



**Integrating Management of Watersheds &
Coastal Areas in Small Developing States of
the Caribbean**

**NATIONAL REPORT
COMMONWEALTH OF DOMINICA**

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Prepared for:

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Caribbean Environmental Health Institute (CEHI)
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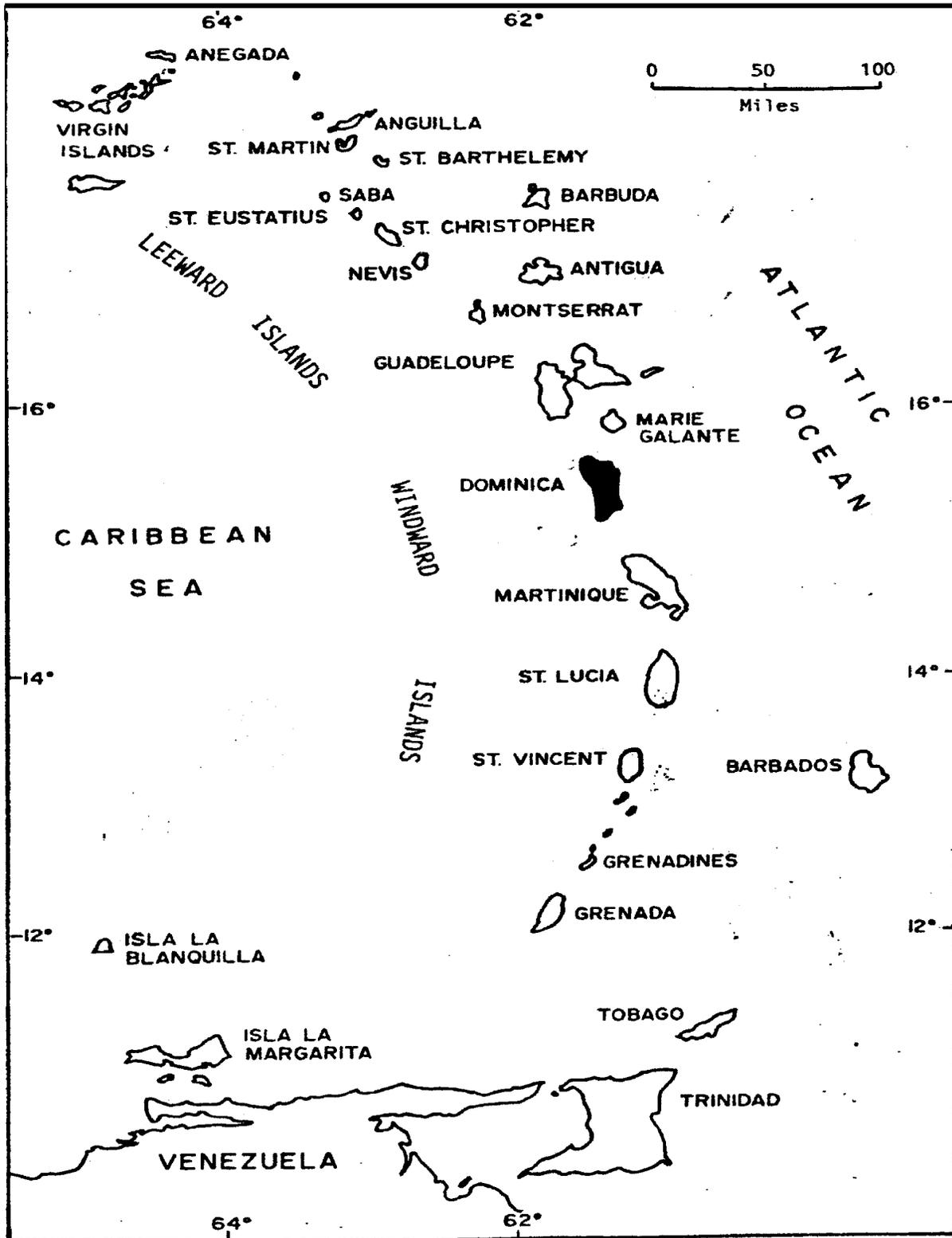


Fig. 1 General map of the Eastern Caribbean, showing the location of Dominica.

EXECUTIVE SUMMARY

The risk for future generations of Dominicans lies in under-valuing the country's remarkable, common resource base and, by doing so, inadvertently allowing it to deteriorate and devolve into a diminished habitat for Dominicans in the future.

In this connection, the major issues associated with the management of Dominica's watersheds and coastal zones include *inter alia*: the absence of a coordinated mechanism at the national level for watershed and coastal zone resource management; absence of updated legislation and a lack of enforcement of existing legislation; lack of data to assist in the decision-making process and an absence of critical human and financial resources to implement improved management systems.

Notwithstanding the multitude of laws and regulations existing on the statute books a number of conflicts exist pertaining to the use of land resources within watersheds. These conflicts are due fundamentally, to the limited availability of lands, a lack of enforcement of the regulations and the more pressing issue of private ownership of lands within the country's watersheds, which has been shown to contribute significantly to resource degradation.

Natural resource pollution within an island ecosystem has been demonstrated to have severe negative impacts on the health of the human, animal and plant organisms that inhabit the system. Within the context of Dominica, improper disposal of **solid waste, agricultural waste, manufacturing and industrial waste**, are the major sources of both point and non-point pollution of watersheds and the coastal zones.

In order to satisfy the **potable** water demand, which consists of the domestic, commercial and industrial demand The Dominica Water and Sewerage Company (DOWASCO) currently extracts water from about 47 independent river intakes, providing a total capacity of over 10 million gallons per day (10mgd). These supply systems are **generally more than adequate to satisfy the demands** of the communities. This demand is currently estimated at about 60 gallons per head per day in urban areas and declining to 45 gallons per head per day in rural areas.

Concerning threats, growing populations, unsuitable development practices, insufficient management attention and limited public understanding and appreciation of the critical role watershed and coastal zone ecosystems play in the sustaining of life pose real threats to the environmental integrity of these systems. Indeed, these threats provide a sound basis for the integration of watershed and coastal area management in Small Island States such as Dominica.

This integration however, will be contingent on the vigorous pursuit of capacity building, and improvements to the formal mechanisms within government for inter-sectorial/inter-agency cooperation and coordination among the multiplicity of agencies involved in Watershed and Coastal Zone Management.

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FOREWORD

The continuing need for Small Island Developing States (SIDS), to sustainably manage their freshwater resources and vulnerable coastal zones, in the light of increasing anthropogenic related threats to these ecosystems is well recognised and documented. It is for this reason therefore, that the Caribbean Environmental Health Institute and United Nations Environmental Programme, Caribbean Regional Coordinating Unit funded, Integrating Management of Watersheds and Coastal Areas in SIDS of the Caribbean project are particularly timely.

The overall objective of the proposed project is assisting participating countries in improving their watershed and coastal zone management practices in support of sustainable development.

The compilation of this national report together with the reports of the other 12 participating countries will serve to inform the development of both a Regional Project Brief (PDFB), as well as a full-scale project for consideration by the Global Environment Facility (GEF). This report itself was compiled in the main by drawing heavily on the significant volume of already available secondary data available on the subject based on previous national consultations, workshop reports, consultant reports and other related activities. This body of knowledge was supplemented by the hiring of local experts to contribute and speak to the relevant areas of their expertise, as well as to carry out limited consultations with key stakeholders and interest groups.

Thus, the report is truly national in content and outlook. It provides a review of water resources, watershed and coastal zone management in Dominica and suggests a 7-point National Plan of Action for Integrating Management of Watersheds and Coastal areas. Notwithstanding the national outlook, the report makes several recommendations to enhance Integrating Management of Watersheds and Coastal areas in Caribbean SIDS.

The Ministry of Agriculture and the Environment looks forward to collaborating with the other participating Caribbean countries, as well as the executing and implementing agencies in making this critical project idea a success.

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1.0 Introduction

The risk for future generations of Dominicans lies in under-valuing the country's remarkable, common resource base and, by doing so, inadvertently allowing it to deteriorate and devolve into a diminished habitat for Dominicans in the future.

The Commonwealth of Dominica is an independent state within the Organization of Eastern Caribbean States (OECS). It is located at about 15° N and 65° W, between the French dependencies of Martinique to the South and Guadeloupe to the North (*See map inside front cover Fig. 1*). It is the largest of the member states, measuring 47 Km in length by 25 Km wide and occupies an area of 750 square kilometers (290 square miles/195,000 acres).

The island is volcanic in origin with much of it formed as little as 20,000 – 40,000 years ago. The topography is characterized by very rugged and steep terrain extending above 1500 meters in elevation over much of the country. The cone of Morne Diablotin (1730 m) dominates the topography of the northern half of the island whilst a chain of mountains, including Morne Trois Piton (1424 m), Morne Micotrin, Morne Anglais, and Morne Plat Pays extends through the south of the island. The peaks of all these mountains are less than 7 km from the sea. The more gently sloping (flatter) areas are restricted primarily to the river valleys, the coastal areas of the Northeast, and the Bell's Wet area in the center of the island. Given its mountainous terrain, the island is blessed with an abundance of water including perennial streams, rivers, lakes and waterfalls.

The rich and diverse natural resource base and mostly unspoiled landscape have led to Dominica being known as the "Nature Island of the Caribbean". However, these resources are coming under increasing pressures from the islands economic development efforts based primarily on agriculture (bananas), agro-processing, manufacturing and more recently tourism. Thus, it is this particular combination of a challenging physical environment and the overarching dependence of the population on the land for their socio-economic well being which, more than anything else has guided the course of Dominica's history, its economic development and patterns of land and coastal zone degradation.

1.0.1 Climate

Dominica's climate is classified as "humid tropical marine", which is characterized by little seasonal or diurnal variation with strong and steady trade winds. There is a distinct "dry" season (between February and June) and the "wet" season (between July and December). In this connection, the lush forested interior enjoys an average annual rainfall in excess of 300 inches at the central peaks. This reduces to an average of about 50 inches per annum along the central portion of the west coast, which tends to be the driest section of the island (*See Iso-hyetal map of Dominica Figure 2*). Average temperature values range from 27 degrees Celsius on the coast to approximately 21 degrees at the highest elevations and there is little seasonal fluctuation, generally less than two degrees Celsius (Lang, 1967; Fehr, 1989).

DOMINICA/RAINFALL

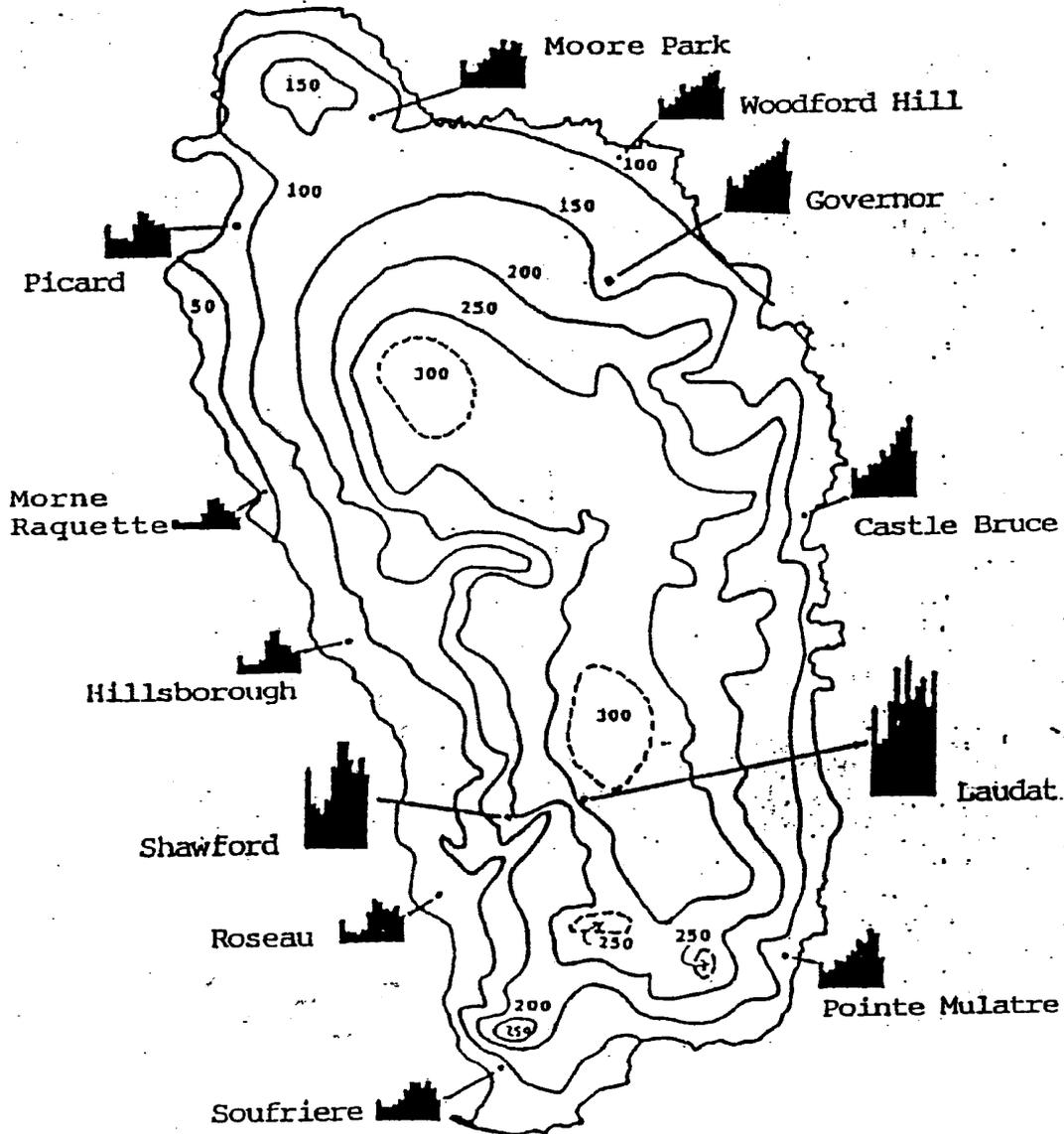


Fig. 2 Rainfall data for Dominica: (1) recorded as average monthly rainfall for specific sites and (2) shown at various elevations (e.g., numbers record inches of rain) (source: adapted from Lang, 1967, as reprinted in Shankland Cox and Associates, 1971).

1.0.2 Vegetation and Soil Types

The island's terrain and climate have given rise to a wide diversity of soils and vegetation types that vary with the elevation and exposure to strong and steady trade winds. Dominica's undisturbed forests have been identified as the most extensive in the Lesser Antilles (between 60 – 75% forest cover), while its rain forest is considered the finest in the Caribbean. Stands of mature rain forest, montane thicket and elfin woodland, littoral woodland, scrub woodland, grasslands, secondary rain forest, and swamps and wetlands are found all over the island.

-
Essentially, Dominica's soils are classified into eight major groups: Hydrogenic Soils, Protosols, Young Soils, Allophanoid Clay Soils, Kandoid Soils, Smectoid Clay Soils, Unstable Soils and "Other Clay" Soils. These soils are, generally, readily erodible since they tend to be unconsolidated and friable.

1.0.3 The Economy

Dominica's economy is heavily dependent on agriculture, and the agricultural sector is the main determinant of economic growth and the main source of food and income for most of the population. In this regard, for the period 1992 – 1999, agriculture accounted for, an average **25%** of GDP, **70%** of total export earnings and **60%** of foreign exchange. Moreover, it supplied **60%** of the food requirements of the population and employed **30%** of the labour force (CSO, 1999).

In this situation, the small domestic market makes economic growth highly dependent on exports. Over the last five years (1995 – 1999) real growth average 2.0% per annum, and growth is estimated at less than 1% for the year 1999. Decline and stagnation characterized the major productive sectors, agriculture and manufacturing and tourism between the period 1995 –1999. At the same time, Government services contribution, the second largest sub-sector of the economy, has been variable against the background of worldwide reduction in aid flows (*See Table 1*).

Table 1: Dominica's Key Economic Indicators

	1995	1996	1997	1998	1999
EC – US Exchange Rate	2.7	2.7	2.7	2.7	2.7
Inflation Rate	-	1.7	2.4	1.0	1.2
GDP at Factor Cost (1990 prices)					
% Contribution of:	410.3	422.9	431.3	441.8	445.8
Agriculture	20.0	20.8	20.0	19.2	18.9
Manufacturing	6.8	7.0	7.0	8.0	6.4
Tourism	2.8	2.6	2.6	2.4	2.5
Government Services	17.3	17.1	17.2	17.7	17.6
Visible Trade Balance, EC\$M	-142.3	-128.9	-136.5	-118.4	-185.6
Debt, EC\$M	457.4	471.5	493.8	508.3	590.7

Source: CSO

1.1 Current Watershed/Water Resources Management Issues

Given Dominica's mountainous terrain a number of significant (approximately 10) watersheds have been identified. These are highlighted in Figure 3 and include the Layou, Roseau, Castle Bruce and Hampstead river basins. A number of watershed management issues have arisen over time, linked to the increased pace of development in the country. The major issues include inter alia:

- The absence of a coordinated mechanism at the national level for watershed and water resource management.
- Absence of updated legislation and a lack of enforcement of existing legislation.
- Lack of data to assist in the decision-making process.
- Absence of critical human and financial resources to implement improved management systems.

1.1.1 Freshwater Habitats and Ecosystems

Dominica has an extensive operational and legislated protected areas system consisting in the main of National Parks and Forest Reserves.

In this regard, Dominica's protected areas system contains five (5) units, viz. two (2) forest reserves the Northern Forest Reserve (**13,528 ac**) and Central Forest Reserve (**1,013 ac**) and three (3) national parks, Cabrits National Park (**13,313 ac**), Morne Trois Pitons National Park¹ (**16,898 ac**) and Morne Diablotin National Park (**8,242 ac**).

The two forest reserves, and the two larger national parks, that is Morne Trois Pitons National Park and the Morne Diablotin National Park protect the upper watershed of several of Dominica's larger rivers, including the Roseau River, Melville Hall River, Layou River, Rosalie River and Pointe Mulatre River (*See Figure 2*), however, only a small number of water catchments (about 5) are contained totally or partially within the protected areas: these are namely Grand Fond, Londonderry, Roseau WA1, Dublanc and Portsmouth. Importantly, the water catchment area providing water for hydro-electricity generation is contained in part, within the Morne Trois Pitons National Park.

1.1.2 Significant Fresh Water Ecosystems

The three most significant Freshwater Ecosystems in Dominica are namely the:

1. Freshwater Lake in the Morne Trois Pitons National Park
2. Indian River wetlands, which are brackish and contain marshes, and freshwater swamps, which provide a habitat for migratory and resident birds.
3. Cabrits Wetlands in the Cabrits National Park, which contains patches of mangrove forest, a freshwater swamp and marsh. These wetlands provides habitat for migratory and resident bird species.

¹Declared a UNESCO World Heritage Site in 1991

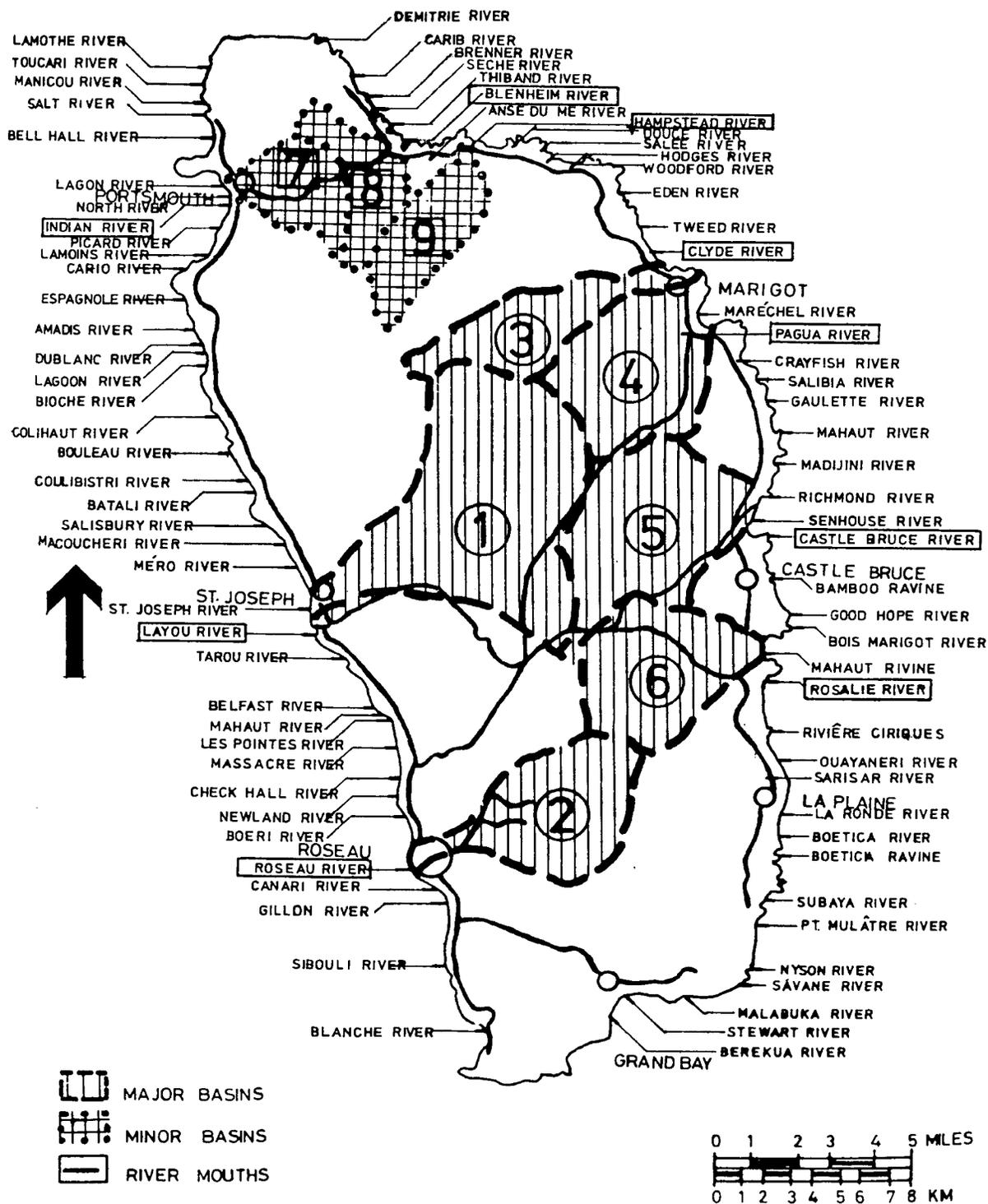


Fig. 3 Important watersheds of Dominica (source: GOCD, 1976), showing the following MAJOR BASINS: (1) Layout River; (2) Roseau River; (3) Clyde River; (4) Pagua River; (5) Castle Bruce River; (6) Rosalie River and MINOR BASINS: (7) Indian River; (8) Blenheim River; and (9) Hampstead River.

1.1.3 Threats to Management of watersheds and Ecosystems

A number of serious threats are faced in the management of watersheds and ecosystems. These are outlined below:

1. Lack of a coordinated inter-departmental and inter-departmental approach for management of the resources.
2. Lack of a suitable mechanism for resolving conflicting, potentially resource-degrading land uses within water catchments.
3. Database related problems – limited data on stream flows for example make effective planning and management of the freshwater resources difficult.
4. Lack of public education and understanding of the critical role that watersheds and ecosystems play in maintaining the ecological integrity of the island.
5. Lack of financial and human capital to effectively manage and monitor the resource.
6. Inadequate legislation and failure to enforce existing legislation pertaining to watershed and ecosystem management constitute a major threat.

1.2 Supply and Demand for Water

The Water and Sewerage Act, Chap. 43:04 of the revised laws of Dominica states the Government's water policy. The Act generally speaks to the orderly and coordinated development, use and conservation of Dominica's water resources. It also makes the DOWASCO responsible for the supply of water to all residents of the country.

The demand for water can be categorized as **potable** and **non-potable**. The potable demand consists of the domestic, commercial and industrial demand whilst the non-potable is inclusive of agricultural, fishing, laundering, hydro-electrical, religious and baptismal, recreational to include swimming, boating, and commercial ecotourism activities.

In order to satisfy the **potable** demand, DOWASCO currently extracts water from about 47 independent river intakes, providing a total capacity of over 10 million gallons per day (10mgd). In this regard the 10 largest rivers namely; Indian, Picard, Layou, Roseau, Blenheim, Hampstead, Clyde, Pagua, Castle Bruce and Risalie rivers all have average annual flows in the order of 10mgd. The most important rivers are listed at (*Figure 3*). Most of the rivers originate on the slopes of the central mountain ranges, whilst a few originate as outcrops of underground springs along low-lying valleys. The largest of the water systems has a supply capacity of over 4.3 million gallons per day (4.3mgd) for the capital Roseau and its environs. This system serves a population of about 25 thousand people. Two other systems have a supply capacity of about 1.4mgd, whilst the other systems are much smaller serving communities with populations usually less than 1000. In addition to these domestic supply systems, a system has been built particularly for bulk

water export, which is capable of delivering 6mgd at a special docking facility situated in Newtown just north of the city center.

These supply systems are **generally more than adequate to satisfy the demands** of the communities. These are estimated at about 60 gallons per head per day in urban areas and declining to 45 gallons per head per day in rural areas. However, at some periods during the dry season, intermittent shortages can be experienced in a few of the systems. This is associated with the observation that in some streams dry weather flows are estimated to drop as low as 30% of average wet weather flows. The period from January to June is considered to be the drier half of the year although this distinction is less pronounced in some years through the interior and the east coast than along the west coast. In the months of April and May the occurrence of hot, dry spells tend to be more persistent and more intense. During these dry spells water consumption increases due to increased watering of lawns and backyard gardens, as well as longer and more frequent bathing. The effect of this increased consumption is compounded by a reduction in stream flows. In some streams dry weather flows have been estimated to drop as low as 30% of average wet weather flows.

DOWASCO currently serves 16,000 customer connections, which represents a population of about 50,000 or about 63% of the island population. In addition to these connections, 590 standpipes have been installed throughout the islands water networks extending water supply coverage to all major communities with population in excess of 200 people. The total DOWASCO coverage is estimated at over 90% of the total population. A number of the small communities, which are not served by DOWASCO, operate small systems built by NGO's such as Save The Children Fund (DOM Save and Can Save, Dominican and Canadian branches respectively), and SPAT (Small Projects Assistance Team).

1.2.1 The Competing Uses of Water

“Water is a vital resource for human survival and economic development; as populations and economies grow, water demand increases while the availability of the resource remains constant...” (Mission Statement of the Integrated Water Resources Division of the Sustainable Development Unit of the Inter-American Development Bank).

In Dominica the major competing uses of water are for **agriculture, industry and domestic** supply. In this regard, the main users of Dominica's abundant water resources include the Dominica Water and Sewerage Company (DOWASCO) for supplying the potable **domestic** and **export** water supply and the Dominica Electricity Services (DOMLEC), for hydropower generation. The potable water supplied to domestic, commercial and industrial users are given priority over all others in catchments where competing demands exist. In practice all of DOWASCO's intake structures are located above the intakes of competing users. Other than the use for potable water and hydro electricity generation individuals and communities living adjacent to streams and rivers use those resources for a number of **activities including cooking, drinking, bathing, fishing, washing, farming/irrigation and nature-based tourism** activities.

Additionally a few industries utilize adjacent watercourses for a range of processing activities including bottling and mining.

With regards to hydro electricity generation DOMLEC uses well over 6mgd on average in the hydropower generation system for its four (4) hydro-electricity plants, which account for 48% of the generation capacity. The water catchments in the vicinity of the Fresh Water Lake, Laudat and Trafalgar, are used to generate electricity in three of the four power stations, however in these instances there is no competition with the potable water supply since water is obtained from different water supply sources.

Notwithstanding this, a coordinated approach to water resources monitoring and inventory by way of a centralized agency, will be necessary to avoid clashes in demands from various sectors and to ensure optimization of water resource usage.

1.2.2 DOWASCO Tariff and Tariff Structure

The DOWASCO operates a tariff system for the potable water supply. **However, the operating and maintenance costs (average production cost estimated at US\$1.13/1000 gallon) for all the small scattered water systems around the island are not always recovered from revenue gained through service connections.**

The national water rates were last revised effective January 1998 and a schedule of this current tariff is presented at Annex 1. These rates were not designed to reflect the economic value of water but rather are more a function of **affordability to pay**, and the need to **encourage conservation**. In this context, the tariff structure allows for public standpipes to be paid for by the government of Dominica (GOCD), thereby giving free access to members of the public who are unable or unwilling to subscribe to a private connection.

1.2.3 The Importance of Irrigation Nationally

Notwithstanding the stated importance of agriculture to the economy (25% GDP), the bulk of Dominica's agriculture is rain-fed. Irrigated agriculture presently accounts for less than 1% of the estimated 52,256 acres of farmland.

Presently, there are plans by both the Ministry of Agriculture and the Dominica Banana Marketing Corporation (DBMC) in particular, to bring approximately 1000 acres under irrigation mainly to enhance productivity in banana² and vegetable³ cultivations.

The main source of irrigation water is expected to be surface water either pumped or gravity-fed from streams or rivers. Currently there are no measures in place with respect to drainage linked to irrigation schemes.

² In Castle Bruce and Londonderry in particular

³ In Grand Savanne, Warner, Marigot

Plans to irrigate the Castle Bruce farming catchment would require proper drainage so as to restrict soil erosion and siltation of the Castle Bruce River.

1.2.4 The Environmental Impact of Irrigation

The potential environmental impact of irrigation has been difficult to assess. This is due to the small area under irrigation, and the minimal use to which most systems are utilized, since water deficits for most crops usually only occur in February to May. Increased soil salinity is not expected to occur due to the high rainfall experienced during the wetter period of the year.

1.2.5 Conservation and Reuse of Water Resources

Island wide the per capita rate of production is estimated at about 137 gallons per day but actual per capita consumption averages about 60 gallons in Roseau and its environs and some 45 gallons per day in rural areas.

Water loss in the distribution system is a major factor contributing to wastage of this important resource. It has been estimated that prior to commencement of the Roseau Water and Sewerage Project in 2000, some 60% of the water supplied was lost to leakages existing in the urban system. However, an EC 52 million-dollar project geared at rehabilitating the ailing water and sewage system is expected to reduce wastage due to leakages to a minimum. A universal phase-in, metering system for all consumers is expected to drastically reduce wastage.

Metering has been adopted as a deliberate conservation policy. At present the majority of customers are metered. However, the cost of implementing this system has been a deterrent to its quick implementation

In one community (Giraudel) not served by a potable water system, extensive use is made of the cistern system for collection and storage of water.

1.3 Ground Water vis-à-vis Surface Water Utilization

The abundance of the surface sources (47 intakes previously described in section 1.2) has up to this point minimized the need to explore groundwater sources. In 1986 a drilling exercise was conducted in the Giraudel area in an unsuccessful bid to locate an alternative water source. Similarly hydrological studies undertaken to date, indicate that aluminum deposits in the valleys for the most part form limited aquifers with low yields of fresh water. The site of the old fort at the Cabrits overlooking Portsmouth bay has evidence of an old well with a hand-pump, but no known use has been made otherwise of ground water sources. **However, some ground water is utilized in spring water bottling (single commercial venture) and for the DOWASCO water supply systems at Soufriere, Cockrane, and La Plaine.**

1.3.1 Policies and Measures for Water Sources Protection

A number of policies and measures are in place to protect the island's water sources from degradation and contamination as a result of human activities. These are highlighted in Table 2. A 1987 DOWASCO survey of its 43 watersheds in use at the time indicated that very few of these were void of human activity. Thus, concern was expressed regarding the level of pesticide and fertilizer use and the presence of human habitat and livestock in watersheds. Clearly therefore, the high level of private land ownership within catchment areas carries with it serious risks of water supply contamination.

The results of ongoing water quality monitoring suggest that effects of chemical fertilizer and pesticides are not yet a threat to human health through the water supply. However, this problem can be expected to increase as activities incompatible with maintaining an uncontaminated water supply increase in the quest for economic development.

As provided for under the 1989 Water and Sewage Act, DOWASCO has recommended that all the islands catchment areas be declared "Water Quality Control Areas". There is no guarantee however that these catchments will be protected since most of the 47 water system utilize catchments which contain private lands. Indeed the Stewart Hall Water Catchment which serves the most persons constitutes the country's only protected forest source as provided for under the 1958 Forest Ordinance.

Table 2: Major Policies for Protection of Water Sources

Policy	Year
The Forests, Soil and Water Conservation Ordinance	1946
Crown Land (Forest Produce) Rules	1949
Forestry Act	1958
Pesticide Control Act	1974
National Parks and Protected areas Act	1975
Stewart Hall Catchment Rules	1975
Forestry and Wildlife Act	1976
Forest Rules	1977
Mines and Minerals Act	1996
Water and Sewerage Act	1997

However, water catchment areas (for domestic and hydro uses) located within the boundaries of national parks and forest reserves receive full legal protection and normally remain under natural vegetation cover.

1.3.2 Salt Water Intrusion

As previously stated, ground water resources are exploited to a limited extent in Dominica, and where this occurs, the areas of extraction are usually inland at high elevations. Thus saltwater intrusion is not presently a problem.

1.4 Land Use

The total land area of Dominica is estimated at 74,851 hectares or 195,200 acres. The Physical Planning unit estimates that approximately 53% of this land area is under forest or conservation; another 34% under agriculture, 7% under settlement whilst 6% is classified as wastelands.

1.4.1 Land Use Policy for Water Resources Management

Notwithstanding the fact that Dominica does not have a legislated land use policy or zoning system a number of policies and regulations that speak specifically to the issue of water resources management are existent. In this connection, approximately 20% of Dominica's forestlands are legally protected either as forest reserves or national parks. This protection is provided through the National Parks and Protected Areas Act of 1975, which has the primary objectives of watershed protection, soil erosion control and preservation of the island's biodiversity. In addition a number of the policies highlighted in Table 1 deal specifically with the issue of land use as it affects the water resource base for example the Forestry Act (1949), the Stewart Hall Catchment Rules 1975, and the Pesticide Control Act 1974.

1.4.2 Existing Conflicts in Relation to Land Use Within Watersheds

A number of conflicts exist pertaining to the use of land resources within watersheds. This, notwithstanding the multitude of laws and regulations existing on the statute books (*See Table 2*). These conflicts are due fundamentally, to a lack of enforcement of the regulations and the more pressing issue of private ownership of lands within the country's watersheds, in the context of limited available land area.

These conflicts are exemplified by activities occurring within the Stewart Hall Catchment for which land use restrictions are established in law. The Stewart Hall Catchment Rules prohibit agricultural cultivation and other activities, which may be detrimental to the water supply. Though such activities are undoubtedly being carried out, not one violation has been cited since the regulations were enacted. One problem has been the fact that the original intention, which was provision of compensation to the owners of the land, was never provided.

Another area of obvious potential conflict is with regard to mining. The competition for use of available resources with regard to the mining of minerals within watersheds has many socio-economic conflicts.

Clearly, the present conflictual system of land use and ownership in the watersheds is negatively impacting on the ability of those agencies charged with water source protection to effectively carry out their mandates.

1.5 Impacts of Climate Change and Natural Disasters on Watersheds and Coastal Zones

Global warming, climate change and sea level rise are real issues, which have the potential to severely affect both the coastal areas and critical watersheds of Dominica. In recent times increasingly destructive hurricanes and storm surges have caused tremendous damage to reef systems located in shallow waters. For example Hurricane Lenny (November 1999), which was characterized by extremely high impact waves in excess of 60 ft high took a toll on the inshore coral reefs of Dominica. It caused transformation of the seabed and coastline. In some areas huge pieces of reef were ripped from the seabed and tossed onto the beach causing severe loss of habitat to coastal pelagic and reef fisheries. The resulting damage to the Fisheries Sector was estimated to be in excess of EC\$6m. In addition, coral bleaching has been noticed on many reefs in Dominica. Some loss of diversity of coral species has occurred and to this end Dominica is now involved in the deployment of underwater temperature recording devices as part of its coral reef monitoring programme.

With regard to hurricanes, the defoliation and other forms of damage to vegetation canes, probably leads to temporary changes in the hydrological cycle in affected watersheds.

What is clear is that the potential negative impacts of global climate change and natural disasters will only serve to exacerbate the existing negative impacts on the watersheds and coastal zones.

1.5.1 National Natural Disaster Plan

The National Disaster Preparedness Plan is particularly well developed for hurricanes. The Plan is implemented by the office of Disaster Preparedness of the Ministry of Communication and Works and the National Emergency Planning Organization (NEPO). In the event of floods and other types of natural disaster the appropriate national response systems will be activated by these organizations. However, the National Emergency Planning Organization has responsibility to respond to all natural disasters, which may occur. Currently a National Climate Change Adaptation Policy for dealing with the potential negative impacts of climate change is being developed under component 4 of the regional CPACC Project.

1.5.2 Impacts of Floods/Runoff

Sedimentation is thought to be the largest single cause of death of coral reefs in Dominica. **Soil erosion** caused by bad agricultural practices and poor land management on the very steep slopes results in sedimentation and death of coral reef habitats. **Unregulated quarry operations** also cause severe sedimentation to coral reefs and most, if not all of them are located within coastal areas. However, the level of siltation is

minimized due to infrequent floods and the steepness of the coastline, which leads to deposition of the silt in deeper waters (*absal plain*).

1.5.3 Development Practices Contributing to Threats to Life and Property

The existing threats to life and property in the coastal zones arise from the fact that most of the human settlements, industry, and infrastructure is located along the coastline and are therefore more prone to flooding and the impacts of hurricanes and storms.

The lack of enforcement of building codes together with the unplanned and unregulated developments, which have occurred in the coastal areas, pose a serious threat to life and property. The implementation of poor agricultural practices and poor road cutting techniques leads to landslides triggered by heavy rains, both in and out of the tropical weather (hurricane) season, thereby posing a serious threat to the coastal zone.

1.6 Transboundary Threats

No major transboundary threats are currently faced. However, the depletion of fish resources due in particular to illegal fishing in the Exclusive Economic Zone (EEZ) is of major concern.

1.7 Pollution Impacts on Watersheds and Coastal Areas

Natural resource pollution within an island ecosystem can have severe negative impacts on the health of the human, animal and plant organisms that inhabit the system. Within the context of the Dominican situation improper **solid waste**, **agricultural waste**, **manufacturing** and **industrial waste** disposal, are the major sources of both point and non-point pollution of watersheds and the coastal zones.

Solid waste - generated by the manufacturing sector consists primarily of plastics, cardboard and carton boxes, broken wooden palettes, pepper, grapefruit and lime residues, metal, plastic drums, broken glass, scrap aluminum, stainless steel copper and galvanize. In the absence of suitable sanitary land fields much of this solid waste finds its self into rivers, and gullies thereby exacerbating the problem of land based pollution. In this connection, the single greatest source of marine pollution in Dominica is due to improper treatment and disposal of sewerage. The discharge of untreated sewerage and other liquid waste for example wastewater used for cleaning or sanitizing equipment finds its way to rivers and streams and the sea through the sewage drainage systems and has severe negative impacts on biodiversity. This wastewater content varied from chlorinated water, water with citric and pepper residues, to water with dyes directly into the coastal and marine habitats. Similarly, the solid waste generated by the tourism product negatively affects dive tourism by ruining the aesthetics of reefs.

Poor land management and agricultural practices - coupled with the very steep slopes of Dominica, causes soil erosion and eventual sedimentation of the marine environment. Indeed sedimentation is reported as posing the greatest threat to coastal degradation and reduction of biodiversity in Dominica. Siltation is thought to adversely affect juvenile

fish with the increased abrasion leading to increased mortality. Non-point source pollution resulting from the improper use and disposal of agricultural chemicals (fertilizers, pesticides) is widely accepted as occurring, though the impacts are unquantified to date.

Most of the land-based pollution from the **manufacturing** sector comes from the quarries. This problem is most evident on the west coast of the island where quarry operations, discharge their waste into the marine environment leading to siltation of coral reefs and fishing bank.

Other land-based sources of marine pollution are household detergents, discharge of spent engine oil into drains and waterways, and inadequate disposal of solid waste and effluent from **industries**. These sources to a limited extent cause habitat degradation and loss of biodiversity. For example, household detergents like clorox, ammonia or caustic soda and carbon dioxide are reported as having serious effects on planktons and juvenile fishes leading to net depletion in population dynamics.

1.8 Tourism

The tourism sector has the potential to have serious negative impacts especially on the coastal areas. Coral reef destruction due to anchor damage is particularly evident in the Portsmouth and Castaways areas. The magnitude of the damage is less in the Soufriere/Scottshead Marine Reserve (SSMR) where such damage is subject to a US\$3000.00 fine.

The industry has inadequate infrastructure to handle their clientele, therefore, it competes for resources with traditional users of coastal space and for use of that space for tourism development. For example, water sports activities lead to displacement of fishermen from traditional fishing grounds giving rise to social dislocation, and marginalisation of fishermen.

The major impacts of tourism are summarized below:

- Coastal and marine pollution and degradation as a result of solid waste disposal.
- Loss of biodiversity and degradation of freshwater swamps, as a result of the construction of tourism infrastructure on these lands.
- Soil compaction and erosion in watersheds and forest areas arising from visits to scenic sites at numbers in excess of established carrying capacities.

1.9 Health

The single greatest source of marine pollution in Dominica is due to improper treatment and disposal of sewerage. The discharge of untreated sewerage and other liquid waste directly into the coastal and marine habitats has severe negative impact on biodiversity. The turbidity caused by such suspended solids results in death of sea grass beds, marine algae and other dependent organisms. Presently the new Roseau sewerage system will

result in the separated sewage being carried 300 ft out to sea, to reduce the level of inshore pollution.

1.10 Data, Information Management and Research

Measuring stations for rainfall and stream flows are few and in cases where they operate, the records are not continuous. Rainfall records from Ridgefield estate, (privately owned) and Melville Hall airport are the most continuous of these records. The Ministry of Agriculture at various agricultural stations island-wide operates other rainfall stations, and the Forestry Division of the Ministry of Agriculture maintains a few streamflow and rainfall measuring stations. A few streamflow-measuring stations established by DOWASCO in 1990, were damaged by storms and have not been operated recently.

In this connection, Iso-hyetal maps (*See Figure 2*) have been developed for Dominica, as well as hydro-geological maps, however no hydrological models are known to exist for determination of run-off, and estimates of total available water resource.

The Division of Physical Planning has an operational Geographic Information System (GIS) complete with 2 computers, plotter, digitizer and printer, that could be utilized in the future for water resources data information management.

1.11 Stakeholder Participation/Awareness and Education in Watershed & Coastal Zone Management Activities

There are no specific organized training programs offered at the national level for water resources management. Similarly, activities geared towards increasing stakeholder participation, and coastal zone public education and public awareness activities in water resources management have been relatively insignificant at the national level. Instead, these activities have traditionally been undertaken as reactions to specific problems or highlighted public issues. In recent times however, DOWASCO has been preparing programs to incorporate public input into design of all the recent major projects. DOWASCO has also celebrated World Water Day and has used the occasion to disseminate information and display exhibits on water conservation and environmental protection.

The Forestry Division through its radio programs and field-based work also routinely incorporates aspects of both watershed and coastal zone management. Similarly the Division of Agriculture through its extension staff holds routine soil conservation workshops for farmers.

It is perhaps however, the Fisheries Division through its outreach program, which has the most organized educational program for resource base conservation particularly with regard to freshwater ecosystems and the marine environment.

The Dominica Conservation Association through its public education program also makes a significant contribution to public awareness and education on the subject, particularly at the formal school system level.

It must be noted however that there is no formal structure or mechanism in place for public consultation at the national level for policy formulation or plan preparation. As such the previously described activities are not part of sustained and continuous programs and have not been as successful as they otherwise could have been. The level of personnel and resources committed to these activities has also been limited, thereby further reducing their impact.

1.12 Institutional Frameworks for Watershed and Coastal Zone Management

The institutional base of natural resource management in Dominica dates to the late 1940's with the establishment of a Forestry Department in 1949. Over time, this institutional base has widened to include a host of mainly government ministries and departments, which have specific responsibilities for management of different aspects of the island ecosystem. Table 3 highlights the wide range of players involved in watershed and coastal zone management in Dominica.

1.13 Institutional Dimensions of Water Management

The Ministry of Communication & Works (MOCW), the Ministry of Agriculture & Environment (MOAE), and the Ministry of Health (MOH), share the major responsibilities for water resource management in Dominica. The DOWASCO which falls under the portfolio of the MOCW is charged under the Water and Sewerage Act, Chap. 43:04 with the responsibility of water resource monitoring and assessment as well as planning and organizing for efficient management of the islands water resources. The DOWASCO has been granted exclusive license to supply water and to collect and dispose of wastewater for the entire island.

The MOH is responsible for establishing water quality and treatment standards for the island, and although specific standards for Dominica have never been established, DOWASCO is expected to operate within the established guidelines of the World Health Organization (WHO). In this regard, DOWASCO operates its own laboratory for treatment and testing of water quality, and is monitored regularly by the Environmental Health Division of the MOH. In addition, the Environmental Health Division of the MOH has a responsibility to monitor source protection, water quality and water treatment island-wide.

The Forestry Act (Section 5) charges the Forestry and Wildlife Division and the Lands and Surveys Division of the MOAE to play important roles in the demarcation and protection of water catchments, and in the regulation of activities within the forest reserves and national parks.

Clearly therefore, both DOWASCO and the Forestry and Wildlife Division have a responsibility for resource protection and conservation, since regulations for catchment protection exist under both the Water and Sewerage Act (Section 13) and the Forestry Act (Section 5). These Acts outline responsibilities for both agencies by way of catchment control in the case of DOWASCO, and protection of reserves in the case of the

Forestry Division. It is important to note that the above regulations are currently being reviewed with a view to achieve greater cohesion, and encourage compatibility and clarification of the roles of the two agencies.

Table 3: Government Agencies and their Responsibilities Relative to Watershed and Coastal Zone Management

Agency	Resource Management Legislation	Resource Management Responsibilities
MINISTRY OF FINANCE AND ECONOMIC DEVELOPMENT		
Economic Development Unit/Physical Planning Division	Town & Country Planning Act (No. 17, 1975) Beach Control Ordinance (No. 21, 1966)	Responsibility for development control and physical planning; administers removal permits
Development & Planning Corporation	Development & Planning Corporation Act (No. 19, 1972)	Decision-making authority for planning and development control; Corporation has delegated much of its authority to a Technical Committee
MINISTRY OF AGRICULTURE AND THE ENVIRONMENT		
Agriculture	Agricultural Small Tenancies Ordinance (Cap. 74, 1953)	Soil and water conservation
Pesticide Control Board	Pesticides Control Act (No. 15, 1974), as amended (No. 4, 1987) with Regulations on Labeling (1986) and Licensing and Registration of Pesticides (1987)	Enforcement of Pesticides Control Act and Regulations
Lands and Surveys	Crown Lands Ordinance (Cap. 169, 1960) (SRO No. 49, 1960; No. 28, 1961; No. 13, 1963)	Responsible for the survey and for the administration of Government lands, and for carrying out surveys for other Ministries
Forestry and Wildlife Division	Forests Ordinance, 1958 (Cap. 80) Forest Rules (SRO No. 17, 1972) Stewart Hall Water Catchment Rules (SRO No. 11, 1975) Forestry and Wildlife Act (No. 12, 1976) Forestry & Wildlife (Amendment) Act (No. 35, 1982) Botanic Gardens Ordinance (Cap. 166, 1889) National Parks and Protected Areas Act (No. 16, 1975) Cabrits National Park (SRO No. 54, 1986)	Protection and management of the nation's forest and wildlife; watershed management; environmental education; management of national parks

Fisheries Development Division	Fisheries Act (No. 11, 1987)	Promotion and management of fisheries; fisheries research; protection and management of marine reserves
MINISTRY OF TRADE, INDUSTRY AND TOURISM		
National Development Corporation	National Development Corporation Act (No. 17, 1988)	Promote and support tourism and industrial development
MINISTRY OF COMMUNICATION AND WORKS		
Ministry	Water and Sewerage Act (No. 17, 1989)	Issue water and sewerage licenses to the Dominica Water and Sewerage Company Ltd.
MINISTRY OF COMMUNITY DEVELOPMENT AND GENDER AFFAIRS		
Cultural Division National Culture Council Village Councils Local Government and Community Development Division	Culture Act (No. 22, 1981) Village Councils Ordinance (Cap. 190)	Promote an awareness of the country's cultural heritage and an appreciation of traditional folklore, arts and crafts Responsibility within their jurisdictions for sanitation, waste removal, nuisance abatement, beach control Assist local governments in carrying out their responsibilities, including such areas as disaster preparedness

In this connection, comprehensive planning for coastal resource development is largely confined to the Fisheries Division. The Fisheries Act of 1987 allows for the designation of local fisheries management areas and organizations to represent local fishermen. Furthermore, there are no comprehensive coastal zone management requirements in Dominica.

The multiplicity of institutions charged with the responsibilities for watershed and coastal zone management demands that some form of operational framework be defined and institutionalized. However, to date no coordinating agency or mechanism has been specifically set up for dealing with water resources management in the country. Institutions charged with this responsibility continue to operate in an adhoc atmosphere, with no clear lines of jurisdiction, resulting in overlap and duplicity of responsibilities, inefficient operations and unsatisfactory levels of management of both the watershed and coastal zone resources. This, in a situation where there are additional indications that Dominica's marine resources will be subjected to increased and varied demands in the near future, in keeping with the requirements for an expanding tourism sector.

2.0 Current Coastal Area Management Issues

A number of critical coastal area management issues are easily identifiable. These are briefly described below.

- ***Lack of Human Capacity*** – This is a major issue facing the efficient management of coastal areas and resources. It is evident at several levels, for example, policymaking, enforcement, and management of resources.
- ***Inadequate Research*** – a lack of human and institutional capacity, together with the absence of equipment and research facilities results in very little specific research being undertaken on coastal resources at the national level. For example, very limited work is done on analysis of non-point pollution sources and their impact on the coastal zone.
- ***Financial Resources*** – the budgetary allocation of the Fisheries Division is vastly inadequate to allow it to effectively manage the coastal areas and its resources.
- ***Absence of an Institutional Framework for Coastal Area Management*** – as has been previously pointed out, there is no coordinated approach to coastal area management. This responsibility is spread over many divisions, units, ministries and other organizations.
- ***Absence of Supportive Legislative Framework*** – Notwithstanding the existence of several bits of legislation specific to the management of both watersheds and coastal zones, there is no supporting legislation for their integrated management.

2.1 Coastal Habitats and Ecosystems

Dominica does not have extensive wetland, mangrove, sea grass, and coral reef habitats due to the steep topography and rugged terrain characteristics of Dominica's coast. The country's critical coastal and marine habitats are shown in Figure 4. These include the:

1. Indian River and Associated Wetlands
2. Cabrits National Park
3. Grand Savanne Coral Reef Banks
4. Soufriere Scottshead Marine Reserve (SSMR)
5. Delices, La Plaine Coral Reef Bank

Dominica boasts two (2) marine protected areas in the Soufriere, Scottshead Marine Reserve (SSMR) and the Cabrits Marine Park – which is a component of the Cabrits National Park. Presently, there is no proper management structure of the Cabrits Marine Park.

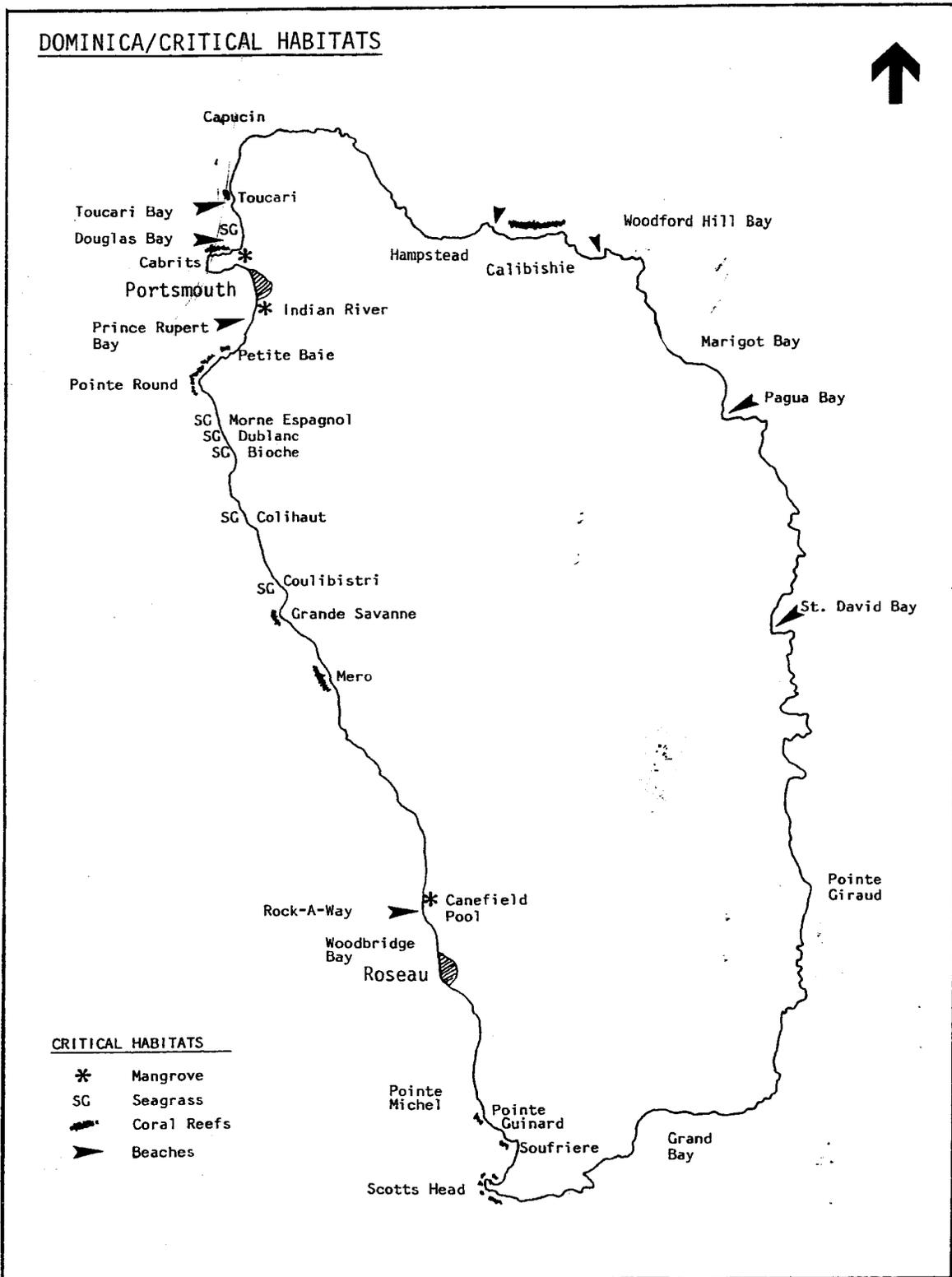


Fig. 4 Coastal and marine habitats of Dominica (source: Goodwin, 1985; Johnson, 1988)

2.1.1 Major Threats to Management of Coastal Habitats and Ecosystems

The major threats to the management of the islands coastal habitats and ecosystems include:

- Lack of Human Capacity
- Inadequate Research
- Inadequate Financial Resources
- Absence of an Institutional Framework for Coastal Area Management
- Absence of Supportive Legislative Framework and lack of Enforcement of Existing Legislation

In addition to these generic types of threats a number of threats associated with specific habitats also exist. These are described below:

Activities on Adjoining Private Lands - The development of commercial properties on privately owned lands adjoining the Indian river for example, has resulted in the cutting off of the fresh water sources to the river. This has serious implication for habitat of migratory birds, crabs, and nursery grounds for marine spp.

Tourism Development – Proposed land based tourism marina development around the Cabrits National Park will transform wetlands with implications for coastal fish spp. Therefore valuation of coastal resources are urgently required, to guide the decision-making process in such situations.

Quarrying – It is estimated that 90% of quarry waste disposed on beachfront leading to sedimentation of reefs and depletion of fish resources. In this regard, the Grand Savanne Banks are reported to be particularly negatively impacted by inappropriate disposal of quarry waste from neighbouring quarry operations.

User Conflict – Implementation of a new management structure for the SSMR has greatly reduced user conflict. However, greater education of users is required, as well as financing to implement management programs.

Activities of Upstream Agricultural – The Delices, La Plaine Bank for example is negatively affected by siltation from upstream agricultural activities.

2.2 Living and Non-living Marine Resource Exploitation

Many types of living and non-living marine resources are significantly exploited for food, infrastructural development and recreation. These are described below.

2.2.1 Living Marine Resource Exploitation

The main types of living resources utilized include the following:

1. **Corals** – corals are extracted for tourism craft industry and commercial harvesting for aquarium trade and reef restoration projects. A 1994 fisheries study describes the status of the coral reefs of Dominica as being 75% healthy (Philbert 1994).
2. **Gastropods** - gastropods including conchs, land and sea crabs are heavily used in the local cuisine. Land crabs however are protected from over hunting by the implementation of a close season.
3. **Seaweeds** – seaweeds are harvested for both household and commercial seamoss making.
4. **Fish** - the coastal waters of Dominica provide different types of habitat for many species of fish. In particular the coral reefs around the island, which are located at depths of between 10m and 60m, are endowed with a very wide diversity of species. The Table 4 below shows the level of exploitation of major fisheries in Dominica. The Fisheries Division has reported a decrease in the size and quantity of reef fish being landed in recent years (Guiste et al 1993).

Table 4: Level of Exploitation of Major Fisheries in Dominica

Fisheries Groups	Exploitation Level	Trends	Potential
Reef Fisheries	145.9 tons	Declining both in terms of catches and size of individual fish	Fisheries can be sustainable if managed properly
Deep Slope Fisheries	67.3 tons	Production has remained relatively steady over the years at a low level of exploitation	Has great potential for increase in production
Coastal Pelagic Fishery	470.8 tons	Shows an increasing trend	Shows great potential for development as it is caught in large quantities
Migratory Pelagics	437 tons	Increasing trend	Has greatest potential for development

There are four species of turtle found nesting in Dominican waters, namely the hawksbill (*Eretmochelys imbricata*) (Linnaeus 1766), the green turtle (*Chelonia mydas mydas*) (Linnaeus 1758), the loggerhead turtle (*Caretta caretta*) and the leather back turtle (*Dermochelys coriacea*). These species are however protected by law and are not widely utilized for food. However some illegal hunting for food does occur.

Dominica has developed a small whale watching industry where day trips are organized for visitors and locals alike. The whales are located from about 0.5 miles to 4 miles from the coastline.

Whales are not hunted in Dominica except for the pilot whale, which exist in great abundance and is caught as an incidental catch. Fishermen on the island do not target whale as part of their fishing practices, however, on rear occasions a pilot whale may be landed.

With regard to aquaculture little or none is practiced in the coastal areas.

2.2.2 Non-living Resource Marine Exploitation

The two main types of non-living resources utilized are sand and gravel.

- *Sand and Gravel* – The Beach Control Ordinance enacted in 1966, establishes a system for managing removal of sand and stone from beaches. The Ordinance is currently administered by the Physical Planning Unit and provides seldom-imposed penalties for illegal removal of beach material. It is estimated that about 4.5% of sandy beaches along the west coast are being mined by comparison with 20% on the east coast. The mined materials are widely used in the construction industry.

2.2.3 Impacts of Exploitation of Marine Resources in Coastal Areas

Illegal beach mining has a negative impact on the coastline, further increasing the threat posed by natural disasters and potential climate change impacts. Coral harvesting for tourism craft leads to a net erosion of the beach profile, leading coastline to become more susceptible to beach activity.

3.0 Integrating Watershed and Coastal Area Management

The need for integration of watershed and coastal area management in Small Island States takes on critical significance in light of the real threats posed to the environmental integrity of natural ecosystems by: growing populations, unsuitable development practices, insufficient management attention and limited public understanding and appreciation of the critical role these systems play in the sustaining of life.

In Dominica, the interactions of watersheds with coastal areas, and in particular, how activities taking place in the watershed affect the coastal area are well borne out by activities occurring in the Agricultural Sector.

Most of Dominica's agricultural production occurs in the mountainous interior with very few farms being located along the coast. The agricultural production system is characterized by clear felling of forest, high use of agricultural inputs including fertilizers, agric-pesticides and non-biodegradable inputs such as banana sleeving materials.

The results of this agricultural productions system on the coastal area resources are: high levels of sedimentation of coral reefs and sea grass beds, with the associated loss of habitat and biodiversity; questionable levels of agricultural (non-point source) pollutants reaching the marine environment and negatively impacting marine biodiversity. In this regard, the Fisheries Division has in recent years been reporting reduced fish catches as well as a reduction in the size of fish caught.

Based on the above discussion watershed and coastal area management should be integrated, however, the management of watersheds and coastal areas remains fragmented along sectoral lines. There is no holistic approach to the management of these resources, rather sectoral and piece-meal approaches to management are pursued.

3.1 Integrated Management Issues Across Sectors

3.1.1 Legal and Policy Issues

The need for coherence between the legislative framework developed for guiding the management of watersheds and coastal zones with their attendant resources and the enabling policy environment in which the framework operates cannot be over-emphasised. This takes on added significance in the Dominican situation since several agencies impact upon or are involved with the protection of the natural resource base, each guided by its own policies and particular bits of legislation and regulations (*See Table 5*). Most of the legislation was developed to address national problems of watershed management and marine and coastal resources conservation and management.

From Table 4, it is clear that some of the legislation is outdated and does not reflect current standards and indicators for natural resources management. Particular deficiencies exist in relation to management responsibilities for watersheds, proper

protection of biodiversity, clearly enforceable laws regarding the issuing of permits and carrying out of mining of any sort, especially sand.

In addition, the laws need to be consolidated in some more coherent manner rather than being scattered throughout the law books. Environmental impact assessments for developing projects involving dredging, shoreline or marine construction, removal of mangroves, and large-scale land clearing of any sort should be made legal requirements.

Table 5: Major Legislation for Watershed and Coastal Zone Management

Agency Responsible	Legislation	Year
Forestry & Wildlife Division	Botanic Gardens Act	1898
Forestry & Wildlife Division	Botanic Gardens Rules	1932, 1934
Forestry & Wildlife Division	The Forests Soil and Water Conservation Ordinance	1946
Forestry & Wildlife Division	Crown Land (Forest Produce) Rules	1949
Forestry & Wildlife Division	Forestry Act	1958
Physical Planning Division	Beach Control Act	1966
Ministry of Agriculture & Environment	Pesticide Control Act	1974
DOWASCO	Stewart Hall Catchment Rules	1975
Forestry & Wildlife Division	National Parks and Protected Areas Act	1975
Forestry & Wildlife Division	Forestry and Wildlife Act	1976
Forestry & Wildlife Division	Forest Rules	1977
Fisheries Division	Fisheries Act	1987
Ministry of Tourism	National Development Corporation Act	1988
Ministry of Agriculture & Environment	Mines and Minerals Act	1996
DOWASCO	Water and Sewerage Act	1997
Physical Planning Division	Proposed Model Physical Planning Act	

3.1.2 Institutional Issues

The multitude of institutions involved in the uncoordinated attempts at watershed and coastal zone management in Dominica has previously been highlighted in this paper. A few of the main institutions involved and their roles are presented below:

- a) **Ministry of Agriculture and Environment:** forests, parks, marine resources, state lands, mining and stream flows
- b) **Ministry of Health:** environmental health, and solid waste management
- c) **Development and Planning Authority:** beach control and land use

- d) **National Development Corporation:** industrial lands
- e) **Ministry of Communication and Works:** housing land
- f) **DOWASCO** – maintenance of water quality

Because of the multiplicity of agencies involved, institutional strengthening, inter-ministerial and inter-sectorial linkages and capacity building constantly emerge as national priority issues concerning watershed and coastal zone management. In addition the need for a formal monitoring and evaluation mechanism/body, which could advise on the sustainable use of both the land-based and coastal marine resources.

Therefore, the improvement of the formal mechanisms within government for inter-sectorial and inter-agency cooperation and coordination will have to be vigorously pursued if any gains are to be made towards integrated watershed and coastal zone management at the institutional level.

4.0 National Action Program to Improve Integrated Management of Watersheds and Coastal Areas

Table 6 below summarizes the major activities that could form part of the national action program to improve integrated management of watersheds and coastal areas.

Valuation of Coastal Resources - The results of the ongoing research work under component 7 of the CPACC Project, to value coastal and marine resources within an area stretching from Roseau to Scottshead in the South, should be continued and expanded to cover the entire island.

Data Collection - The paucity of available data on all aspects of Watershed and Coastal Zone Management suggest that a well thought out, expansive data collection system needs to be instituted.

Research – Similarly a national research agenda needs to be developed and implemented. In this connection the Fisheries Division in collaboration with the Organization of Eastern Caribbean States – Natural Resources Management Unit embarked upon a project to inventory and map the physical and biological resources of the west coast of Dominica. The project will enable the managers of those resources to make more informed decisions and to develop strategies for better planning, more effective management of coastal developments, sustainable use of resources and conserve biodiversity

Public Awareness - The national program could build on the Fisheries Division's marine environmental education programmes aimed at primary and secondary schools, as well as the general public, which has brought about an awareness of the importance of coastal and marine resources and the need to conserve biodiversity, in general.

Institutional Framework - Strengthening of institutional structures and administrative capacity including cross-sectoral and inter-agency structures to integrate economic and environmental planning and policy process and outcomes. A situational analysis of existing institutions involved in the development policy and planning process to determine current capacities, functions and processes.

Legislative Reform - The formalization and legitimation of the structures by legislative mandate. The terms of reference of each structural unit/committee will be established in the legislative mandate to ensure the process.

Table 6: Summary of National Action Program

No.	Major Activities
1	Valuation of Coastal Resources
2	Data Collection
3	Research
4	Public Awareness
5	Establishing Institutional Framework
6	Enforcing Legislation
7	Drafting Legislation

5.0 Major Recommendations for the Regional Action Program

5.0.1 Institutional

1. Institutional Capacity building for both National and Regional organizations involved in Watershed and Coastal Zone Management for example staff training.
2. Strengthening of Institutional Structures and Administrative Capacity including cross-sectoral and inter-agency structures to integrate watershed and coastal zone management into national planning and policy processes.
3. Study of the impact of private land holdings on the sustainable management of watersheds and recommendations towards the sustainable management of such lands.
4. Development of a Regional mechanism for evaluating the impact of land based activities on the coastal zone.
5. Development of Regional Research Capacity on sustainable systems/mechanisms for the Integrating of Watershed and Coastal Zone Management.
6. That a Survey, Assessment, Inventory, and Valuation of coastal resources be undertaken (could build on the CPACC, C7 activity).
7. Strengthening of existing national water quality monitoring laboratories by providing adequate levels of financial resources and human technical capacities and capabilities.
8. Establishment of regional/sub-regional laboratory with the capacity for assessment of levels of residues of pesticides in water. (seen as being critical)
9. That CEHI as the designated lead agency for fresh water resources management in the region seeks to mobilize the requisite funding in support of these recommendations. (Should not be limited to the GEF)

5.0.2 Legislative

1. Assessment of existing legislation and regulations with regard to watershed management and coastal zone management – paying special attention to the regulation of activities on private lands within watersheds and coastal zones.
2. Improving the capacity of national enforcing agencies, to implement existing legislation on watershed and coastal zone management.
3. Development of Regional Model Legislation on Integrated Watershed and Coastal Zone Management, to include requirement for conducting of EIA's for all projects within watersheds and coastal zones (could be modeled on OECS Draft Planning Legislation)

5.0.3 Information Exchange

1. That an online network of National Project Coordinators be set up, similar to that operating for Ozone Officers – for dissemination of information.
2. That the National Reports be synthesised into a regional report.
3. Coming out of this exercise a listing of regional experts on watershed and coastal zone management be prepared and disseminated among participating countries.

5.0.4 Financial

1. Funded program for community based reforestation programs within the context of sustainable rural livelihoods and overall sustainable development.
2. Identification and development of fiscal incentives to promote best practices in the management of watersheds and coastal zones in the region.
3. Launching of a regional initiative to secure “additional” funding in support of for watershed and coastal zone management from the GEF.

5.0.5 General

1. That the regional project be so developed so as to maximize the potential benefits to ALL participating states.
2. Continued collaboration with the OECS-NMRU, and other regional organizations in the preparation of this regional project given the OECS watershed project and implementation of project activities (build on lessons learned, etc).
3. In preparation of this project that a review of similar Regional Projects for example “Conserving Biodiversity and Preventing Land Degradation in Small Island Ecosystems in the Caribbean “ (GEF, Block B PDF being sought), to avoid duplicity and enhance chances of securing multi-lateral funding.

5.0.6 Multi-Lateral Agreements

1. Development and submission of a funded public awareness campaign for Watershed and Coastal Zone Management targeted at all stakeholders including the NGO community to the multi-lateral community. (could be developed along lines of Latin American project “Building, wider public and private constituencies for the GEF”.)
2. As a follow up activity to the development of the regional synthesis a meeting of donors be arranged to look at possible funding of particular aspects of the project.

5.0 ANNEX 1. WATER RATES

DOWASCO'S CURRENT TARIFF STRUCTURE

METERED SUPPLY

Domestic

- Fixed service charge per month \$10.00
- For 0 – 1000 gallons per month 8.80
- For more than 1000 gallons per month 8.80 per 1000 gallons

Commercial & Industrial

- Fixed service charge per month \$20.00
- For 0 – 1000 gallons per month 11.80
- For more than 1000 gallons per month 11.80 per 1000 gallons

Stand Pipes

- Fixed service charge per month \$ 20.00
- Flat rate per stand pipe per month 270.00

Bulk Water Shipment

- Water delivered to ships \$20.00/1000 gallons
- Water delivered to bulk carriers 10.00/1000 gallons

UNMETERED SUPPLY

- For property with one fixture \$25.00 per month
- For property with more than one fixture 42.00 per month

SEWERAGE

- Flat Rate \$10.60 per month

MICELLANEOUS CHARGES

Connection Fee (Minimum)

- Sewer \$250.00
- Water \$240.00

Reconnection Fee

- Sewer & Water \$100.00
- Service call for turning on water \$100.00

Meter Testing Fee

- With a bore of less than 2" \$50.00
- With a bore of more than 2" 75.00

Bibliography

- CCA, 1991. *Dominica Country Environmental Profile*. U.S. Agency for International Development, Bridgetown, Barbados.
- Evans, P.G.H., 1986. *Dominica Multiple Land Use Project*. *Ambio* Vol. 15 No. 2, pp 82-89.
- GOCD, 1994. *Dominica National Environmental Action Plan*. Government of the Commonwealth of Dominica.
- James, A. and Gallion, A., 1990. *The Utilization of Non-Wood Forest Products in Dominica*. *Caribbean Journal of Agriculture and Natural Resources*, Vol. 1, No. 2, pp 4-12.
- FAO, 1998. *Forestry Policies in the Caribbean. Volume 2: Reports of 28 selected countries and territories*. FAO Forestry Paper 137/2.
- Clarke, P., 1994. *Conservation Status of the Flora and Fauna of Dominica*. Island Resources Foundation (IRF).
- James, A., 1990. *Freshwater Swamps and Mangrove Species (Revised Edition)*, Forestry and Wildlife Division, Ministry of Agriculture. Dominica.
- OAS/OECS, 1998. *Institutional Analysis in the area of Natural Resource Management. The Case of Dominica*.
- Pollard, Duke E.E. et al., 1991. *Environmental Laws of the Commonwealth Caribbean – Analysis and Needs Assessment*. Commercial Law Monograph Series No. 1 Caribbean Law Institute, University of the West Indies, (UWI) Barbados.
- Johnson, T., 1988. *Biodiversity and Conservation in the Caribbean: profiles of selected islands* International Council for Bird Preservation (ICBP), Monograph No. 1, Cambridge, UK.
- Varty, N. et al., 1992. *Proposed Morne Diablotin National Park – Draft Management and Development Plan (1993-2003)* International Council for Bird Preservation (ICBP).
- Prins, P., 1987. *Forestry Policy and Administration 1987-1997 Natural Resources and Rural Development Project*. Commonwealth of Dominica. Dept. Reg. Dev., OAS, Washington, DC.
- DeMilde, R., 1987. *Inventory of the Exploitable Forests of Dominica*. FAO, Rome.
- Lausche, B., 1986. *Dominica National Legislation related to Natural Resource Management*. Country Legal Report No. 1. OECS-NRMU, Castries, St. Lucia.
- Rainy, W., et al., 1987. *Dominica (West Indies) Banana Industry Rehabilitation: A Pesticide Assessment* Island Resources Foundation (IRF), St. Thomas, VI.