlife species are well adapted to the mixed forest found here under natural conditions. A mixture of tree species provides a variety of food, and since fruiting occurs at different seasons for different tree species, wildlife food is provided throughout the year. Thus, in addition to the temporary effects of clearcutting, wildlife will suffer from a reduction in the variety of food sources and nesting sites permanently.

e. Effects on Scenic Resources--The visual effects of clearcutting have already been described in 3e. The type of reforestation practiced makes very little difference from a scenic viewpoint, so long as it is successful.

f. Effects on Genetic Diversity--Since manual replanting is limited to one or two species, and competing species are systematically repressed, genetic diversity is seriously reduced, making the forest less adaptable to changing climatic and environmental conditions. Monocultural plantations are highly susceptible to destruction by disease and insect pests.

5. Clearcutting and Replanting with Exotic Species

This silvicultural technique differs from the previous one only in the type of trees replanted. Exotic tree species are not native to Dominica, but are planted here because certain ones have desirable characteristics. For example, teak and mahogany trees produce wood of great beauty and high value. Caribbean pine is a light, easily worked wood. Eucalyptus trees are noted for their fast growth. Still other exotic tree species are known for their disease and insect resistance, or a growth habit that maximizes the amount of usable wood in the trunk. As with replanting native species, the exotic trees are usually replanted in pure stands or mixtures of two species.

a. Effects on Water Quality--The effects are identical to those described for clearcuts which are replanted to native species. (B.4.a.)

b. Effects on Soil Conservation--The effects are identical to those described for clearcuts which are replanted to native species. (B.4.b.)

c. Effects on Rare or Unique Natural Features--Clearcutting is an inappropriate activity in areas with rare or unique natural vegetation. As with other managed forest plantations, growth of trees to over-maturity is not allowed to take place; thus preventing formation of parrot nesting cavities. From a parrot feeding standpoint, exotic species are even worse than replanting native trees. None of the commonly-favoured exotic trees have any value as a source of parrot food.

d. Effects on Wildlife--The effects on wildlife are likely to be worse than those associated with replanting native species. Local wildlife species are not adapted to make use of exotic tree species. One would expect a serious decrease in the variety of wildlife in areas planted to exotic species.

e. Effects on Scenic Resources--The visual effects of clearcutting have already been described (B.3.e.). The type of reforestation practiced makes very little difference from a scenic viewpoint, so long as it is successful.

f. Effects on Genetic Diversity--Exotic forest plantations tend to have a higher economic value than the native mixed forest, but certain other values are foregone. Monocultural plantations are highly susceptible to destruction by disease and insect pests. The original genetic diversity is destroyed or suppressed, making the forest less adaptable to changing climatic or environmental conditions.

6. In-situ Sawing

This is the traditional logging technique in Dominica. The tree is felled and sawn into boards on the spot, either by the traditional pitsaw or a portable Alaskan chain-saw mill. The log is maneuvered only very short distances, eliminating the need for mechanized skidders or cable systems. The sawn boards are of small enough dimensions that they can be carried to a road by hand. In-situ sawing is typically practiced under a light selective cutting system, because the range of species and tree sizes that can be handled is somewhat limited.

a. Effects on Water Quality--In-situ sawing is the least hazardous logging method, from a sedimentation standpoint. Disturbance of the soil and surface litter is minimal, since whole logs are not skidded out. The need to transport cut boards out by hand may, however, tempt sawyers to build crude temporary roads to bring the transport closer to the sawing area. Such roads, if not well laid out, may be a significant source of sediment.

b. Effects on Soil Conservation--Since logs are not skidded for any significant distance, soil compaction is minimal. Other effects on the soil depend more upon the silvicultural method used for reforestation than on logging method.

c. - f. Effects on Rare or Unique Natural Features, Wildlife, Scenic Resources, and Genetic Diversity--Effects depend upon silvicultural technique used, rather than logging method.

7. Tractor Skidding

In this logging method, the trees are felled, tops and limbs are cut off, and the trunk is sawn into suitable lengths of log. The logs are then skidded to a yarding or pickup area by means of rubber-tired skidder or tractor. At the yarding, the logs are lifted onto trucks and removed by road. During tractor skidding, one end of the log is lifted, the other end drags along the ground. Ideally, the skidding distance from stump to landing should be less than 300 metres. Tractor skidding is inappropriate in areas with slopes of over 15 degrees, so that large areas of Dominican forest are too steep for this logging method.

a. Effects on Water Quality--Of all the common logging methods, tractor skidding entails the highest risk of sedimentation. One reason is that the soil and surface litter layer is severely disturbed by tractor tires and logs being drug along behind. Another reason is that the short skidding distance requires a dense network of logging roads. Sedimentation can be minimized by prohibiting such skidding on slopes of more than 15 degrees, and by designing logging areas so that most logs are skidded across the slope, rather than up or down the hill. There are very few areas of commercial forest in Dominica that can be logged with tractors without severe water quality problems, due to steep slopes and high rainfall.

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(Tractor Skidding, continued)

b. Effects on Soil Conservation--In addition to disturbing surface soil layers, tractor skidding can cause soil compaction, particularly in the deep clay soils of the rain forest zone. Compaction will inhibit free movement of water through the soil profile and damage soil structure, which is important for optimal plant growth. Thus, reforestation success and forest growth rates may suffer, though over a period of years, the soil will regain its former qualities if left undisturbed.

c. and d. Effects on Rare or Unique Natural Features and On Wildlife--Effects depend upon silvicultural techniques, rather than on logging method.

e. Effects on Scenic Resources--Usually the scenic effects dpend upon silvicultural technique (clearcut vs. selective cut), but in the case of tractor logging, the degree of surface disturbance is so great as to make the logging area unusually unsightly when viewed at close range.

f. Effects on Genetic Diversity--Effects depend upon silvicultural technique, rather than logging method.

8. <u>High Lead Cable Skidding</u>

In this logging method, the logs are skidded to the landing by means of a long cable attached to an elevated pulley. The pulley may be mounted on a high tree trunk or a metal tower. The high lead system eliminates tractors traversing the logging area. Also, the elevated pulley reduces somewhat the amount of weight being dragged along the surface, particularly as the log is brought closer to the tower or spar tree. The high lead system works best when the skidding distance is less than 300 metres, and on slopes of less than 30 degrees.

a. Effects on Water Quality--The risk of sedimentation is somewhat lower with high lead skidding than with tractor skidding. Soil and litter layer disturbance is less, because tractors do not traverse the area and because of the reduced weight on the skidded end of the log. Even so, much of the logging area is disturbed, particularly near the tower or spar tree. The potential for sedimentation is high for moderate to steep slopes, and even higher if loggers are allowed to skid down the slopes, rather than up or across.

b. Effects on Soil Conservation--The soil compaction described under tractor skidding is experienced to a somewhat lesser extent with high lead skidding, since only logs traverse the area, and not heavy tractors.

c. - f. Effects on Rare or Unique Natural Features, Wildlife, Scenic Resources, and Genetic Diversity--These effects are dependent upon silvicultural technique, rather than logging method.

9. Skyline Cable Logging

In this logging method, the logs are extracted by means of overhead cables suspended between two towers or spar trees. The main overhead cable runs up and down the hill. A secondary cable is connected to the first, and is attached to the logs for extraction. The logs are skidded a short distance across the slope, then the main cable lifts the log off the ground and brings it to the top or bottom of the slope. Such a system can be used on slopes up to 40 degrees, and can be used to extract logs at distances up to 1300 metres.

a. Effects on Water Quality--The skyline cable system is the only logging system (excluding in-situ sawing) that enables steep slopes to be logged without high rates of soil erosion and sedimentation. Skidding disturbance is limited to short distances across the slope, which is unlikely to trigger sedimentation. The long yarding distance (1300 metres rather than 300) enables logging to be done with fewer roads per hectare, thus reducing the risk of sedimentation from roads.

b. Effects on Soil Conservation--The soil compaction experienced during tractor or high lead skidding is all but eliminated with skyline cables.

c. Effects on Rare or Unique Natural Features--Effects depend upon silvicultural technique, rather than logging method.

d. Effects on Wildlife--These effects depend primarily on silvicultural technique, but the need for fewer roads with skyline cable logging is an advantage for wildlife species that are able to use logged areas. Fewer roads mean that hunter access and human disturbance are less than in areas logged by tractor or high lead cable.

e. Effects on Scenic Resources--These effects depend primarily on silvicultural technique, but the limited road system associated with skyline logging is less obtrusive than with other systems.

f. Effects on Genetic Diversity--Effects depend upon silvicultural technique, rather than logging method.

C. AGRICULTURAL PRACTICES

1. Road-building and Maintenance

Agricultural feeder roads differ from logging roads in a few respects. First, they are all permanent roads, built to withstand continous traffic (ideally), unlike some of the secondary logging roads, which are used only during extraction in a given area. The second difference is that a much less dense road network is needed to service agricultural areas. This is because the agricultural products are relatively light and high in value, making it possible to hand-carry them some distance to the road. With the exception of sawn boards and poles, forest products must be removed by equipment that requires roads that reach very near the active logging area.

a. Effects on Water Quality--There are several well-designed, well-maintained surfaced feeder roads in Dominica which probably contribute little or no sediment to downstream areas. These roads are exceptions. The vast majority of agricultural roads create water quality problems. In fact, agricultural feeder roads are probably the number one contributor to stream sedimentation in Dominica. As with logging roads, agricultural roads can cause serious sedimentation if they are unsurfaced, located on steep slopes, have steep roadbed grades, or have inadequate bridges and culverts. Poor maintenance of ditches and culverts causes runoff overflow and sedimentation long after initial construction. Feeder roads built along continuous ridges are the most desirable where such an alignment is possible. These ridgeline roads tend to have gentle grades and avoid the numerous stream-crossings associated with valley-bottom roads.

b. Effects on Soil Conservation--Effects on soil are limited to the erosion potential near the roadbed described above.

c. Effects on Rare or Unique Natural Features--In Dominica, feeder road construction encourages agricultural clearing in forested areas some distance from the end of the road. Thus, indirectly, it is destructive of rare or unique natural features and the endangered parrots.

d. Effects on Wildlife--Agricultural roads are in continuous use, and thus act as barriers or impediments to wildlife movement. Some animals will be killed while trying to cross the road, others will avoid the road completely. The effect is not so noticeable as with logging roads, since many wildlife species have already ceased using the cleared agricultural areas before the road arrives.

e. Effects on Scenic Resources--Poorly located and designed roads can have a negative scenic impact. However, many of the roads which allow people to view the "scenery" of Dominica were originally built for agricultural purposes. Agricultural clearings along these roads permit travelers to look beyond their immediate surroundings, to distant mountain peaks or valleys below.

f. Effects on Genetic Diversity--The effects of the roadbed itself are negligible, but since roads are necessary for agriculture to take place, the indirect effect is quite marked.

2. Shifting Cultivation

Shifting cultivation is a traditional agricultural practice, whereby an area of land is cleared, cultivated for a few years, then abandoned. Secondary forest then re-occupies the site until the area is cleared once again. This cycle is repeated again and again. Although this system requires large areas of land to support each farmer, it has the advantage of minimizing fertilizer and agricultural chemical costs. The land is cultivated only until the soil fertility is depleted or insect/disease levels become very high, then it is abandoned for "new" land. During the fallow period, the secondary forest helps to rehabilitate the soil and rid the area of agricultural pests. Shifting cultivation was once more common than it is now in Dominica, primarily because population pressure prevents land from being allowed to fallow. Some of the steep marginal areas which were productive under shifting cultivation have slowly become permanent farmland, to the detriment of the land and the farmers.

a. Effects on Water Quality--For a given land area, one would expect fewer water pollution problems where shifting cultivation is practiced than if the entire area were under permanent cultivation, since much of the land area is in secondary forest fallow at any given time. Certainly, shifting cultivation all but eliminates the need for dangerous agricultural chemicals, which are potential toxic pollutants in permanent agricultural areas. Several characteristics of shifting cultivation lead us to expect high levels of soil and sedimentation, however. Farmers practicing shifting cultivation tend to utilize much steeper slopes than they could possibly cultivate permanently. The high rates of soil loss from these slopes are tolerable to the farmer only because he is able to abandon the plot and move on to fresh land. Also, since a given plot is cultivated only a few years, the crops planted tend to be root crops, which provide much less erosion protection than tree crops. The third reason for high sedimentation is that soil loss is usually greatest during initial clearing and establishment of crops. Once crops are established, soil losses usually diminish. Since new areas are cleared every two or three years with shifting cultivation, the critical crop establishment period is repeated at frequent intervals.

(Shifting Cultivation, continued)

b. Effects on Soil Conservation--Erosion effects are described above. During the period of cultivation, dramatic changes in the soil take place. Organic matter is lost very rapidly, making the soil less permeable to rainfall and less stable. Nutrient levels drop steadily, and major nutrients are usually not replenished with fertilizer. Some soil compaction may occur. Nonetheless, if shifting cultivation is properly practiced with adequate fallow periods, the soil has a chance to recover. Secondary forest replaces organic matter and nutrients, provides a protective cover to prevent further erosion, and the tree roots help restore the compacted soil. This restorative process has allowed shifting cultivators in many parts of the world to have continuously high crops yields for many generations. The problems come when farming pressure increases, so that the fallow period is shortened or eliminated, as has happened in Dominica. Without an adequate fallow period, the soil never has a chance to recover from the last cultivation, and soil properties steadily deteriorate.

c. Effects on Rare or Unique Natural Features--Shifting cultivation is destructive of rare or unique natural vegetation, and both endangered parrot species, since their old-growth forest habitat is supressed.

d. Effects on Wildlife--A few wildlife species are able to live very well in the secondary forest which sprouts up after a plot is left for fallow. The dense tangle of forest growth limits human passage to some extent and provides cover. Native species which are adapted only to high rain forest conditions suffer from shifting cultivation, however, and the frequent human presence discourages many wildlife species from using the area.

e. Effects on Scenic Resources--Shifting cultivation is often practiced on steep land, which means that the clearings are highly visible from many points. The clearings are particularly obtrusive when farmers burn the area, leaving a blackened parcel in the midst of an otherwise green hillside.

f. Effects on Genetic Diversity--The secondary forest which establishes itself during the fallow period is nearly always naturally seeded, and is highly diverse. Overall, genetic diversity is reduced, however, because large areas are occupied by secondary species which would, under natural conditions, support a variety of species found only in old-growth forest.

3. Permanent Tree Crops

Tree crops like coconut, lime, citrus, bay, and cocoa are often grown in pure stands. Mango, nutmeg, guava, tamerind, and other minor tree crops are usually scattered throughout other types of cultivation or in secondary forest. Some tree crops require cultural practices such as foliar spraying, clearing of undergrowth, and fertilizer applications. Soil disturbance (once trees are established) is usually minimal.

a. Effects on Water Quality--Fertilizers and foliar sprays are potential sources of water pollution, but they are little used in Dominica, or applied so sparingly as to present little danger of pollution by nutrients or toxic chemicals. Tree crops with a modest undergrowth of grasses, forbs, or mulch provide little opportunity for soil erosion and sedimentation to occur. Sedimentation is most likely to occur during initial planting of the trees or in areas where clearing of undergrowth has been overly zealous. If the undergrowth or leaf mulch is completely cleared away, exposing bare soil, stream sedimentation will result, particularly on moderate to steep slopes. Tree crops should not be established in areas of "high agricultural erosion hazard" as defined elsewhere in this report, due to the risk of erosion and sedimentation.

b. Effects on Soil Conservation--Nutrient depletion is common in many tree crop areas. Fruits, leaves (in the case of bay), and pruned branches are removed year after year, thus preventing recycling of nutrients back to the soil. Commercial fertilizers or manure can remedy this to some extent. Soil compaction is another common problem, due to the action of human trampling during harvest and maintenance, livestock, and sometimes vehicles, over a long period of time. Soil compaction and reduced levels of organic matter make the soil less permeable to water, more erosion-prone, and less productive with time.

c. Effects on Rare or Unique Natural Features--Tree crops cultivation is destructive of rare or unique natural vegetation and both endangered parrot species.

d. Effects on Wildlife--With the exception of a few wildlife species which have adapted to make some use of tree crops for food or shelter, tree crop cultivation is destructive to wildlife habitat.

e. Effects on Scenic Resources--Tree crops are by no means unsightly, and they add variety to the landscape.

f. Effects on Genetic Diversity--Natural genetic diversity is destroyed by tree crop cultivation.

4. Permanent Bananas

Included in this catagory are bananas, plantain, and several other banana-like crops. Cultural practices associated with permanent banana cultivation include frequent foliar spraying with oil or oil with fungicide, clearing of all undergrowth, fertilizer application, and periodic removal of old banana plants followed by replanting. The level of human activity in the fields is considerably higher with bananas than with tree crops, thus increasing the impact on the environment.

a. Effects on Water Quality--Aerial sprayings of oil or fungicide-oil-mix may affect aquatic life to some extent. With aerial spraying, it is nearly impossible to avoid spraying directly onto surface stream water. While it is known that both oil and fungicides do have deleterious effects on aquatic life, it is not known whether the concentrations caused by banana spraying are high enough to warrant concern. Hand-spraying is less effective than aerial for control of leaf spot, but the spray is less likely to be applied to stream water. Risk of nutrient pollution from fertilizer is low, since fertilizer is applied by hand directly to the base of the plant, and is used sparingly in any case. Frequently, banana "trash" and reject bananas are thrown into streams. This degradable organic matter reduces the dissolved oxygen content of the streamwater, thus reducing the capacity of the stream to support fish and other aquatic creatures. Finally, in controlling growth of competing vegetation, farmers often use a cutlass to clear down to bare soil. This exposed bare soil is an invitation to erosion and sedimentation. Use of herbicides to kill undergrowth is also common, but the erosion effects are somewhat less severe, since the dead vegetation acts as a soil mulch. Due to erosion and sedimentation hazard, bananas should not be planted in areas of "high agricultural erosion hazard" or "moderately high agricultural erosion hazard" as defined elsewhere in this report.

b. Effects on Soil Conservation--Soil nutrient depletion is rapid with bananas, and regular fertilization is required if cultivation is to continue. Soil compaction also occurs rapidly, due to the constant movement of farmers through the area to harvest, spray, and maintain the crop. The need for clean fields (for pest control) brings about rapid depletion of soil organic matter. Thus, productivity is likely to drop in older fields despite fertilization, due to deterioration of soil properties.

c. Effects on Rare or Unique Natural Features--Cultivation is destructive of rare or unique natural vegetation and both endangered parrot species.

d. Effects on Wildlife--Very few wildlife species derive any habitat benefits from banana areas. Those that do, like the bananaquit, are considered agricultural pests.

e. Effects on Scenic Resources--Banana cultivation is not unsightly and may add variety to the visual landscape, but is visually obtrusive when found in otherwise forested areas.

f. Effects on Genetic Diversity--Natural genetic diversity is destroyed by banana cultivation.

5. Permanent Root Crops and Row Crops

Included in this catagory are dasheen, tanya, carrots, cabbage, tomato, maize, beans, and many other crops which require tillage or whose roots are harvested. Growing these crops requires that the soil be disturbed at frequent intervals. Fertilizers, pesticides, and fungicides are commonly employed.

a. Effects on Water Quality--Since the soil is frequently disturbed, it is vital that these crops not be planted on steep slopes. Not only will this cause soil erosion and sedimentation, but fertilizer and toxic chemicals are usually carried into the water on soil particles which have eroded away. Due to these water quality hazards, root crops and row crops should never be planted in areas of "high agricultural erosion hazard" or "moderately high agricultural erosion hazard", as defined elsewhere in this report.

b. Effects on Soil Conservation--Loss of nutrients, reduced organic matter, and soil compaction are all effects common to this type of farming, and must be counteracted by various soil amendments and practices, if productivity is to be maintained.

c. Effects on Rare or Unique Natural Features--Cultivation is destructive of rare or unique natural vegetation, and both endangered parrot species.

d. Effects on Wildlife--With the exception of a few wildlife species which have adapted to make use of crops for food (wild pig, manicou, etc.) cultivation is destructive to wildlife habitat. Even when crops provide wildlife food, they provide very little wildlife shelter.

e. Effects on Scenic Resources--Different crops add variety to the rural landscape, but are visually obtrusive when found in otherwise forested areas.

f. Effects on Genetic Diversity--Natural genetic diversity is destroyed by permanent cultivation.

D. VILLAGE AND URBAN USES

Included in this catagory are all the land uses which require substantial alteration of vegetation or landform, such as dwellings, industrial facilities, mining areas, business facilities, playing fields, airports, etc. Human activity is concentrated in these areas, making them primary sources of sewage, solid waste, and other pollutants of land and water. In Dominica, livestock grazing also takes place in and near village and urban areas, thus concentrating livestock wastes as well. In the urban areas, raw sewage is dumped directly into the streams or the sea. In the villages human wastes are usually left in any convenient place. Sanitary septic systems and sealed-vault latrines are utilized only by a small proportion of the population. There are no sanitary landfills on the island, so solid waste is placed in exposed dumps or the sea, or simply thrown down a steep hillside.

a. Effects on Water Quality--Given the present state of waste disposal practices in Dominica, village and urban areas nearly always cause significant water quality degradation, particularly with bacterial contamination and degradable organic matter. Much of this water pollution is avoidable, but it requires construction of treatment and disposal facilities, and changes of habits and attitudes. High rates of sedimentation are often experienced downstream from urban construction, caused by soil disturbance from construction of roads, driveways, and land leveling for building sites. In addition, many villages have large areas of permanently bare soil (due to constant trampling) which are sources of stream sediment. Mining areas are also a prime source of sediment if runoff is not controlled. Changes in streamflow regime often accompany human settlement and urbanization. Soil surfaces are compacted or paved over, thus preventing rainfall from soaking into the soil and thence to the underground water table. Whenever rain falls, it runs off the land surface immediately, making streamflow very high during storms and lower during dry periods (since the water table is deprived of this water). Thus, risk of flooding and lowered minimum streamflows often result from urbanization in a given watershed.

b. Effects on Soil Conservation--Most village and urban uses do not require that the soil be used as a medium for plant growth, but rather as a construction material. As a result, nutrient losses, compaction, loss of organic matter, and other soil disturbances (except erosion) which do occur are not of overwhelming concern.

c. Effects on Rare or Unique Natural Features--Village and urban uses are completely destructive of rare or unique natural vegetation, and both endangered parrot species. Natural features such as waterfalls, soufrieres, etc. are degraded by too much urban activity nearby.

d. Effects on Wildlife--Wildlife species derive no habitat benefits from urban and village areas.

e. Effects on Scenic Resources--The effects of village and urban structures on the scenic resource are highly variable and very subjective. There are numerous examples of urban eyesores in Dominica, and some very scenic structures as well.

f. Effects on Genetic Diversity--Natural genetic diversity is destroyed by village and urban settlement .

Appendix II

COMMON NATIVE AND EXOTIC PLANT SPECIES OF DOMINICA

Acajou or red cedar	Cedrella mexicana* (C. odorata)
Acomat St. Christophe	Mastichodendron foetidissimum*
Acoucoua	Antirhea coriacea
Adegon	Arsidia sp.
Ananas montagne	Pitcairnia spicata
Angelin	Geoffroea inermis* (Andira inermis)
Aralie (rain forest kaklin)	Clusia plukenetii or rosea
Avocado pear	Persia americana
Babara	Diospyros revoluta* (D. ebenaster)
Balata	Manilkara bidentata*
Balate	Pouteria fabrilis* (Oxythece pallida)
Bastard gommier	Bursera simarouba*
Blue mahot	Hibiscus elatus*
Bois bande	Richeria grandis*
Bois blanc	Simarouba amara*
Bois bre	Cordia sulcata*
Bois canon	Cecropia peltata*
Bois cote	Tapura latifolia* (T. antillana)
Bois d'inde or bay rum tree	Pimenta racemosa* (P. acris)
Bois de fer	Chionanthus compactus* (Linociera caribaea)
Bois de rose or cypre	Cordia alliodora* (C. gerascanthoides)
Bois diable	Licania ternatensis*
Bois d'orme	Guazuma ulmifolia*
Bois flot or balsa	Ochroma pyramidale*
Bois gin	Calyptranthes fasciculata
Bois jaune or laurier jaune	Aniba bracteata*
Bois lezard or bois lizard	Vitex divaricata*
Bois mang	Pterocarpus officinalis
Bois perdux or bois perdrix	Heisteria coccinea*
Bois pichette	Ixora ferra
Bois pin	Talauma dodecapetala*
Bois pissat	Tabernaemontana citrifolia
Bois pistolet blanc	Guarea glabra
Bois pistolet rouge	Guarea macrophylla*
Bois riviere	Chimarrhis cymosa*
Bois rouge	Cyrilla racemiflora or arborescens
Bois septans	Meliosma Herbertii*
Bois tan	
Bois violon	Guatteria caribaea*
Breadfruit	Artocarpus altilis* (A. incisa)
Cachiman falaise	Marila racemosa*
Cachiman maron	Annona glabra*
Caconier rouge	Ormosia monosperma*
Caconier blanc	Ormosia krugii*
Caimite	Pouteria discolor
Campeche or logwood	Haematoxylon campechianum*
Carapite	Amanoa caribaea*
Caribbean pine	Pinus caribaea*
Chataignier grandes feuilles	Sloanea Massoni or truncata
Chataignier petit coco	Sloanea berteriana

Chataignier ti feuilles	Sloanea caribaea
Coco poule	Cordia elliptica* (C. laevigata)
Contrevent	Pouteria semecarpifolia*
Crabwood	Carapa guianensis*
Cre´ cre´	Miconia spp. and others
Figuier	Ficus spp.
Flamboyant	Delonix regia
Fleur montagne	Lobelia cirsifolia*
Galba	Calopyllum Calaba* (C. antillanum)
Gommier	Dacryodes excelsa*
Graines bleues or caca rat	Symplocos martinicensis*
Grey cedar or white cedar	Tabebuia pallida* (T. pentaphylla)
Guiavier or wild guava	Eugenia coffeifolia
Gumbo montagne	Hibiscus tulipiflorus*
Honduras mahogany	Swietenia macrophylla*
Hybrid mahogany	Swietenia aubrevilleana*
Kaklin (cloud forest)	Clusia venosa*
La glu	Sapium caribaeum*
Large-leaf or Honduras mahogany	Swietenia macrophylla*
Laurier	LAURACEAE
Laurier de rose	?
Laurier marbre	LAURACEAE
Laurier poivre	Hieronyma caribaea*
L'encens	Protium attenuatum*
Le´pine´	Zanthoxylum monophyllum*
Locust or courbaril	Hymenaea Courbaril*
Mahot cochon	Sterculia caribaea*
Mahot piment	Daphnopsis americana ssp. caribaea*
Mangle blanc	Symphonia globulifera* (Moronobea coccinea)
Mangle rouge	Tovomita Plumieri*
Mango	Mangifera indica
Mapou	Pisonia fragrans*
Mauricif	Byrsonima martinicensis
Merise or couroupoume	Myrcia citrifolia*
Mille branches	Margaritaria nobilis* (Phyllanthus nobilis)
Olivier	Terminalia buceras
Pain d'epice	Pouteria multiflora*
Palmiste	Euterpe dominicana*
Palmiste montagne	Prestoea montana* (Euterpe globosa)
Pipirie	Pithecellobium Jupumba*
Pois doux marron	Inga ingoides*
Pommier	Dussia martinicensis*
Pourier	Tabebuia pallida*
Quinquina	Exostema caribaeum or sanctae-luciae
Radegond	MYRTACEAE or Catalpa longissima?

Raisinier bord de mer or sea grape	Coccoloba uvifera*
Raisinier grand feuille	Coccoloba pubescens*
Raisinier montagne	Podocarpus coriaceus*
Red cedar	Cedrella mexicana* (C. odorata)
Saman	Pithecellobium saman
Savonette	Lonchocarpus pentaphylla*
Serrette or bois tan	Byrsonima coriacea var. spicata*
Staghorn (club moss)	Lycopodium meridianum
Swamp bloodwood	Pterocarpus officinalis
Teak	Tektona grandis* (Tectona grandis)
Ti baume	Croton fragrans
Ti citron (rain forest)	Ilex Macfadyenii*
Ti citron (cloud forest)	Ilex sideroxyloides or Ilex nitida
Ti feuille	Freziera undulata*
Tree fern	Cyathea spp.
West Indian mahogany	Swietenia mahogani*
White cedar or grey cedar	Tabebuia pallida* (T. pentaphylla)
Yanga	Geonoma pinnatifrons*
Yellow sanders	Zanthoxylum flavum
Zaman or almond	Terminalia catappa*
Zicaque or fat pork (littoral)	Chrysobalanus icaco
Z'Olivier	Buchenavia capitata*
Zoranger blanc	Swartzia caribaea*
Zoranger noir	Swartzia simplex
Zyeux crabbe (rain forest)	Eugenia domingensis
Zyeux crabbe (montane thicket)	Myrcia fallax

NOTES: An asterisk (*) indicates that the scientific name follows the newest available nomenclature, that of Jacques Fournet (1978) in "Flore Illustree des Phanerogames de Guadeloupe et de Martinique". Institut National de la Recherche Agronomique, Paris, France. Scientific names in paranthesés are older scientific names still in use in some Dominican literature.

Appendix III

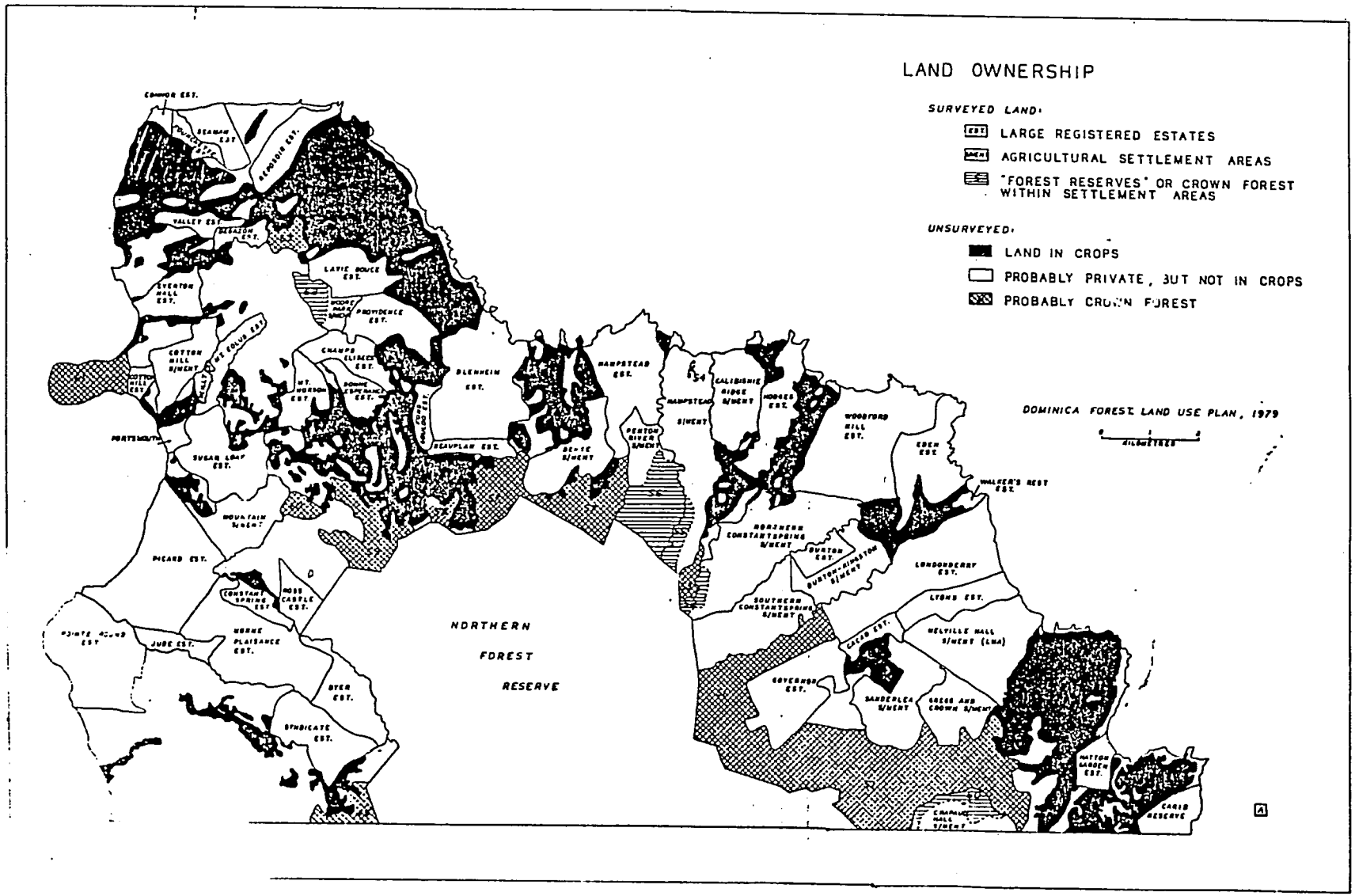
ENGLISH EQUIVALENTS OF METRIC MEASUREMENTS USED

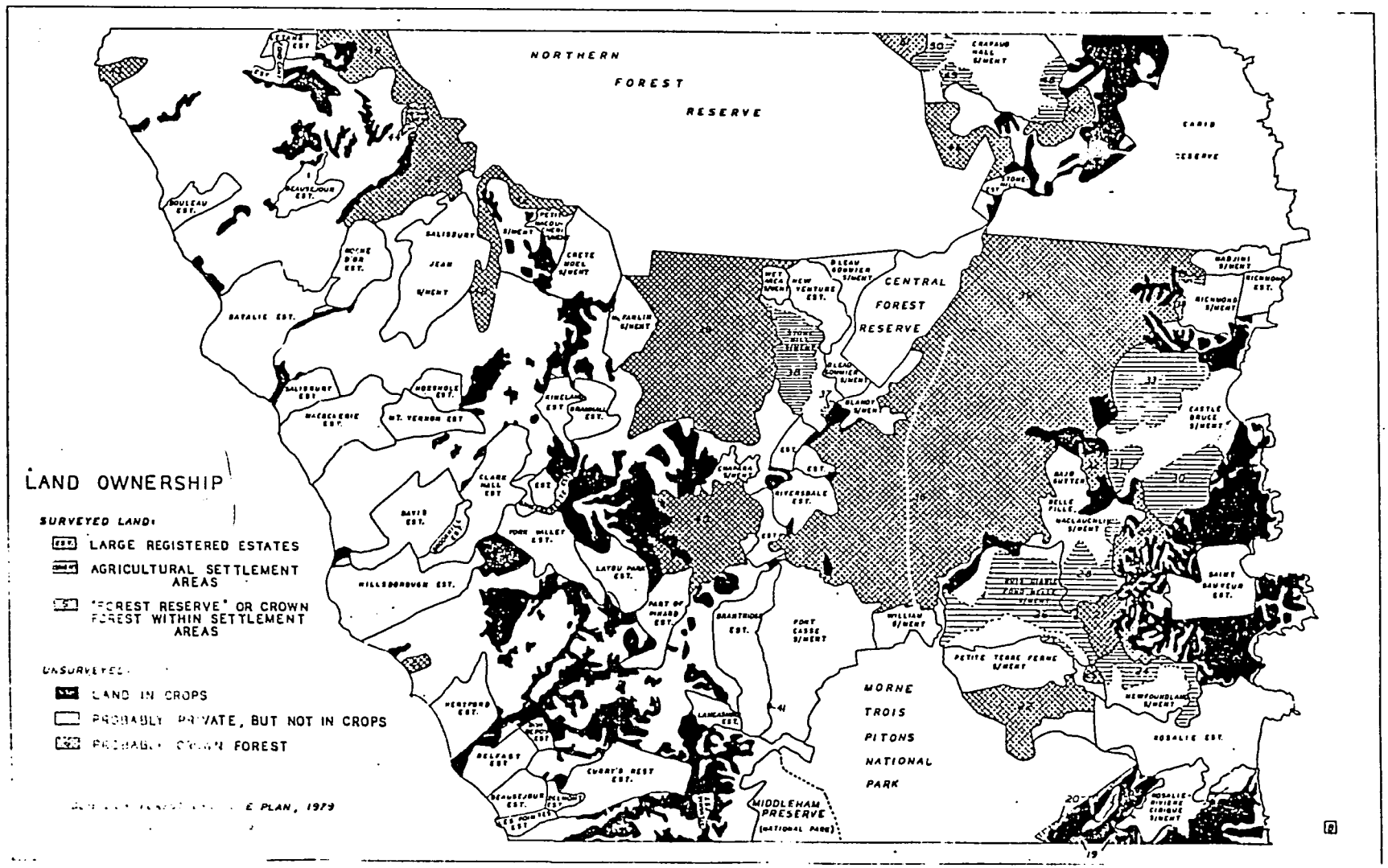
Length		
1 centimetre (cm.)	=	0.393701 inch
1 kilometre (km.)	=	0.621371 mile
1 metre (m.)	=	3.28084 feet
Area		
1 square centimetre (cm^2)	=	0.155000 square inch
1 hectare (ha.)	=	2.47105 acres
1 square kilometre (km^2)	=	0.386102 square mile
1 square metre (m^2)	=	10.7639 square feet
Volume or Capacity		
1 litre (l.)	=	0.264172 gallon (U.S.)
1 cubic metre (m^3)	=	35.3147 cubic feet
1 cubic metre expressed as timber volume	=	210 board feet sawn lumber, highly approximate*
Weight		
1 gram (g.)	=	0.035274 ounce
1 kilogram (kg.)	=	2.20462 pounds
1 tonne (t.)	=	1.10231 tons (of 2,000 lb.)
Ratios		
1 kilogram per cubic metre (kg/m^3)	=	0.062428 pounds per cubic foot
1 square metre per hectare (m^2/ha)	=	4.35600 square feet per acre
1 cubic metre per hectare (m^3/ha)	=	14.2913 cubic feet per acre
1 tonne per hectare (t/ha)	=	0.446090 ton (of 2000 lbs.) per acre

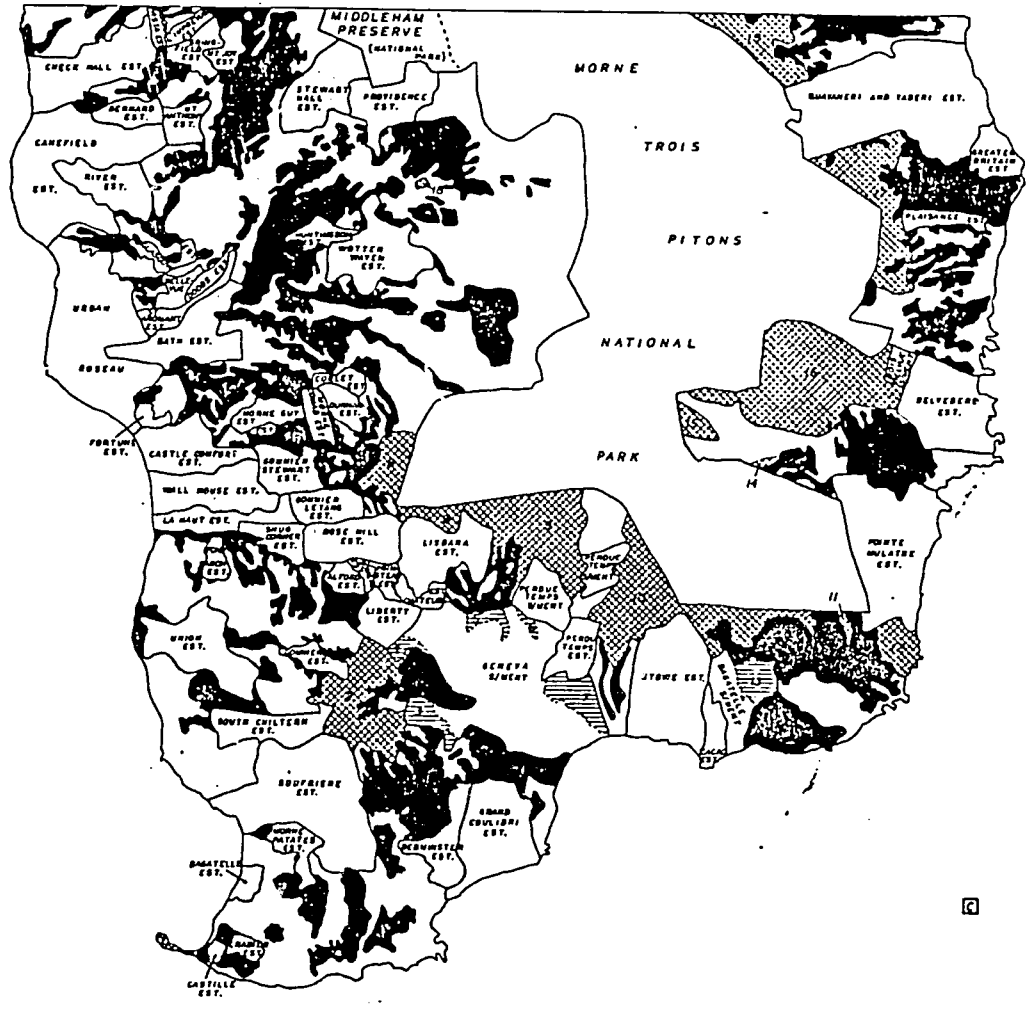
* The actual yield of sawn lumber from round sawtimber varies widely, depending upon the method of log volume estimation, type of sawmill used, and many other factors.

Appendix IV

DETAILED MAPS OF LAND OWNERSHIP


LAND OWNERSHIP
SURVEYED LAND:
LARGE REGISTERED ESTATES
AGRICULTURAL SETTLEMENT AREAS
"FOREST RESERVES" OR CROWN FOREST WITHIN SETTLEMENT AREAS
UNSURVEYED:
LAND IN CROPS
PROBABLY PRIVATE, BUT NOT IN CROPS
PROBABLY CROWN FOREST
DOMINICA FOREST LAND USE PLAN, 1979
NORTHERN FOREST RESERVE
CARIB RESERVE


LAND OWNERSHIP
SURVEYED LAND:
LARGE REGISTERED ESTATES
AGRICULTURAL SETTLEMENT AREAS
"FOREST RESERVE" OR CROWN FOREST WITHIN SETTLEMENT AREAS
UNSURVEYED:
LAND IN CROPS
PROBABLY PRIVATE, BUT NOT IN CROPS
PROBABLY CROWN FOREST
NORTHERN FOREST RESERVE
CENTRAL FOREST RESERVE
MORNE TROIS PITONS NATIONAL PARK
MIDDLEHAM PRESERVE (NATIONAL PARK)
BOULEAU EST.
BEAUVEJOUR EST.
SALISBURY
JEAN S/MENT
CRETE HOEL S/MENT
BATALIE EST.
MT. VERNON EST
KINGLAND EST
CLARE HALL EST
DAVID EST.
FORT VALLEY EST.
LATOU PARK EST.
HILLSBOROUGH EST.
HERTFORD EST.
BELFAST EST
CHAR'S REST EST.
LANCASHIRE EST.
FORT CASSE S/MENT
WILLIAM S/MENT
PETITE TERRE FERME S/MENT
NEWFOUNDLAND S/MENT
ROSALIE EST.
SAINT SAUVEUR EST.
CASTLE BRUCE S/MENT
RICHMOND S/MENT
CARIB RESERVE



LAND OWNERSHIP

SURVEYED LAND:

- LARGE REGISTERED ESTATES
- AGRICULTURAL SETTLEMENT AREAS
- "FOREST RESERVES" OR CROWN FOREST WITHIN SETTLEMENT AREAS

UNSURVEYED:

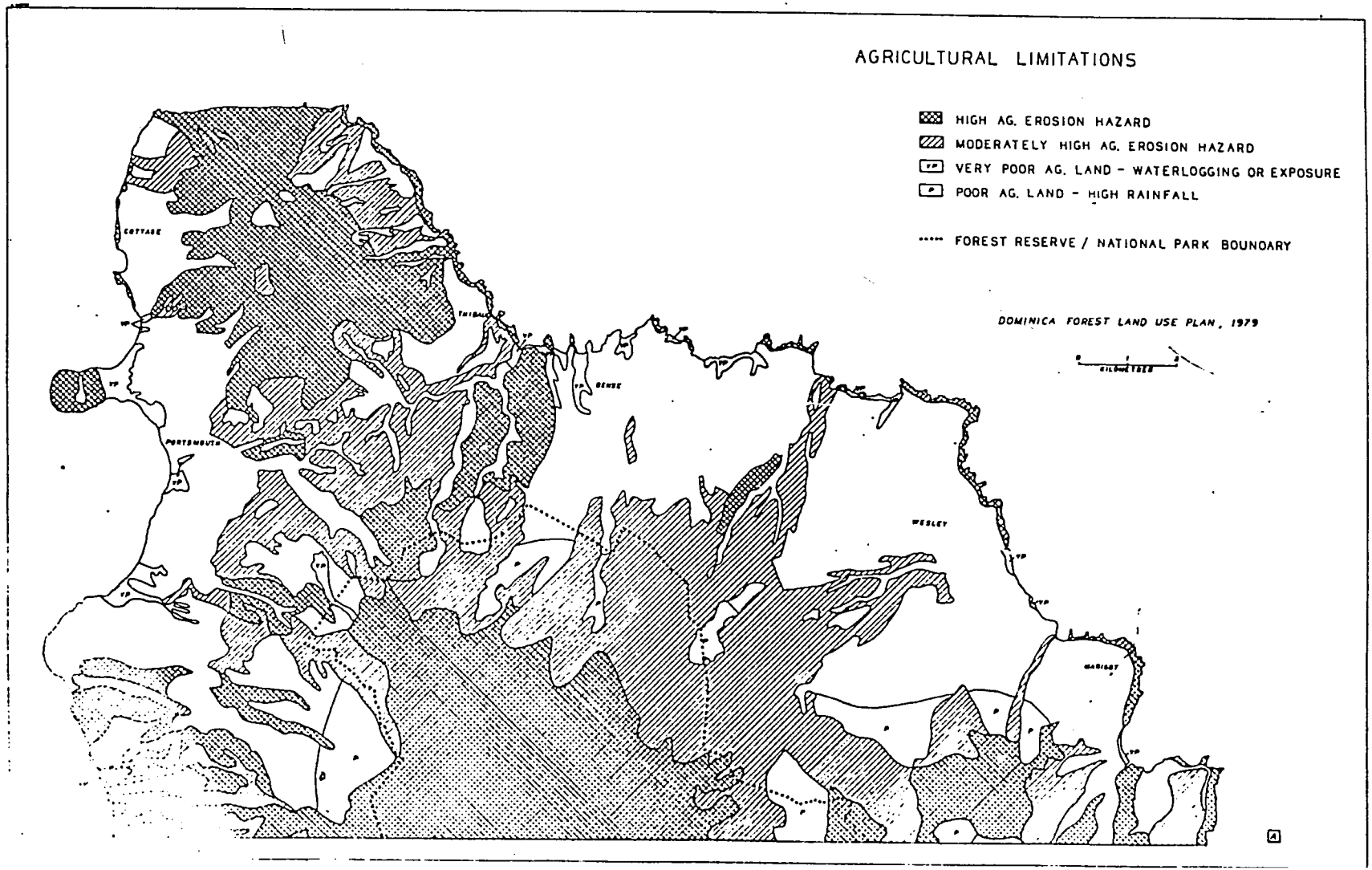
- LAND IN CROPS
- PROBABLY PRIVATE, BUT NOT IN CROPS
- PROBABLY CROWN FOREST

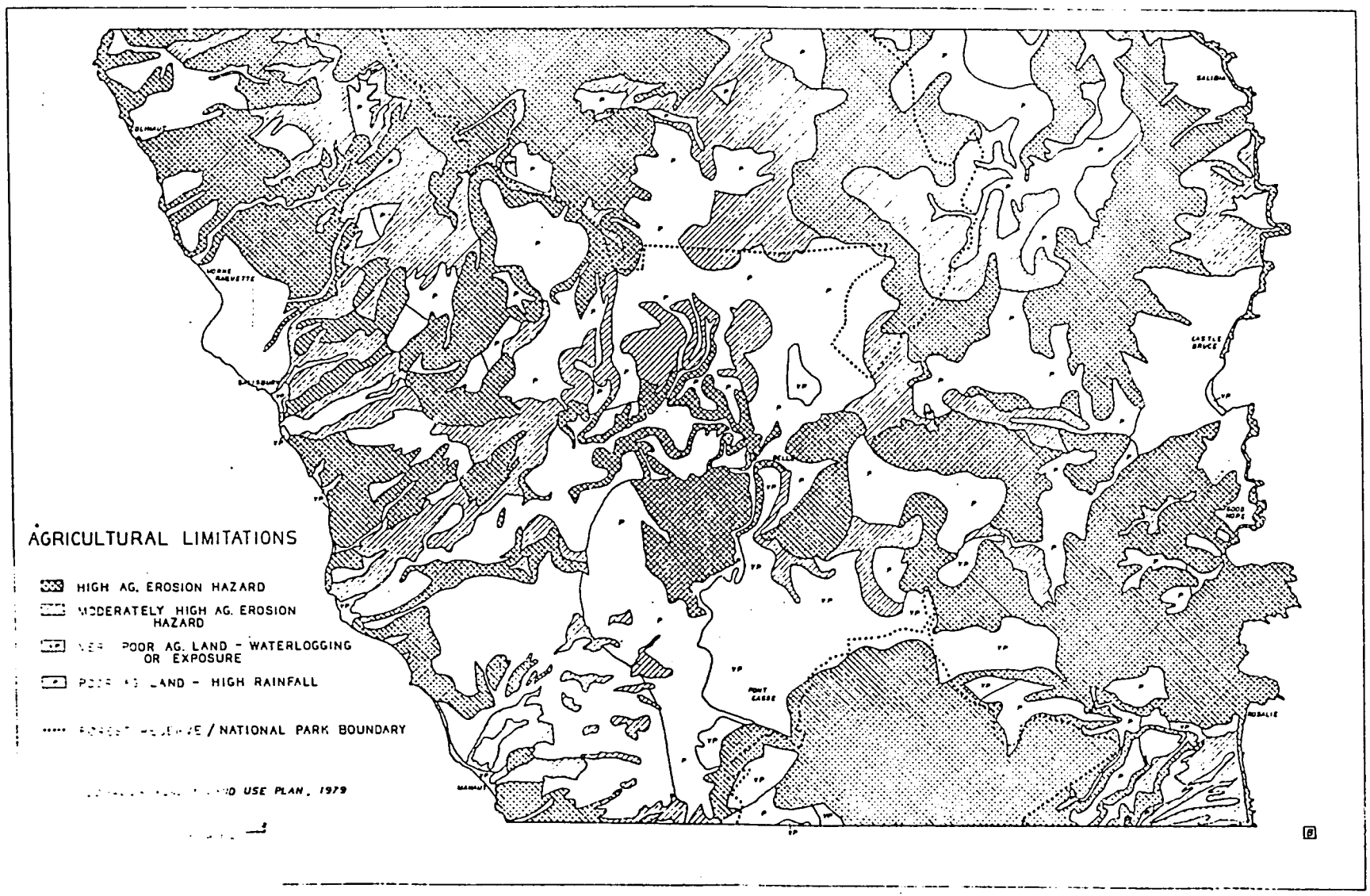
[illegible] FOREST LAND USE PLAN, 1979

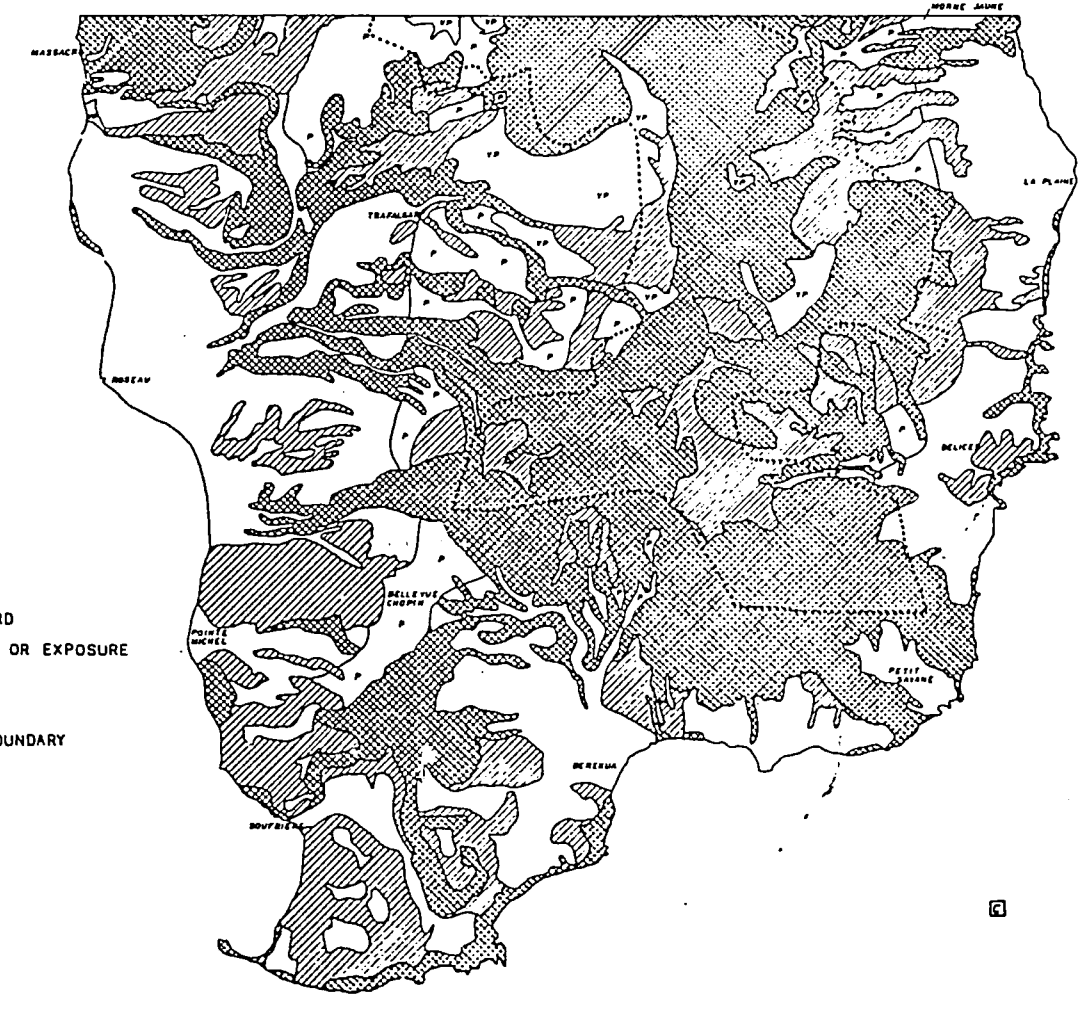
[illegible]

Appendix V

DETAILED MAPS OF AGRICULTURAL LIMITATIONS


AGRICULTURAL LIMITATIONS
HIGH AG. EROSION HAZARD
MODERATELY HIGH AG. EROSION HAZARD
VP VERY POOR AG. LAND - WATERLOGGING OR EXPOSURE
P POOR AG. LAND - HIGH RAINFALL
FOREST RESERVE / NATIONAL PARK BOUNDARY
DOMINICA FOREST LAND USE PLAN, 1979
COTTAGE
PORTSMOUTH
BENSE
WESLEY
MARIGOT


AGRICULTURAL LIMITATIONS
HIGH AG. EROSION HAZARD
MODERATELY HIGH AG. EROSION HAZARD
POOR AG. LAND - WATERLOGGING OR EXPOSURE
POOR AG. LAND - HIGH RAINFALL
/ NATIONAL PARK BOUNDARY
USE PLAN, 1979
CASTLE BRUCE
ROSALIE



AGRICULTURAL LIMITATIONS

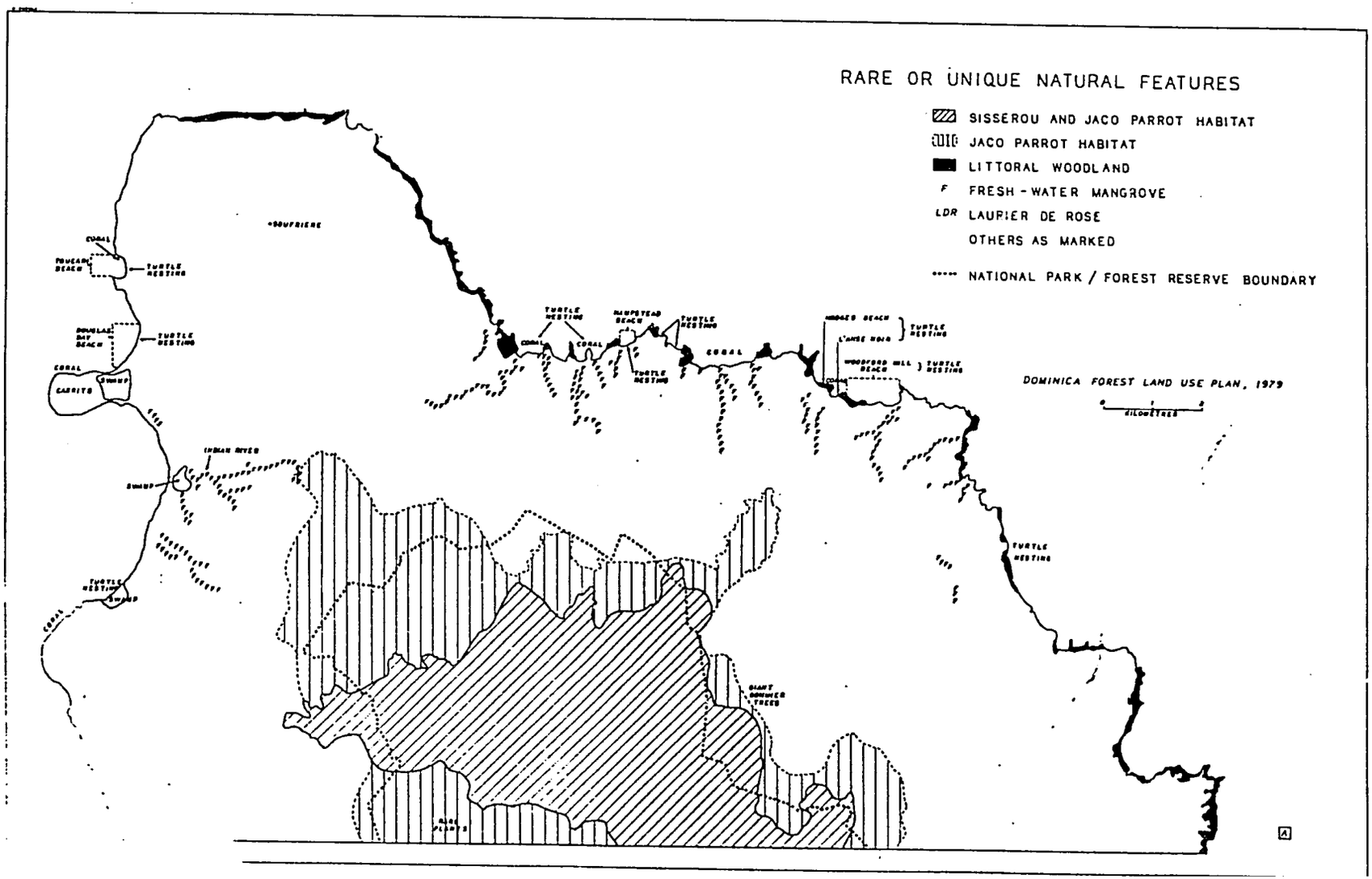
- HIGH AG. EROSION HAZARD
- MODERATELY HIGH AG. EROSION HAZARD
- VP — VERY POOR AG. LAND - WATERLOGGING OR EXPOSURE
- P — POOR AG. LAND - HIGH RAINFALL
- FOREST RESERVE / NATIONAL PARK BOUNDARY

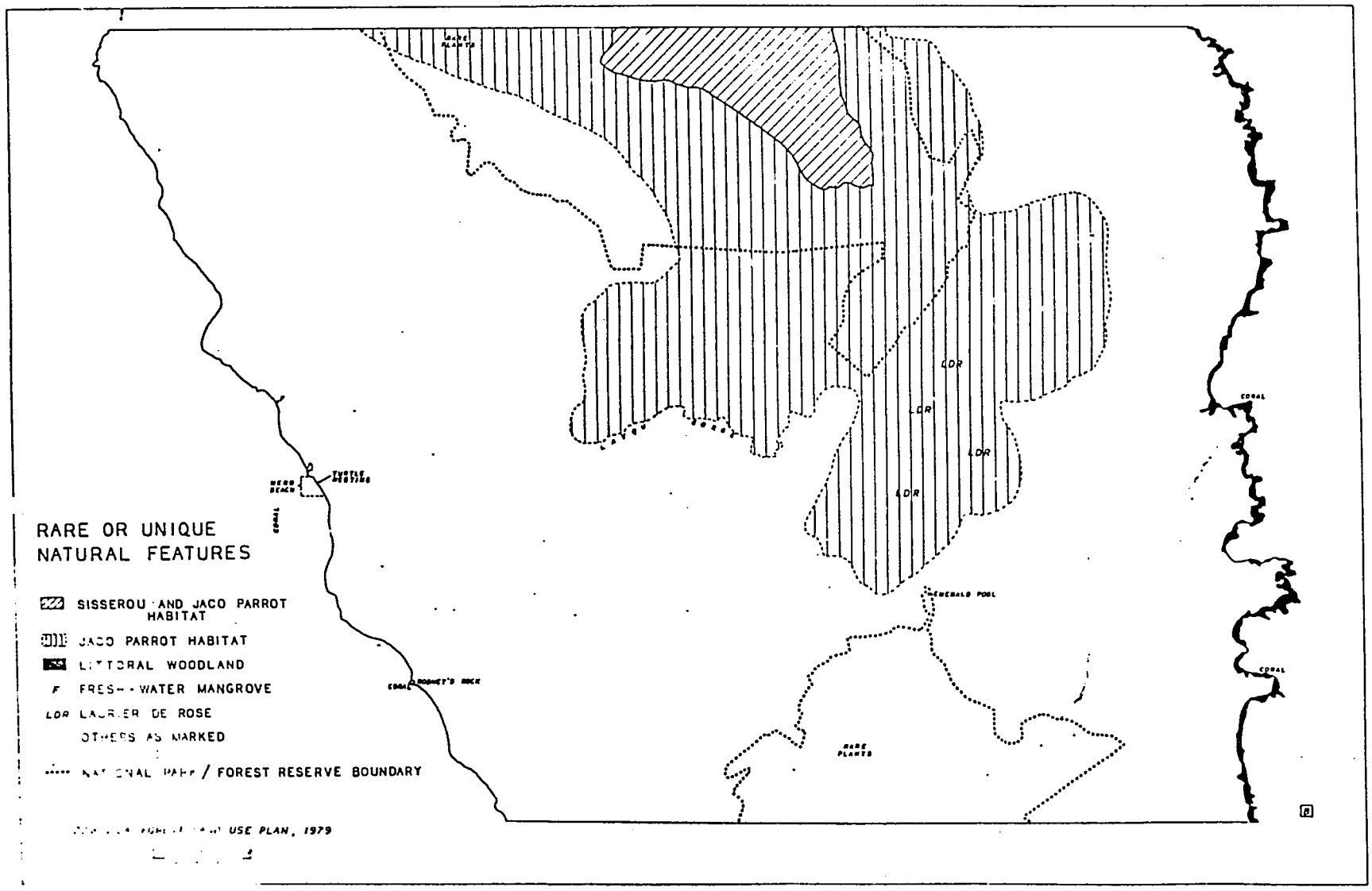
SOURCE: FOREST LAND USE PLAN, 1979

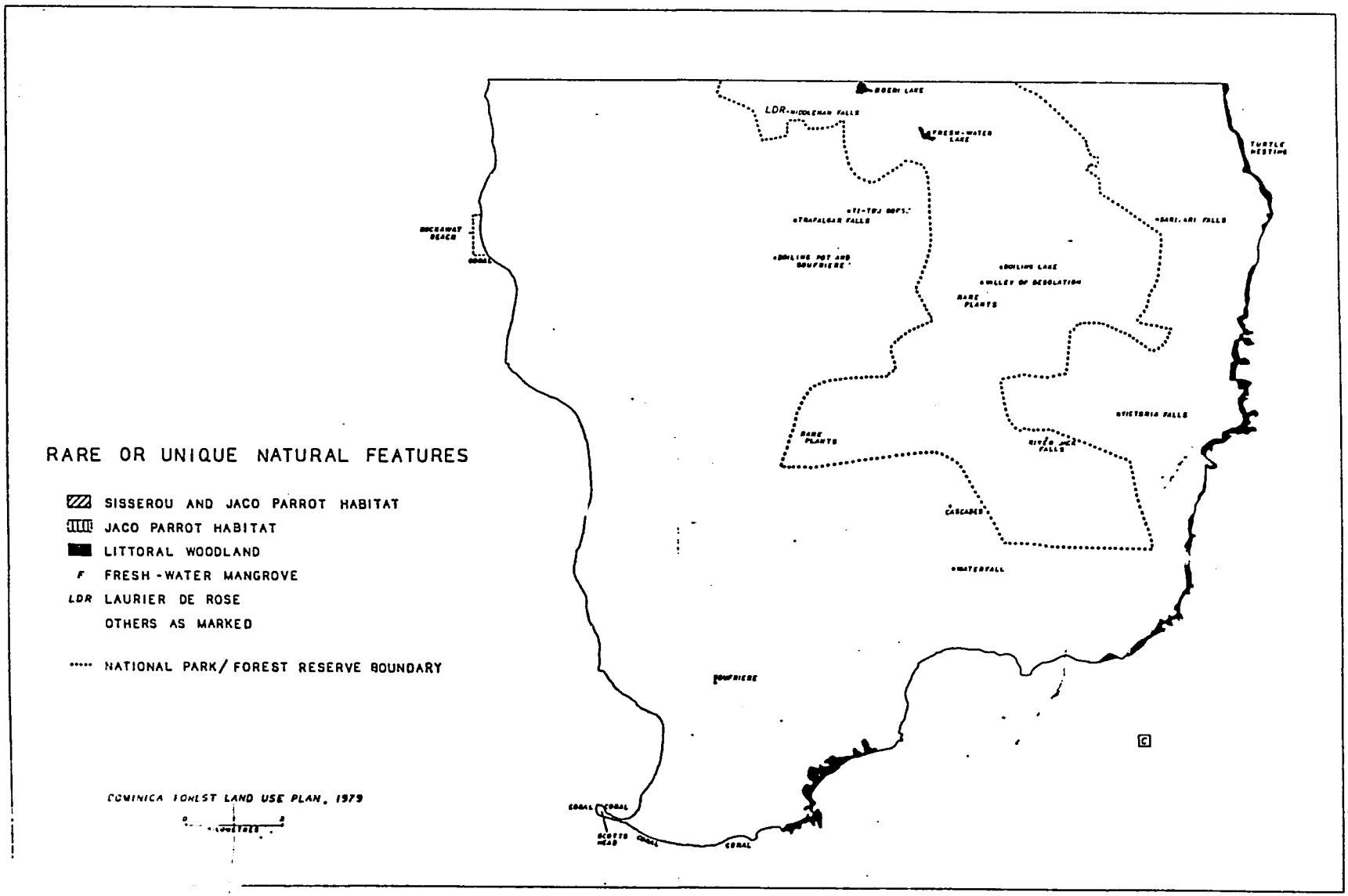
0 1 2
KILOMETRES

Appendix VI

DETAILED MAPS OF RARE OR UNIQUE NATURAL FEATURES


RARE OR UNIQUE NATURAL FEATURES
SISSEROU AND JACO PARROT HABITAT
JACO PARROT HABITAT
LITTORAL WOODLAND
F FRESH - WATER MANGROVE
LDR LAURIER DE ROSE
OTHERS AS MARKED
NATIONAL PARK / FOREST RESERVE BOUNDARY
DOMINICA FOREST LAND USE PLAN, 1979
KILOMETRES
SOUFRIERE
CORAL
TOUCARI BEACH
TURTLE NESTING
DOWLADI BAY BEACH
CARRITE
SWAMP
FRESH
INDIAN RIVER
HAMPSTEAD BEACH
HODGES BEACH
L'ANSE NOIRE
WOODFORD HILL BEACH
GIANT DOMINICA TREES
GIANT FERNS


RARE OR UNIQUE
NATURAL FEATURES
SISSEROU AND JACO PARROT HABITAT
JACO PARROT HABITAT
LITTORAL WOODLAND
F FRESH-WATER MANGROVE
LDR LAURIER DE ROSE
OTHERS AS MARKED
NATIONAL PARK / FOREST RESERVE BOUNDARY
USE PLAN, 1979
LDR
LDR
LDR
LDR
EMERALD POOL
RARE PLANTS
CORAL
CORAL
CORAL
CORAL
TURTLE NESTING
WEBB BEACH
MONKEY'S ROCK


RARE OR UNIQUE NATURAL FEATURES
SISSEROU AND JACO PARROT HABITAT
JACO PARROT HABITAT
LITTORAL WOODLAND
F FRESH-WATER MANGROVE
LDR LAURIER DE ROSE
OTHERS AS MARKED
NATIONAL PARK/ FOREST RESERVE BOUNDARY
DOMINICA FOREST LAND USE PLAN, 1979
LDR-MIDDLEMAN FALLS
FRESH-WATER LAKE
TURTLE NESTING
TRAFALGAR FALLS
BOILING POT AND SOUFRIERE
BOILING LAKE
VALLEY OF DESOLATION
RARE PLANTS
VICTORIA FALLS
CASCADE
WATERFALL
SOUFRIERE
CORAL
SCOTTS HEAD

Appendix VII

DETAILED MAPS OF FOREST GROWTH POTENTIAL

FOREST GROWTH POTENTIAL MAPS

Forest growth potential describes the relative ability of a given land area to grow timber trees quickly and of good merchantable form. The ratings are based upon soil and climatic conditions; existing vegetation is used only as an indicator of prevailing soil/climatic conditions in a given area. Forest growth potential is independent of present land use or type of timber species grown. Where natural vegetation is unsuitable for sawtimber (dry scrub forest), the ratings indicate growth potential for artificially-planted timber trees.

Soil types given are from the soil survey by Lang (1967). Vegetation types are from the Land Use/Vegetation maps prepared for this report. Forest cutting classes are from a forest survey report and map by Brown (1962).

Lands Incapable of Growing Sawtimber

--Montane Thicket (MT), Elfin Woodland (E), and areas where these are the climax vegetation types.
--Littoral Woodlands (L)
--Landslide Zones (LS)

Lands with Low Forest Growth Potential

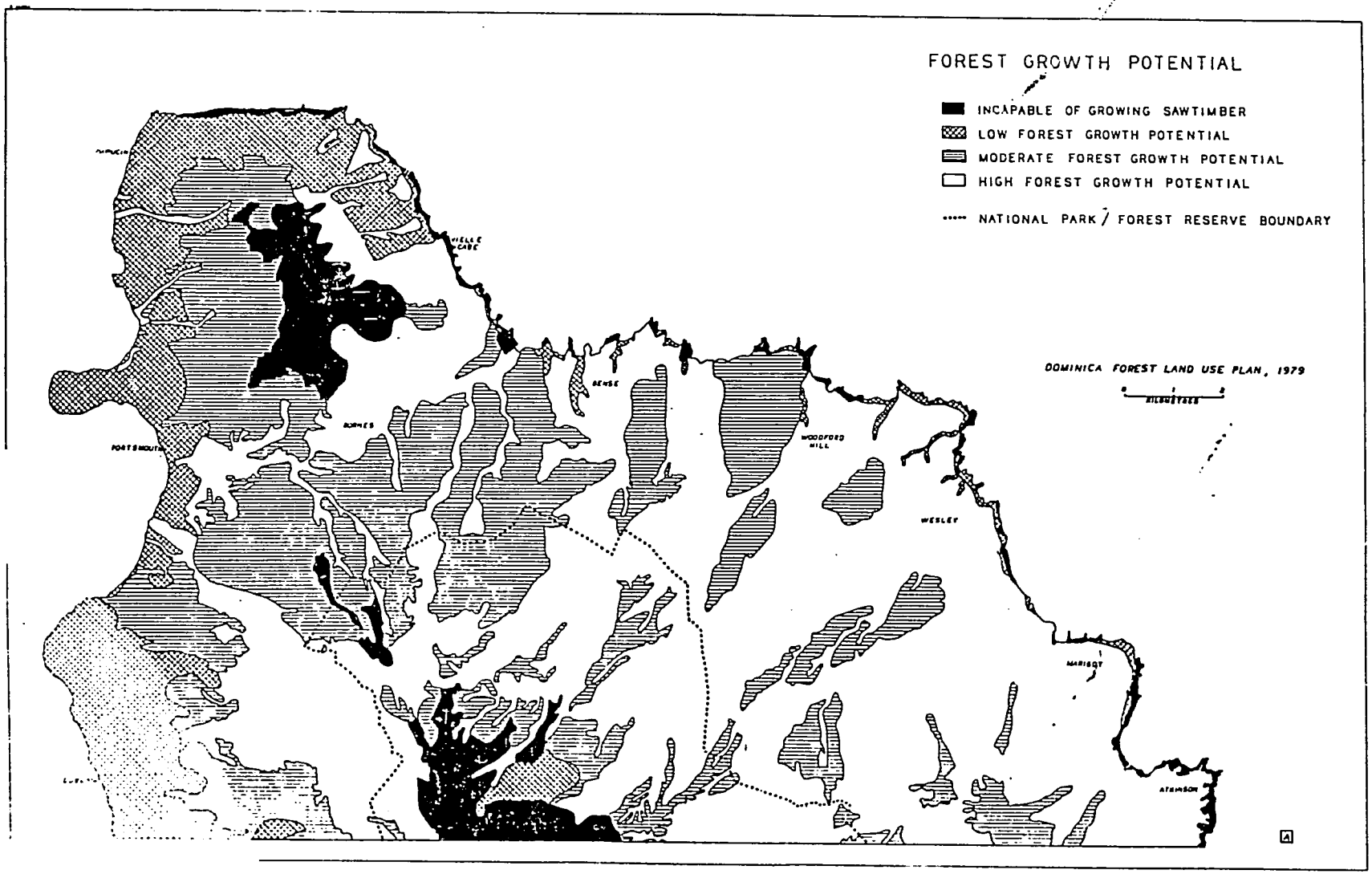
SOILS:
--Allaphanoid podzolic soils (1, 2, 3, 4, 5)
--Smectoid soils (48, 49, 50, 52, 53, 63)
--"Other" clay soils (44, 45, 46)
--Young soils, arid (62, 70, 72, 73)
--Protosols (76, 77, 77T, 78, 80, 96)
--Shingle, skeletal, and beach sand areas.
INDICATOR VEGETATION:
--Fresh-water swamps (FS)
--Montane swamp forest (MS)

Lands with Moderate Forest Growth Potential

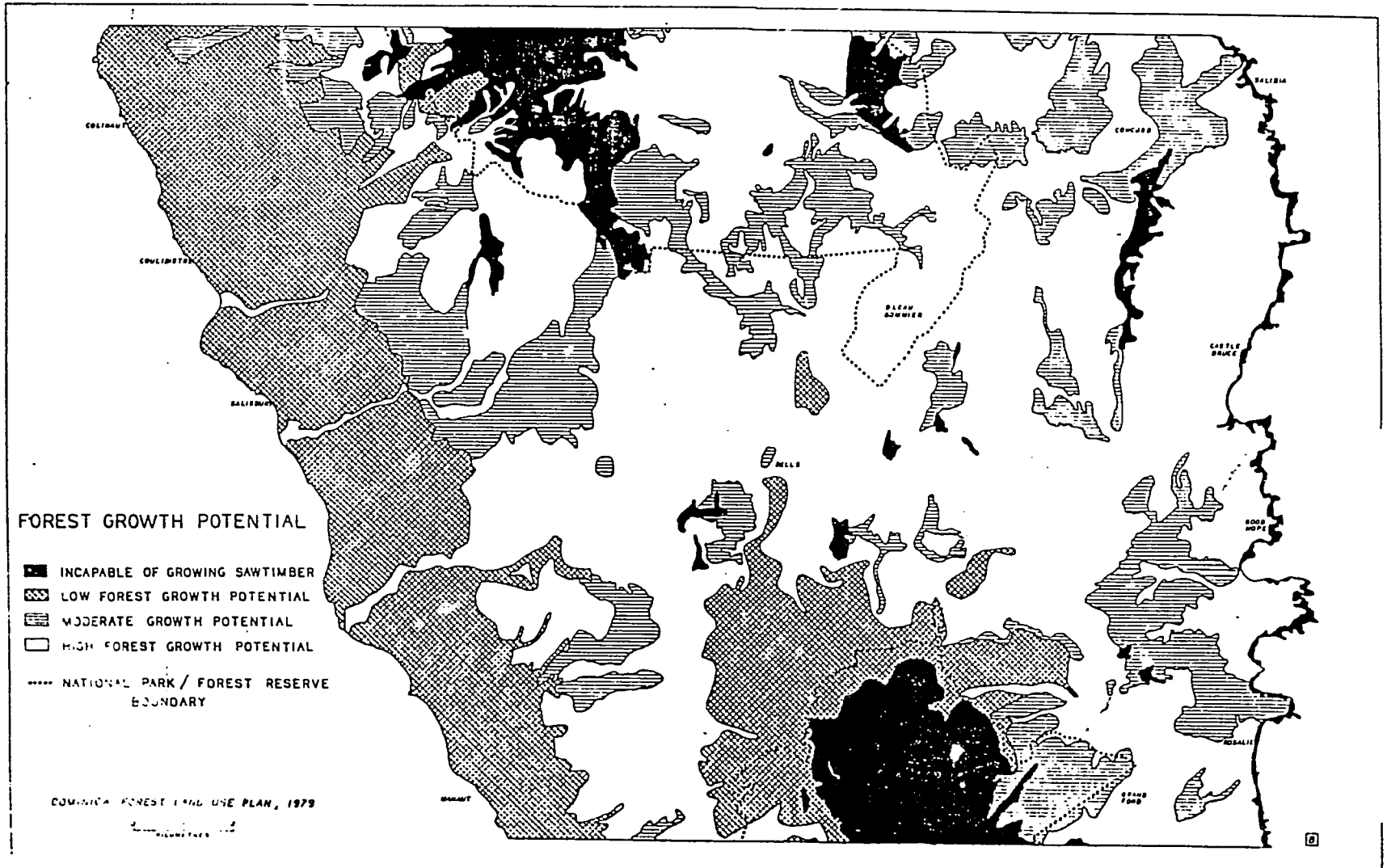
Areas not found in above catagories, but classified by Brown (1962) as poor forest sites (cutting classes 3a and 4a). Most of these areas are exposed ridgetops, and exhibit many trees of small diameter and poor growth form. Lower growth rates would be expected than in less-exposed rain forest areas.

Lands with High Forest Growth Potential

All lands not classified in one of the above catagories.


FOREST GROWTH POTENTIAL
INCAPABLE OF GROWING SAWTIMBER
LOW FOREST GROWTH POTENTIAL
MODERATE FOREST GROWTH POTENTIAL
HIGH FOREST GROWTH POTENTIAL
NATIONAL PARK / FOREST RESERVE BOUNDARY
DOMINICA FOREST LAND USE PLAN, 1979
MILLEVACHE CAVE
BENSE
BARNES
PORTSMOUTH
WOODFORD HILL
WESLEY
MARIGOT
ATKINSON

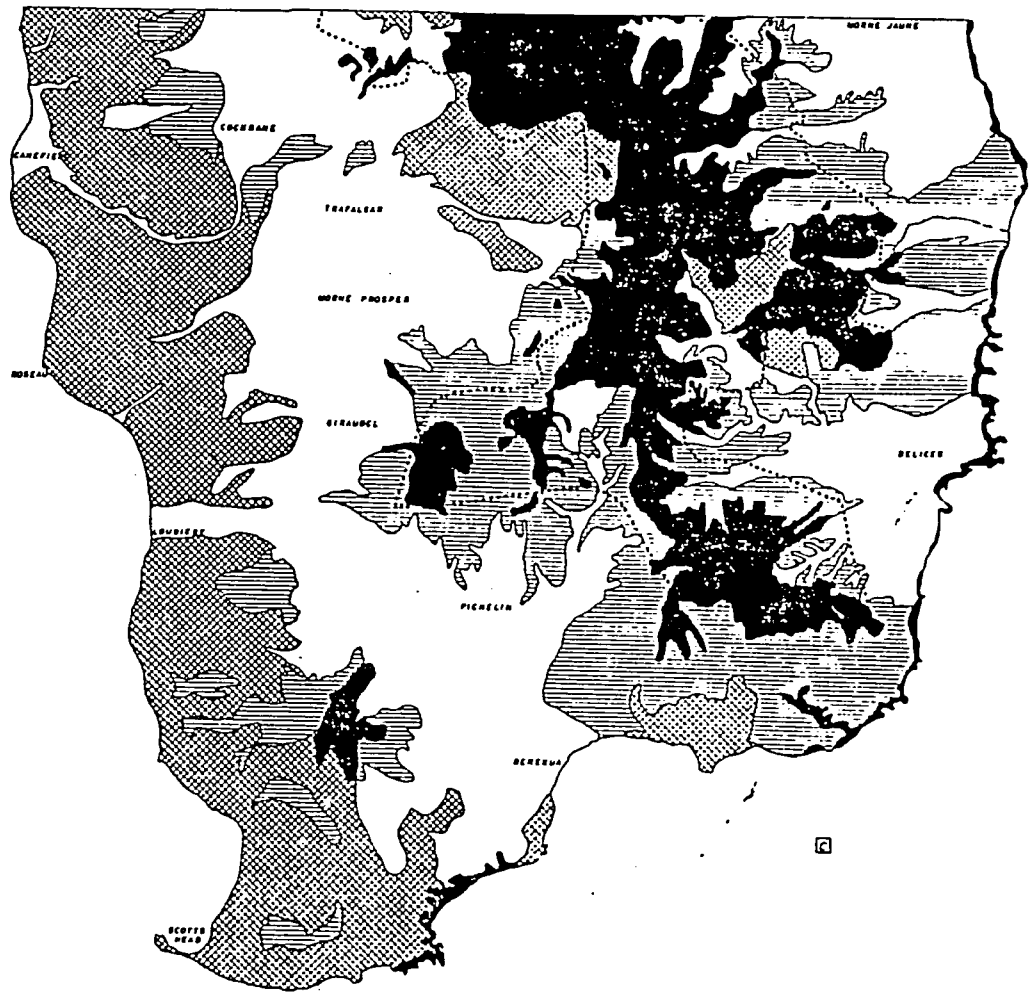
147



COMMISSION FOREST LAND USE PLAN, 1979

FOREST GROWTH POTENTIAL

- INCAPABLE OF GROWING SAWTIMBER
- LOW FOREST GROWTH POTENTIAL
- MODERATE FOREST GROWTH POTENTIAL
- HIGH FOREST GROWTH POTENTIAL
- NATIONAL PARK / FOREST RESERVE BOUNDARY



DOMINICA FOREST LAND USE PLAN, 1979

0 1 2
KILOMETRES

Appendix VIII

FOREST TYPES OF DOMINICA--TIMBER VOLUME AND SPECIES COMPOSITION

Forest Types of Dominica--Timber Volume and Species Composition

Type Code	Nomenclature According to Brown*	Avg. Merchantable Volume Per Hectare (cubic metres)	Major Species and Percent of Total Volume for each
Gm 5	Gommier 5	528 m^3/hectare	Gommier 42%, Carapite 18%, Chataignier 14%, Bois diable 10%, Mahot cochon 6%, others 10%.
GmCh(S) 5	Gommier-Chataignier (Southern) 5	448 m^3/hectare	Chataignier 49%, Gommier 24%, Mangle blanc 11%, others 16%.
MH 5	Mixed Hardwoods 5	398 m^3/hectare	Gommier 30%, Carapite 25%, Chataignier 18%, Bois diable 10%, Mahot cochon 5%, others 12%.
Gm 4	Gommier 4	358 m^3/hectare	Gommier 56%, Chataignier 11%, Carapite 9%, Mahot cochon 7%, Bois diable 5%, others 12%.
GmCh 4	Gommier-Chataignier 4	368 m^3/hectare	Gommier 47%, Chataignier 19%, Bois diable 7%, Carapite 7%, Mahot cochon 7%, others 13%.
GmCh(S)4a	Gommier-Chataignier (Southern) 4a	196 m^3/hectare	Gommier 34%, Chataignier 31%, Mahot cochon 6%, Mauricif 5%, others 24%.
GmCp 4	Gommier-Carapite 4	357 m^3/hectare	Carapite 36%, Gommier 29%, Chataignier 11%, Bois diable 11%, others 13%.
GmCpBd 4	Gommier-Carapite-Bois Diable 4	401 m^3/hectare	Gommier 38%, Carapite 22%, Bois diable 22%, Chataignier 5%, others 13%.
GmCpBd 4a	Gommier-Carapite-Bois Diable 4a	384 m^3/hectare	Bois diable 31%, Gommier 29%, Carapite 20%, Balate 7%, others 13%.
BdGmCh(S) 4a	Bois Diable-Gommier-Chataignier 4a	367 m^3/hectare	Bois diable 57%, Chataignier 19%, Balate 10%, Gommier 8%, Bois violon 5%, others 1%.

*W.G.E. Brown (1962) Forest Inventory of Dominica. Cutting class 5 indicates large sawtimber stands, cutting class 4 indicates medium sawtimber stands, "a" stands are of poor growth form on poor forest sites.

(continued on following page)

Type Code	Nomenclature According to Brown	Avg. Merchantable Volume Per Hectare (cubic metres)	Major Species and Percent of Total Volume for each
MH 4	Mixed Hardwoods 4	270 m^3/hectare	Carapite 27%, Gommier 18%, Chataignier 15%, Bois diable 8%, Mahot cochon 8%, Balate 6%, others 18%.
MH 4a	Mixed Hardwoods 4a	195 m^3/hectare	Gommier 21%, Chataignier 20%, Carapite 19%, Mauricif 8%, Mahot cochon 8%, others 24%.
MH(Gm) 4a	Mixed Hardwoods (Gommier) 4a	274 m^3/hectare	Gommier 27%, Chataignier 16%, Bois diable 15%, Mahot cochon 6%, Balate 5%, others 31%.
MH (W) 4	Mixed Hardwoods (Wet) 4	247 m^3/hectare	Carapite 23%, Gommier 22%, Chataignier 19%, Mahot cochon 10%, Mangle blanc 9%, Bois diable 6%, others 11%.
MH (S) 4a	Mixed Hardwoods (Southern) 4a	209 m^3/hectare	Bois diable 23%, Chataignier 22%, Balate 13%, Gommier 10%, Mahot cochon 7%, others 25%.
P	Secondary Rain Forest--Polewood. Includes Brown's Bois diable 3a,** Mixed Hardwoods 3 and 3a, Mixed Hardwoods (Gardens) 3a, and Mixed Hardwoods (Southern) 3a.	85 to 186 m^3/hectare	Babara, Balate, Bois bande, Bois diable, Carapite, Chataignier, Gommier, Mahot cochon, Mauricif, Ti citron, Z'yeux crabbe and others in varying proportions.
MS	Montane swamp forest. Includes Brown's Carapite 3 and 3a.	92 to 166 m^3/hectare	Carapite 54-60%; Mangle blanc, Gommier, Bois diable, Mahot cochon, and Bois bande in varying proportions.
E	Elfin Woodland	virtually nil	Kaklin, Gumbo montagne, Z'yeux crabbe, Staghorn, Fleur montagne, Ananas montagne.
S	Scrub forest and savanna	virtually nil	Savonette, Mapou, Campeche, Ti baume, Merise, and others.
L	Littoral woodlands	virtually nil	Raisinier bord de mer, Zaman, Zicaque, Poirier, and others.

**Cutting class 3 indicates polewood-size timber, not large enough for sawtimber.

(continued on following page)

Type Code	Nomenclature According to Brown	Avg. Merchantable Volume Per Hectare (cubic metres)	Major Species and Percent of Total Volume of each
FS	Fresh-water swamp	virtually nil	Bois mang and others.
MT	Montane thicket	virtually nil	Bois bande, Bois rouge, Mangle rouge, Mauricif, Palmiste, Tree fern, Raisinier montagne.
R	Riparian rain forest	variable	Bois riviere and rain forest species, depending on location and cultivation history.

Appendix IX

IMPORTS OF SELECTED WOOD PRODUCTS: 1973 to 1977

IMPORTS OF SELECTED WOOD PRODUCTS: 1973 TO 1977

Product	1977 Units	1977 Value in $E.C.	1976 Units	1976 Value in $E.C.	1975 Units	1974 Units	1973 Units
Poles, pilings, & other wood in the rough (m^3)	29	$14,303	0	$0	241	385	31
Sawn lumber (cubic metres)	471	$173,719	169	$86,820	206	308	734
Tongue & grooved planks (cubic metres)	2010	$1,132,908	1384	$602,102	1299	2027	2995
Plywood & veneered panels, inlaid wood (m^3)	1617	$272,621	170	$67,768	147	266	337
Particleboards (cubic metres)	39	$17,873	85	$40,868	68	105	96
Hoopwood, chipwood, split poles, piles, etc. (kg.)	n.a.	$19,898	1542	$20,699	91	209,153	115,123
Wood boxes, cases, crates (metric tonnes)	7	$3,897	34	$53,022	44	60	762
Cooperage products (metric tonnes)	38	$41,882	20	$15,936	22	18	73
Prefab & sectional buildings (metric tonnes)	2	$25,649	4	$22,724	32	nil	18
Household utensils of wood (kilograms)	1065	$4,264	136	$3,621	45	544	nil
Domestic or decorative articles of wood (kg.)	704	$7,131	816	$6,973	272	253,456	1088
Tools, handles, shoe lasts, etc. of wood (kg.)	1631	$9,670	363	$2,428	544	907	363
Other articles of wood (metric tonnes)	52	$61,780	9	$20,808	5	10	79
Chairs, seats, & parts thereof	n.a.	$36,354	n.a.	$26,105	n.a.	n.a.	n.a.
Furniture and parts thereof	n.a.	$270,805	n.a.	$94,342	n.a.	n.a.	n.a.
Value of selected wood product imports:		$2,092,754*		$1,064,216			
Total Value of all Dominican wood product exports:		$6,760		$22,743			

*In 1977, the total value of all imported products was $91,718,887. The value of imported wood products shown here represents, then, about 2% of the 1977 import bill.

Source: Government of Dominica Trade Statistics (computer printouts)