

WORLD WITHOUT TREES Why have trees been given such special attention this year? Perhaps because they have been taken too much for granted. They have been there to cut down and use. Now that our population has grown, trees can no longer support the demand we make on them, without care from us in return. Throughout the world, more trees are cut than are being planted. The land has been depleted, and sometimes, the armed forces have been called to guard the remaining forest from illegal clearance. Last summer's drought in the island of Haiti was blamed by some ecologists on deforestation. Earlier this year a visiting biologist, Dr. Charles Wood, of the Natural History Society of Jamaica, said that if deforestation continued the country would end up like Haiti in the next 30 years. Trees are more important as communities rather than as individuals if soil protection is going to be achieved. The forest canopy breaks the fall of rain and causes a slow down flow of water to the ground. This, by producing a gentle flow to the ground, soil erosion is reduced, most of the fallen leaves and branches form a mat of litter that filtrates water rather than let it flow away through the surface.

LAND USE In the island of St. Vincent, the total amount of land being used is divided as follows: crown lands with the natural vegetation = 16,107 ha (39,800 acres), cultivated - 888 ha (1,700 acres), not cultivated - 4,611 ha (11,887 acres), for a total amount of land of 74,918 ha (185,120 acres). Up to date in records but unfortunately there are no dates. The Forestry Division is hoping to carry out as funds become available.

MAJOR WATERSHEDS St. Vincent is divided into six major watersheds of economic importance. Four of these watersheds supply water for domestic purposes, and for agriculture, while the remaining two are used for supplying hydroelectricity.

Three Rivers The watershed situated in the upper Colonaire mountain is approximately 100 ha. Its forest cover consists mainly of indigenous species. Since 1950, some

'Plantations have been established in these areas.' In 1982, under the USA-IDA Basic Human Needs reforestation project, 32 ha of blue mahoe were planted. Honduras mahogany (*Swietenia macrophylla*) has also been grown despite attacks from shoot borers. 'The rivers in this watershed area are dammed at about 450 m (1,476 ft) above sea level in order to supply water to the hydroelectric plant at South Rivers. Management of the area is limited to improve planting, and 57 ---Page Break--- patrolling in Montreal and McMillion, to prevent illegal cutting of trees. 'The upper Colonaire watershed is one of our major domestic water supply sources. It has over 100 ha of which some 32 ha consist of plantations of Caribbean pine (*Pinus caribaea*), blue mahoe, and others. Management includes tending of plantations and guarding the watershed and water catchment areas to prevent squatting and illegal cultivation of lands, a practice which is prevalent in this area. However, the Government has recently taken the decision to remove all persons living in the area. 'The watershed was commissioned in 1948. It is the oldest watershed dammed for domestic purposes. The water is also dammed at the foot of a waterfall and is being distributed to many surrounding villages. There is need for some action against the landslides and erosion caused by farming on the hill slopes. Siltation of the catchment areas and storage tanks has occurred due to the erosion problems. Frequent patrols by forest officials are also needed.

Upper Vermont (Delaware-Stream 24) Watershed This watershed has a total area of about 242 ha. It is one of the most important watersheds of St. Vincent and consists of two water catchments, Delaware and Stream 24, both of which are feeding common reservoirs. The watershed delivers more than 6 million liters of water daily. Almost one-fourth of the population depends on this watershed to satisfy their requirements. 'The Forestry Division manages this area, which is also the home of the *Amazona guildingii*, the national bird of

the island. Forest plantations of blue mahoe, Caribbean pine, Honduras mahogany, and cypre (*Cordia alliodora*) have been established in this watershed since 1966 and are proving quite satisfactory. Management consists mainly of tending the forest to prevent illegal cutting of trees for

charcoal making, and to prevent hunting of parrots. Upper Cumberland Valley Hermitage watershed is dammed at about 450 m (1,476 ft) above sea level and its water is distributed to several villages in the North Leeward area, from Barrouallie to Chateaubelair. A considerable amount of forest plantations have been established in this area. Erosion control measures are also being practiced here. This watershed, which joins the Vermont Valley Watershed, is inhabited. Richmond Watershed (North Leeward) This watershed supplies water to the hydroelectric plant at Richmond. All forests here are natural; no plantations have been established to date, but there is need for work to be done to prevent erosion and to improve the forest conditions in the watershed.

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Minor Watersheds A There are several other small catchment areas, e.g. Owia Perseverance (proposed), North Windward water supply, Higher Lowmans, Greggs Swarts. All these areas are dammed and supply water on a small scale to the villages around them, or assist the larger distribution systems.

WATER QUALITY The use of chemicals, which are being carried by the water from the areas where farming has been going on, has contributed to water pollution in St. Vincent. In the area known as Montreal, where farmers are usually cultivating large amounts of bananas, a high amount of chemicals has been used in order to obtain a bigger and better quality product. After using all these chemicals in this area, where it usually rains all year round, the eventual water runoff deposits chemicals as well as banana trash and grains after harvesting, in the water catchment areas. As a result, our water resources are becoming polluted, producing health problems both to animals and

Humans. How Water is Being Treated Given the high percentage of chemicals contained by the water, it is being treated to remove as much pollution as possible. Water is also treated with another chemical, known as chlorine, to destroy the bacteria that grow after it has been polluted by the use of chemicals and organic matter. Only then is water suitable for drinking and other domestic uses. Water laws that protect the water catchments are strictly enforced. They usually protect the water catchment tanks from people who use them as places for recreation. St. Vincent Water Development Plan In St. Vincent, most of the towns and villages are supplied with pipe water from the water catchment tanks situated in the forested watershed areas on the government-owned land reserves. These water supplies are not being treated. I cannot give further details about when the water supply began in all the villages and towns of the island.

Water Use The mainland of St. Vincent obtains all its water from several streams and springs in the watersheds located in most of the central mountains. In the Grenadines, dependence on rainfall for domestic water is the rule. Water is collected in private tanks, concrete community catchments, and from public ponds. There are a few artesian wells. This is due to the lack of rivers and springs. Water is used on the island by people in their day-to-day domestic work, hotels, industries, and by rural government institutions. During the dry season, water is being shipped to the Grenadines because of the periodic drought that the island suffers.

WOOD AND ITS USES Wood is being used on the island as a source of energy by the majority of the people. It is hard to predict if the demand for firewood will increase in the coming years, especially when we consider the rising cost of fuel, which we import from other islands. Traditional charcoal production techniques are still in use. The damage caused by the eruptions of La Soufriere in 1979, and by Hurricane

Allen in 1980 brought more people into charcoal production. "Wood is also used for construction and for furniture making.

RAINFALL The rainfall on the island ranges from about 3810 mm (150 in) a year in the central mountains, to 1524 mm (60 in) a year on the coast. September, October, and November are the wettest months of the year. The climate of the island is a tropical one. The distribution of the rain superimposed upon the basin shape of the island leads to a concentric distribution of the climate, with the wettest areas located on the central mountains. The most

significant seasonal change in St. Vincent is the migration of the intertropical convergence from January to June of the north coast trade winds. The constant north coast trade winds make the season very pleasant but cause certain crops, e.g., ground nuts, to be abated somewhat during the initial return movement of the winds northwards from May to November. VEGETATION Natural vegetation remains are found only on the central mountains and on the summit of some of the ridges near the coast. The west steep ridges, near the coast, have become dry scrubwood land. On the central mountains, the vegetation is largely of the secondary type, with small areas of rain forest at the head of the larger valleys. Zonation of the vegetation in the inner zone is mainly a result of continuous rainfall. There, we find the rain forest. Then comes a zone of green seasonal forest under the influences of a weak dry season. In some instances, there is a transition to an outer zone marked by a drier season. ---Page Break---

FOREST PROBLEMS

Over the past years, the Forestry Division, within the Ministry of Trade and Agriculture, has been plagued with a number of problems taking place in the forests in St. Vincent. The illegal felling of trees, which are situated on the hillside slopes near the river basins on the government crown lands, is really affecting our wildlife animals. During the heavy rainy season, it causes tons of topsoil to be washed away. As a

Result, siltation of the rivers is occurring and in some cases the rivers change their courses, causing more damage to the vegetation and great losses of animal life. This situation also affects the rainfall patterns of the island.

Use of Chemicals

In many forested watersheds, farmers are planting large amounts of bananas. In doing so, they usually use large amounts of chemicals to obtain better results from their banana crops. In the area of Montreal where most banana cultivation is going on, more chemicals are being used. The largest water catchment tank of the island is located in this area. It supplies half of the island population with pipe water, and has an extension line reaching as far as Georgetown, the second town of the island. Water carrying chemicals from banana plantations is being deposited in the tanks during the heavy rainfall season, which lasts almost all year round. The supervisor of the Forestry Division, working with information from the Agricultural Extension Division, and with the aid of health teams on the island, is reaching out to the people, chiefly by means of radio and other forms of information, about the use of these dangerous chemicals in the forested watershed.

Damages Done to our Forest Plantations

Forest plantations in St. Vincent are established during the dry season. The grass is allowed to grow in order to keep plantations cool. People are taking their animals and grazing them in these plantations. As a result, animals usually debark and uproot the plants and destroy the seedling crops and the understory.

Forest Fire

During the dry season the Forestry Division is plagued with a number of fires taking place in the forests. Sometimes they are caused by farmers cleaning up land for cultivating their crops. Others sometimes start along the Fond side where dry litter accumulates. Fires are affecting our plantations and soils, making tree growth more difficult.

Poison of Rivers

As a means of catching animals from the rivers, people throw chemicals, e.g., tobacco dust, into

Then, these methods are widely used throughout the land. Since the use of these chemicals began, plenty of our wildlife has disappeared from the rivers. These animals should be allowed to live, produce, and reproduce.

WAYS AND MEANS OF SOLVING THESE PROBLEMS

Before leaving the island of St. Vincent, we, the members of the Forest Division along with the Agricultural Extension Division, started a series of educational meetings throughout the island in order to educate our people about the use of chemicals and the use of the forests. We started in the primary, junior, and secondary schools in the state by holding lectures. Afterwards, we went to

the streets where we held public mass meetings and discussions. Radio and television interviews and film shows were used. Finally, the newspapers were also used. In the areas where the meetings were being held, the public response was very good because everyone is getting concerned about their health and the use of chemicals. In my return to the island of St. Vincent, at the end of this course, I am hoping to appeal to the head of the Forestry Division in the Ministry of Trade and Agriculture, in order to ask for funds. Funds will help strengthen the staff of the Forestry Division, to patrol the forest areas where these officers are working, and also to supply us with telephones, radio communication, and transport in order to better patrol all the government crown lands and forested watershed areas.

OBJECTIVES

The main objectives of the watershed management are: to conserve soil and water; determine inventory and data needs for the water resources level of management and research; to provide information to aid in the formulation of water resource regulations, laws, and policies; and the development of zoning, land classification schemes, and management planning.

RECOMMENDATIONS

In this case study, I have pointed out the problems which are affecting the forested watershed areas in St. Vincent. I will recommend the following to the Forestry

Division of the Ministry of Trade and Agriculture: The Forestry Division, in conjunction with the Ministry of Trade and Agriculture (Extension Division), should prepare an educational program for farmers using chemicals around the water catchments in the watershed areas. Proper education should be given throughout the state about the hewing of chemicals by farmers. Proper education should also be given about the poisoning of rivers. All forestry subjects should be taught in every school throughout the state in order to aid in the development of our nation and especially our watersheds.

The media should be used as a tool to educate our people. Plants from the nursery should be given free of cost to people who wish to establish their own private plantations. The Forest Officers should also give advice to the people in the care of these plants. Proper legislation should be made and implemented, along with proper penalties and fines, regarding the illegal felling of trees in the forest and the watershed areas. The Forestry Division should ask the government to assist with funds to strengthen the staff and to supply radio communication and transport. The Forestry Division should ask the government to make funds available for the overseas training of all forest officers in order to have a well-trained staff. The Forestry Division should ask the government, USAID, or other international agencies for funding to assist in the establishment of more plantations in some of the watershed areas where land is available for the maintenance of the land where we are hoping to establish plantations. The prices of timber and charcoal production should be increased because they are outdated. The government should acquire land strips on both sides of our rivers, especially where land is privately owned. This will help to stop the increasing erosion problem.

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Agriculture, Forest Service, and the Agency for International Development sponsored this course; Edwin Maldonado, Course Coordinator; Leon Liegel, Advisor; JoAnne Febeley, Librarian; Nilda Echevarria, Secretary; and to all the lecturers and staff of the Institute of Tropical Forestry.

WATERSHED MANAGEMENT FOR ST. LUCIA

Augustin Charles Vincent Forest Alexander Ford St. Lucia

INTRODUCTION

St. Lucia is a Caribbean island of the Windward group, lying between Martinique to the north and St. Vincent to the south at approximately 14°N Latitude. The island encompasses 616 km² (238 mi²) of predominantly hilly terrain, dissected by numerous stream valleys. The population is about 130,000, and population density is approximately 211/km² (540/mi²), of which approximately 40% lives in the urban areas of Castries, the largest city and the capital.

OBJECTIVES

The primary objectives of this case study are to determine inventory and data needs on water resources; develop management and research projects; provide information to aid in the formulation of water resource regulations, laws, and policy; and aid in the development of island zoning, land classification schemes, and management planning.

LAND OWNERSHIP, USE, AND DEVELOPMENT

All lands within the working plan of the Forestry Division area are the property of the Crown. Some parts are already proclaimed Forest Reserves, while the remainder are ungranted Crown lands. Under ordinance, the existing Forest Reserve areas have been constituted under Section 19 and by statutory rule and order No. 48-1946, and some Crown land areas have been declared protected forest under Section 21 and by statutory rule and Order No. 16-1951. Ungranted Crown lands are so named from the time of the French administration. Such areas were those which were never allocated to private citizens by the King of France. Agriculture land is predominantly in the hands of small farmers. Most holdings (932) are less than 4 ha in size and account for the island's total area (table 1). Generally, land

Located in flat alluvial soils are held in larger estates, while smaller individual holdings are not usually found on the best soils. This pattern helps explain the small farmer pressure on forest lands while larger holdings are less intensively cultivated.

Major Watersheds

The island is divided into four major watersheds (Fig. 1), all located within the forest reserves. One area consists of two separate forest blocks, namely the Dennery Water Works Reserve, which comprises 146 ha (365 acres), while the proposed Central Forest Reserve, which is made up of Castries, Quillesse, and Soufriere Water Works Reserve comprises 6408 ha (16,020 acres). This gives a total of 6554 ha (16,385 acres). Watersheds on private lands, names, and numbers are not available at present, but in the inventory, they all will be scrutinized and taken into consideration.

Water and Water Use

No information is available for water yields in St. Lucia. Partial information is available for Joseph River, Piton River, and La Sorciere stream (Table 2). Most towns and villages had some form of

clean water by 1915 (Butler et al., 1980). The cost of water in the past was relatively cheap (Table 3). In 1852, water rates on vessels of 50 tons and upwards per ton, per voyage - 2 pence (4 cents BCC). Vessels under 50 tons and those registered at port - per half-year - 6 pence (12 cents ECC). Before the oil crisis hit the world in October 1973, the cost of water in St. Lucia was approximately \$1.00 BOC per 1,000 gallons. By 1979, the cost had reached \$2.25 ECC per 1,000 gallons and will obviously continue to rise in relation to the oil price rise.

Water Harnessed

In 1979, St. Lucia harnessed a total of 1,100,000,000 gallons from all its water catchment areas. Its use is depicted in Table 4. Prohibited areas in part IV of the forest, soil, and water conservation ordinance are stated in the 1957 law but restrictions are not strictly enforced therein; therefore, it is imperative that new law enforcement be strengthened.

WOOD AND USE

Wood is

used mostly as a source of energy by the majority of people on the island. It is optimistic to predict that the demand for firewood will increase in the years ahead, especially when one considers the rising cost of imported energy. Traditional production techniques are still used by all producers. While certain traditional patterns of use had raised the pressure on other areas, damage caused by Hurricane Allen in 1980 has brought more people into production. Wood is also used for boat construction, furniture making, and other construction work.

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TOPOGRAPHY AND DRAINAGE SYSTEM

The general topography of the island is mountainous, with a central mountain ridge rising at Mt. Gimie to an elevation of 950 m (3117 ft) above sea level. The mountains form a south-southwest to north-northeast axial ridge or cone with offset spurs running down to the coasts on either side. Youthful, mountainous topography predominates except in the southeast and north. Three main physiographic regions can be differentiated, although the exact boundaries are difficult to trace. The first region comprises the central eastern and northern parts of the island, which show more mature relief and in which the large alluvial valleys of the Roseau, Cul-de-Sac, Mabouya, and Marquis Rivers occur. Clear traces of individual volcanic centers are difficult to find. Peaks range from about 61 m (200 ft) in the north to 549 m (1800 ft) above sea level. The second region consists of the mid-western section, starting just south of Roseau Valley and extending about 5 miles inland. It includes some of the highest and most precipitous mountains in St. Lucia, e.g., Mt. Gimie 950 m (3117 ft), Piton Canarie 918 m (3012 ft), Mt. Paix Bouche 745 m (2445 ft), Mt. Tabac 678 m (2226 ft), and Mt. Parasol 613 m (2010 ft) as well as the two Pitons which rise almost sheer out of the sea to approximately 820 m (2500 ft). This region appears to end in the south at Gros Piton. The mountains are dissected by steep-sided narrow valleys which

Have hanging souths. West rapidly to great depths and a relatively straight shoreline. Cliffs exist. This region also contains the only active volcano, La Soufrière. The third region is made up of the southwestern section, extending from Choiseul to Vieux-Fort district, and inland to the southern end

of the central frrial range, just south of Mount Grand Magazin 616 m (2022 ft). It is characterized by a huge fan-shaped glacia sloping gently seaward and ending around old isolated hills belonging to the first region in the Vieux-Fort area. The glacia slopes have been deeply cut by the very narrow gorges which make road building expensive (Fig. 2).

GEOLOGY AND SOILS

St. Lucia is of volcanic origin of the Pleistocene age. The main rock types occurring are andesites, dacites, and basalts in various forms. Most of the rocks occur as pyroclastics, varying from coarse agglomerates and breccias through agglomeratic ashes to fine ashes and tuffs, though coarse fragmental rocks predominate. Soils have been derived from the underlying rocks and from more recent showers of fresh dacitic ash. The number of soils is large and they vary widely in stability, intensity of weathering, and degree of leaching. Generally, they can be described as freely drained acidic clays and clay loams which are red, yellow, or brown in color, and of low fertility. Soil pH ranges from 4.4 to 6.5 approximately.

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HYDROLOGY

The forest area is drained by numerous rivers on either side of the main watershed. Those flowing to the west coast include Cul-de-Sac, Roseau, and Canaries, and those reaching the windward coast include Marquis, Louvet, Fond Dior, Dennery, Praslin, Troumasse, Canelles. The Vieux-Fort River flows southward to Vieux Fort Bay. The Castries Water Works Reserve and the Dennery Water Works Reserve supply the town of Castries and Dennery respectively.

CLIMATE

The island's tropical climate is modified by oceanic influences. The main features are uniformly high temperatures all year round, mitigated by the

Northeast trade winds, which freshen during the dry season. Reliable temperature statistics are few. Mean temperatures (°F) over 31 years at the Botanic Station, Castries, approximately 3 m (10 ft) above sea level, are as follows: January: 74.2 (23.9); February: 74.0 (23.7); March: 74.2 (23.9); April: 76.2 (25.0); May: 78.4 (26.3); June: 78.0 (25.6); July: 77.0 (25.5); August: 77.7 (25.9); September: 77.8 (25.6); October: 77.3 (25.6); November: 75.6 (24.7); and December: 74.0 (23.4). Annual and diurnal variations are relatively small. Temperature decreases with increasing elevation. The quantity of precipitation is influenced by elevation and forest cover. This is demonstrated by the concentric rainfall pattern in the western parts of the island where most of the higher mountains are located. The rainfall of St. Lucia is low and intermittent in the coastal areas and high and continuous in the mountainous interior. Generally, the forest area lies within the range of 1778 mm-3810 mm (70 in-150 in) per annum. The dry season is normally distinctive between January and May; November is the wettest month.

FOREST TYPES AND THEIR DISTRIBUTION

Rainforest is described as a three-storied forest reaching heights of 40 m (130 ft) and consisting principally of the *Dacryodes-Sloanea* association. The most common species are: *Dacryodes*

excelsa (gommer), *Sloanea caribaea* (chataignier), and *Sterculia caribaea*. The lower montane rainforest is a two-storied forest reaching heights of 24-30 m (80-100 ft) and is typified by the *Licania-Oxythece* association. Montane thicket occurs atop the most prominent pitons and on some of the higher ridges, the principal localities being at La Sorciere, Piton Flore, Mt. La Combe, and Piton St. Esprit. This is a two-storied forest up to 18 m (60 ft) in height, but of little or no commercial value. A few species to mention are *Tabebuia pallida* (paletuvier), *Licania elata* (Bois cote), and *Weigandia chrysophylla* (Fenille Sore). Elfin woodland.

1s not constant and the only patch of some importance is on -o1- ---Page Break--- top of the Ginie range. Trees are covered with moss and there are abundant epiphytes and ground plants. Secondary rain forest covers areas which have been devastated by shifting cultivators. These areas are commonly colonized by *Heaitelia* spp. (tree ferns), *Cecropia peltata* (Bois canon), and *Sapiua caritaeun* (la glu). PROBLEMS CONFRONTED Sedimentation is the major pollutant of our streams. Natural land erosion has been aggravated tremendously by bad farming and other kinds of faulty land usage. Contamination of streams with both organic and inorganic materials such as rubbish, human feces, timber waste, etc. Contamination of rivers with harmful chemicals such as herbicides, and detergents. Treatment of water is costly. Pumping of water for distribution is expensive due to fuel cost. DATA AND INVENTORY NEEDS Determine sediment loads. Identify pollution source and loads. Determination of discharge and flow duration curves of major agriculture water consumption. Water supply and use by watersheds, Number of perennial streams. Boundaries and size of watersheds. Number of watersheds in use, and existing sub-watersheds. Number of watersheds on private land Determine water holding capacity of each watershed. ---Page Break--- RECOMMENDATIONS Soil and forest conservation should occupy a place of major importance in planning and carrying out river basin programs. The laws and water resource policies revised. of the government. should be The work of the Central Water Authority responsible for watershed management activities should be coordinated with the Forestry Division into a single effective program for each basin and for the country as a whole. Techniques should be developed to measure and evaluate the accomplishments in the field of watershed management, and to estimate the size of the job still to be done. The government should take provisions for more effective management of the private lands in order to improve forest and

Forage growth, and to minimize the erosion which now pollutes the streams. Expenditures for soil and forest conservation and other aspects of watershed management should be increased in line with the expansions for development programs. Reclamation of private lands in watershed areas should be recognized. In areas where land acquisition is not necessary, but where existing programs are inadequate to achieve satisfactory watershed management, ways should be found to increase the participation of the workers involved and of the general public. The three forest officers who were trained in Puerto Rico should be made solely responsible for coordinating and monitoring watersheds on the island. They should be assigned to collect information on water resources to make management and research recommendations. Conservation education should be a part of our daily responsibilities as citizens, and the spread of conservation should be based primarily on personal contacts so that such a concept becomes a part of our daily life and culture. A great patriotic impulse is needed. ACKNOWLEDGMENTS The officers responsible for this project acknowledge with gratitude Dr. Arsel Lugo, Project Leader, through the U.S. Department of Agriculture, Forest Service, and the Agency for International Development sponsored this course. Further acknowledgment should be given to: Mr. Edwin Maldonado, Course Coordinator; Mr. Jerry Bauer, Advisor; Ms. JoAnne Feheley, Librarian; Miss Nilda Echevarria, Secretary; and to all the lecturers and staff of the Institute of Tropical Forestry.

REFERENCES Water in our development, April 1980, St. Lucia Forest Working Plan, April 1, 1970 - March 31, 1980 by J.A. Goodiet. CARDI, Source 1973-74 Census of Agriculture, Ministry of Agriculture, UNDP Physical Planning Project. May 1975, Soil and Land Use Surveys No. 20 of St. Lucia by J. Stark et al., October 1966.

Table 1. Land Use

Land use type	Percent of total area
Tree crops	40%
Other cropland	18%
Grassland	10%

Forest/woodland 6 Other (Including urban) 6 1 From CARDI - Source 1973/74 Census Ministry of Agriculture, Table 2. Water yield G.P.D.1 River Gallons/day Joseph River 167,000 Piton River 395,000 La Sorciere River 42,800 1 From water in our development April 1980, ---Page Break--- Table 3. Cost of water in 1916. Domestic water dues For every service provided with one tap or stop cork per year or part of a year. For every additional tap or stop cork after the first per year or part of a year. Shipping water dues To every British warship, for every 100 gallons or part thereof. 4.0 6.0 1.6 Table 4, Uses of water is treated water only! Industry and Commerce 5.58 Hotels 13.58 Government rural and institutions 38.0 Domestic consumers 42.8% ships 0.28 1 From H2O in our development April 1980, ---Page Break--- ---Page Break--- RELIEF AND DRAINAGE ST LUCIA ---Page Break--- ---Page Break--- TYPICAL ANNUAL RAINFALL PATTERN RAINFALL STATIONS Bonne de Isle Union Experimental Station FFA would be in 25- MONTHS Figure 4 -16- ---Page Break--- 'THE GOOD HOPE WATERSHED IN DOMINICA Stephon Durand Dominica INTRODUCTION The acceleration of current problems with regard to the past use of land and water intensify the need for attention to the Good Hope watershed. There, the work of humans, past and recent, has disrupted the sensitive balances between water and land. Unconscious of the effects on the lives of others, landowners clearfill and cultivate both export and subsistence agricultural crops on these steep slopes. Drastic impacts on land and water resources have been created by the combined effects of private ownership and the lack of skills and knowledge of land users. As a result, there is a depletion of the natural vegetation, soils, and the quantity and quality of water in the watershed. At this time, I am unable to produce exact information on the acreage of the area, land ownership, soils, and population. There is a need to conduct a study in the watershed in order to collect basic information, formulate methods to

control erosion, evaluate the current and future needs in the watershed, and develop recommendations. OBJECTIVES The objectives of the study would be to conduct an inventory to determine environmental and human characteristics of the Good Hope watershed; assure future benefits geared towards improving water quantity and quality by applying conservation practices; and implement water resource laws and regulations. PROBLEMS Some of the problems facing the watershed are that: water quality is lowered due to soil erosion and sedimentation; water gets contaminated by the use of fertilizers and hazardous chemicals; there is a loss of natural vegetation due to intensive farming practices; and there is a lack of skill, incentives, and knowledge to cope with the situation. CHARACTERISTICS OF THE WATERSHED Unfortunately because of unavailable material in the library, I stress against the lack of information. The necessary information should be collected in Dominica with the help of researchers. Then, I will be in a position to submit recommendations. ---Page Break--- POSSIBLE SOLUTIONS TO PROBLEMS Effective maintenance of the remaining natural forest, taking into consideration topographic

features and drainage patterns. Implement contour farming, terraces, and agroforestry, therefore, contributing to water quantity and quality, and reducing soil erosion. Presentation to the Ministry of Agriculture and Forestry Division acting as sidelines to control and regulate further use of land in the watershed. Organize education programs with directives to raise public awareness. Talk to the landowners personally. I recommend that the government make provisions to either reclaim and enforce acts or policies to rehabilitate the watershed. ---Page Break--- CONSERVATION OF WATER Gloria A. Mortley St. Lucia INTRODUCTION In 1944 Dr. John B. Beard conducted preliminary surveys of the forests in St. Lucia and other Windward and Leeward islands. As a result of Beard's work, the Forestry Division of the

Department of Agriculture was established in St. Lucia in 1946, with W.G. Lang as the first Forest Supervisor. Dr. Beard recognized five forest formations that had slight alterations, and which are used by modern foresters to describe areas for management and research practices. They are the rainforest, the lower montane rainforest, the montane thicket, the elfin woodland, and the secondary rainforest. There are approximately 120 Holdridge Life Zones in the world, sixty-six of these exist in the tropical latitudes, and out of these 65 can support forests. There is some agreement between the Holdridge life zones and the forest formations of Dr. Beard. Two out of three people in the world today are farmers, and in many of the least developed countries almost everyone lives in a village or on a family farm. Trees play a very essential role in this rural life by providing fuel for domestic uses, fodder for livestock to survive the dry season, shade to protect animals, and other beneficial uses. St. Lucia began to lose forested areas in 1638 when the English first arrived; since then, the forest has gradually reduced inwardly from the coast and is now mostly confined to the steep and inaccessible areas of the interior. Yet, we need the forests more than ever, not just for wood products, but to build and stabilize the soil, to absorb rainfall and release useful water, to remove the impurities of air, to balance the climate, and to provide habitat for wildlife, all of which are important to the fine-tuning of the planet. Forested watersheds upstream from agricultural areas are of key importance to agriculture, especially in mountainous countries, because these upland catchments are the prime source of water for irrigation and other human needs downstream. Those upland watersheds have been denuded in many regions as forests are exploited to open up new fields or to provide fuel. Forest cutting typically leads to erosion, resulting in flood damage to villages and the loss of farm fields due to torrential channeling.

erosion. Rapid siltation of irrigation projects, the drying up of village springs, loss of stream flow during the dry season, and other problems are recognized when upstream catchments have already lost their natural protection. Forestry can be an important contribution to agriculture in terms of restoration and work to reverse the damage. Therefore, forest trees and agricultural crops can be grown together in a mutual advantage system known as intercropping or agroforestry scheme, that has been given attention lately because it serves and protects soil and water resources. Conservation should yield some tangible, short-term benefits in order to gather the grassroots support required for success. Upstream conservation should be shown to protect farmer interests and have a clear economic benefit. This pamphlet emphasizes how forestry supports agriculture through conservation of water and is summarized on a general basis, illustrating problems and solutions that can be promising. Conservation can also yield some short-term benefits, such as when a shelterbelt protects a field against wind erosion.

OBJECTIVES

The main objectives of this case study are to: show the need to control natural land erosion which

has been aggravated tremendously by poor farming and faulty land usage; promote conservation among the people and eliminate widespread evils such as indiscriminate forest denudation; recommend experimental work which may be necessary to implement the Forest Policy such as soil and water conservation; promote the preservation of the remaining forest vegetation in order to prevent land denudation and degradation of water resources; and show the necessity for the conservation of forest water resources on privately owned land.

RAINFALL AND CLIMATE

St. Lucia rainfall is expected to be low and intermittent in the coastal areas and high and continuous in the mountainous interior. There are two zones: Vieux Fort in the extreme south with an average annual rainfall of 1600 mm and a dry season from December to April.

(with less than 101 mm of rainfall a month) and Quillesse in the interior, with 1776-3987 mm of annual rainfall and no appreciable dry season. November has the highest rainfall. The island is liable to visitation by severe hurricanes. A recent one struck the island in August 1980. The hurricane was accompanied by torrential rains and high winds, causing great devastation to the forests and wildlife, and also resulted in loss of life. St. Lucia's tropical climate is modified by oceanic influences with main features of uniformly high temperatures all year round. The quantity of precipitation is influenced by elevation and forest vegetation. This is shown by the concentric rainfall pattern in the western parts of the island where most of the highest mountains are found.

THE NUTRIENT AND HYDROLOGIC CYCLES The movement of mineral and organic matter within and through the biosphere is known as the nutrient cycle. The nutrient cycle is similar in conception to the hydrologic cycle which extends above, below, and through the biosphere. Water is a chief agent releasing and transporting nutrients around the ecosystems. There is a recent tendency to regard the drainage basin as the most logical basic unit of an ecosystem and also a growing desire to combine the objectives of land, air, and water management into one efficient system for identifying and solving problems on a watershed basis. The nutrient cycle does not balance on a drainage basin as does the water cycle. The nutrient cycle is replenished through geologic time by uplift of sediments which, in a sense, starts the erosion and nutrient cycle over again. Forests have a large capacity to store nutrients because of the large mass of dry weight of standing crop, e.g., leaves, twigs, and stems which become the free nutrient pool when they fall. But much of this free pool is absorbed again by the roots of trees and by faunal populations. The total pool on a particular basin may build up over the years, leading to greater growth potential. It may require a fire or

severe cutting to release nutrients into the free pool for ready reabsorption by new growth. In this process, some of the nutrients contained in the original standing crop may be lost to the site by leaching through the soil to the streams. Figures 1 and 2 show the hydrological cycle and precipitation and evaporation. **NATURAL WATER QUALITY** Streams and rivers had a certain natural quality before any disturbance by humans. Dust, atmospheric minerals, and gases are picked up as precipitation falls through the atmosphere. Among the most common are oxygen, nitrogen, and carbon dioxide, but a host of others are present in rainwater as well. During the interception process, precipitation picks up additional minerals and organics from the leaves, twigs, and stems of vegetation. The water already contains several materials, which move through the weathered mantle, and the dissolving of minerals occurs. Various complex exchange interactions between the mineral, floral, and faunal components of the soil take place. When the water finally emerges as stream flow, its organic and inorganic constituents reflect the mineralogy of the basin

and the nature of the vegetal cover. Further changes take place in the channel, where riparian vegetation may add great quantities of organic matter during leaf fall. Abrasion and solution of sediments in the channel may add more inorganics to the dissolved and suspended components of the water. The quality of subsurface flow merging into the channel is apt to be fairly stable from year to year; therefore, the quality of stream flow will vary greatly with the discharge rate because of the changing depth and carrying power of the stream during storm flow.

FOREST WATER AND QUALITY The term water quality is generally used in relation to an intended water use such as drinking, recreation, irrigation, power generation, and manufacturing. The term has many definitions and uses. Water quality without reference to the intended use includes the physical, chemical, and biological

Properties associated with the mineral and organic material suspended and dissolved in the water. High quality water, e.g., water used in irrigation, should not have a high salt concentration, that used for cooling should have low temperature, and that used for recreation must have a low infectious organism count. Therefore, water acceptable for one use may not be suitable for another. It has long been recognized that forests promote high quality water primarily by reducing erosion and sedimentation. Burning, harvesting, or clearing forests often degrade water quality to some degree, but it is usually the practices which follow forest removal that produce severe and lasting degradation. Water quality is influenced both by natural factors such as climate, season, mineralogy and vegetation, not forgetting by the activities of humans. When "natural water" is fouled by human activities, to the point where it can no longer meet a specific use, it is said to be polluted. Pollution, like water quality, is related to the intended use.

POLLUTED WATERS Since natural waters already carry materials which are limiting for certain uses, we have some difficulty specifying just what "pollution" is. Over the centuries, water quality has evolved on the stream ecosystem under conditions that lead to what we might rather pointlessly refer to as natural "pollution." For our purposes, however, we should regard pollution as that caused by humans and think of polluted waters as those degraded below the natural level by some activity of people. In this sense, unabused forests and wild lands do not produce polluted waters, although they may at times produce water of impaired quality. An example of pollution follows. Natural waters usually contain little phosphorus, a nutrient essential for plant growth, because soil has a high exchange capacity for phosphorus. Competition among species for phosphorus in the natural stream is severe, and the ecosystem is delicately balanced around its relative availability.

To several activities of people e.g., the application of commercial fertilizers to ponds, or dumping of industrial wastes and sewage, many areas have increased the supply of available phosphorus sufficiently to cause a sudden lush growth or bloom of algae and other objectionable plants in streams and rivers. Although a valuable nutrient, these additional supplies of phosphorus constitute pollution. The death and decay of the blooms remove oxygen from the water by aerobic decomposition, and large fish kills have been traced to such causes. Other human-induced imbalances in the quality of water are creating great concern about all aspects of water supplies and water use.

FOREST CONTROL SOIL EROSION The capacity of trees to recloth worn-out land is proved by the forests that have grown to maturity on what was once cropland. In a good forest, the tree tops usually are close enough to form a closed canopy, and frequently small trees, shrubs, and other forms of lesser vegetation make up a thin or thick undergrowth. Anything less is not first-class forest and is not likely to provide such good protection for the land beneath. The leaves, twigs, branches, and stems of a forest expose innumerable little surfaces, aggregating under good conditions. This loosely thatched roof, often 30 m in thickness, is the first line of protection against soil erosion and excessive runoff. When rainfall beats upon this roof, the raindrops spatter the land,

and the water slips gently down the stem or drips intermittently to the ground. As much as 1.3 cm (1/2 in) of rainfall may be completely intercepted by this intervening thatch. Part of this intercepted water is lost by evaporation and never reaches the ground. The main forest bulk works against erosion and runoff. Still lower down, covering the forest floor, is a blanket of litter and fragments of bark in various stages of decomposition. Beneath it is an endless series of little depressions, which catch part of the water that penetrates the thatched roof.

Overhead, it restrains much of it from running away. This blanket performs a double function, such as absorbing part of the water and, like a sieve, directing the remainder downward to filter slowly to the soil beneath. All these important blankets of vegetative cover exert a powerful influence on the soil in several ways, making it more permeable to water. Erosion is the process by which soil and minerals are detached and transported by water, wind, or gravity; hence we are concerned chiefly with water as the erosive agent. Mass wastage such as slips, slides, and rock falls result from gravity but is aggravated by water. There are two types of water erosion: they are surface erosion, which is the detachment and movement of material over the surface of the ground, and subsurface erosion, which is the elutriation of the earth mantle by subsurface waters, usually in the form of dissolved minerals, but it sometimes includes some colloidal material. Vegetation alone can halt small gully erosion, and when used as a supplement to check dams or technical methods, vegetation also can be used to reduce soil slippage and landslides. **FOREST COVER MAINTAINS GOOD INFILTRATION** The abuse of land after tree removal by repeated burning, unwise agriculture, overgrazing, or haphazard road building reduces infiltration rates and increases local flood peaks and volumes. In other words, infiltration is impaired by the practices that often follow forest clearing, not merely by the cutting and removal of trees and shrubs. So far there is little convincing evidence that the mere presence or absence of forest cover affects infiltration to such an extent that either the prevention or cause of major floods can be related directly to it. In order to increase downstream flood peaks seriously, the reduction in infiltration must be drastic and therefore simultaneously cover hundreds of square miles, conditions that fortunately rarely prevail. **FOREST COVER PROVIDES FOR ADDITIONAL SOIL AND WATER STORAGE**, due to evapotranspiration from the

Forest cover, which is greater compared to other types of cover, often results in a dry soil mantle under the forest during summer. If prevailing rain occurs during this time, much surface flow is diverted to retention storage under the forest; in this case, the volume of direct runoff is less under the forest, and the flood peaks downstream may be reduced. Since the soil mantle is recharged by rain, forest evapotranspiration will play a minor role in reducing the volume of direct runoff.

FOREST ABUSE CAUSES WATER PROBLEMS

In many parts of the world today, upland catchments are covered with a natural protective cover of forest or shrubby vegetation, but as years go by, because of the shortage of land for the growing populations, steeper and erodible lands have been cleared and then put into cultivation. Shifting cultivation of the slash and burn type farming is a critical problem in many countries. The farmers cut and burn the forest, cultivate the site for a few seasons until the soil is depleted, then leave the area and move on to a new site; erosion at this stage is inevitable in most of these situations. In mountain areas, the mountain slopes break loose, creating massive landslides carrying farm fields downslope. Erosion is the number one natural resource problem in modern agriculture as well; the erosion that sometimes follows forest clearing and land use destroys the beneficial role of forests in flood control. Eroding uplands usually dump sediment into main channels where it later elevates

flood stages, and the mud and debris cause additional damage in towns, flood plains, and reservoirs. Roots of forest trees and shrubs also serve in some areas to bind the soil of steep slopes and help to prevent mass wastage during storms and following severe fires.

DEFORESTATION AFFECTS STREAMS

The hydrological response of a basin, or in other words, how the stream acts when it rains, is an excellent index of how a forested watershed can be. Forest cutting changes this hydrological response. Uncontrolled deforestation, as

created by shifting cultivators can lead to serious erosion and cause hydrological problems for farmers downstream, especially: the siltation of reservoirs and irrigation works including turbidity and water quality problems; higher peak flows making rivers cut into fields, flood villages, and destroy irrigation inlets; and debris problems such as logs, branches, etc., which jam and cause serious local flooding. Deforestation reduces the water table and stream base flow, causing the drying up of springs and other drought problems. The term Conservation of Watershed refers to the use of land within a drainage basin, so as to protect it against these problems and also protecting other natural resources while still deriving desired goods and services from the land, such as agricultural or forest products. Each part of a watershed is used according to its capability. The introduction of Crown lands to the Forestry Division, which is soon to be combined as one, will result in the eradication of considerable depletion by farm squatters, and also in decrease in forest denudation and the prevention of wastage and destruction of forest water resources. Farmers would pursue a living, and the consequent necessity for optimum land usage with the introduction of sound Forestry practices on privately owned land and on Crown land will result. SETTING St. Lucia is one of the last truly unspoiled Caribbean islands which is known as the Helen of the West. It is situated 14°N and 61°W of Greenwich. It is the second largest of the Windward islands. It is 617 km² and has a population of approximately 130,000. ---Page Break--- Topography is a range of lush mountainous heights with their glorious peaks and steep ridges, which appear to emerge from illusion, dominated by spectacular piton pinnacles formed by the solid layer of residual volcanic plugs. HISTORY OF WATER IN ST. LUCIA In March 1846, soon after the enactment of the Water Works Ordinance, clean-pipe borne water came to the inhabitants of Castries. Prior to that it would

Seen that each person had to fetch the water they needed from the nearest stream or, in the case of the more fortunate ones, to draw water from the nearest rain cistern, since water was a scarce commodity. A few document references at hand indicate that Castries town was considered an unsanitary place to live in. After the Ordinance in 1846 and the Amendment of 1849, Castries became an attractive port of call for ships and by 1863, it was well established as a loading depot and watering place. After the extensive harbor improvements at Castries in 1885-1890, the water supply had to be expanded, and the Castries Water Works Scheme of 1898, estimated to cost 24,000 pounds, was supposed to supply 151 liters per head per day. The Castries Town Board became the Water Authority in 1893. It was estimated by J.T. Rae in 1898 that the whole available supply of water from the sources tapped for Castries would amount to some 7.5 million liters daily; his calculation was based on an average rainfall around Castries of 2540 mm per annum. George Lingwood produced a report on the Castries Water Works in 1898, giving some interesting statistics. He measured the rate of the flow of certain rivers on the 15th of June and obtained the following results: Joseph River ~ 631,260 l/day; Piton River - 1,493,100 l/day; and Stream at La Soctere = 161,784 l/day. The national forest of St. Lucia contains four major watersheds, located within the forest reserve. They consist of two separate forest blocks, which are the Castries Water

Works Reserves (64 km²) and the Dennerly Water Works Reserves (5 km²). There are watersheds on private lands, but the number at present is not known, and there is no available information for water yield totals. The major catchment areas of the island are located generally where the rainfall is highest. It is on these catchment areas that St. Lucia gains its essential water supply; therefore, a top priority should be their protection. In 1979, St. Lucia harnessed a total of 4.16×10^9 liters from catchment.

areas. **SELECTING TREES TO DO THE JOB** Selection of the tree species for erosion control is a step requiring careful study. Planting an unsuitable species can result in wasted effort and money and possibly years of time if failures are slow to appear. This must be tested, with respect to highly eroded sites, is it in fact worth the effort to plant trees at all? There is no sense in trying to afforest nearly sole sites, because natural tree growth will be preferable. In conservation work, both local and exotic species may be considered, but those already known to grow well in an area are the most logical starting points. The selection of species to halt erosion is largely a matter of assessing their adaptability to prevailing site conditions and their utilization value. Consideration should be given to species which produce abundant litter that mats well. Some desirable characteristics sought in tree species for erosion control are: good survival and fast growth rates on impoverished sites, capability to produce a large amount of litter, strong and wide spreading root system with numerous fibrous roots; deep roots are usually essential, capacity to form a dense crown and to retain foliage year-round, resistance to insects, and provision for some economic returns, particularly on a short-term basis. **SUMMARY** Today water supplies are especially threatened because of erosion. The erosion of farmlands by wind and water, the drifting of sand dunes, stream siltation, flooding, the sedimentation of many reservoirs, and the decrease in groundwater replenishment of catchment and other natural resource problems continue to reduce agricultural farms production and the water table in all regions of the world. At first, the people were few in number, their villages small and scattered, and the forest supplied their needs using the sun, the rain, and the minerals from the soil to replace what was used up by the people. But as population increased, more people cleared land for agricultural demands.

furniture, housing, fuel, boats, posts, and any other uses. Then as a result, the forest began to feel the strain and started deteriorating since humans have indiscriminately infiltrated its domain. Water appears to be a never-ending resource, and there is no doubt that it is the most widely used and widely abused commodity in existence today. There are many opportunities for forests to counteract these problems: Through afforestation for upstream erosion control, and windbreak establishment, upstream forests can be managed to help in protecting water supplies and reduce sediment problems. Forest conservation work can also include short-term benefits of interest to farmers, e.g., fuelwood, fodder, and other goods can be produced in conjunction with conservation. A regular flow of water encourages and supports a high standard of living in terms of food, health, labor, and industrialization. No country can forge ahead prosperously if its water supply is inadequate both in quality and quantity. Forest officers are concerned about the protection, quality, quantity, timing, and conservation of the natural resources of the drainage basin. Our island is like a well; you pour water into the well, it is then utilized from year to year, so let us all be "conservative" to protect our forest in order to save our water.

CONCLUSIONS AND RECOMMENDATIONS. Due to the critical problem of sedimentation of reservoirs and the resultant loss of storage for irrigation water, and loss of flood protection for agricultural areas, which lie downstream, it is recommended that the Central Water Authority coordinate with the Forestry Division in order to establish an effective program. River basin

development projects continue to neglect upstream erosion control and fail to recognize that erosion control frequently costs less than sediment damage control. It should be recommended that legislation is enforced in order to protect all river banks. Simple land use planning techniques have proven useful in several

Countries are seeking to best know how to fit forestry in rural development. It may be recommended that the possibility of some type of center for soil and water conservation be explored. Besides serving as a data and information unit, it might also be a focal point to coordinate research or assist in developing suitable field techniques for soil and water conservation. The removal of the natural vegetal cover can result in numerous problems such as reduction of the water yield and accelerated erosion caused by man's interference with the natural cycle. Therefore, legislation should be enforced stating that all water catchment areas should remain fully covered and untouched.

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REFERENCES. Bennett, H.H. 1939. Soil Conservation. McGraw-Hill Company. New York. Caribbean Research Center. 1980. Water in our development. Hewlett, J.D., and Wade L. N, 1969, An outline of forest hydrology. School of Forest Resources, University of Georgia, Athens.

WATERSHED MANAGEMENT FOR DOMINICA

Charles Katty

Dominica

INTRODUCTION

Dominica is an island of volcanic origin. The main rock types are andesites, dacites, and basalts in various forms. Soils have been derived from the underlying rocks and from more recent showers of dacite. Soils vary widely in stability, intensity of weathering, and leaching.

They can be generally described as freely drained loam soil! With only a superficial review of the water resources of Dominica, it's capricious to suggest that this island, with so many rivers and receiving over 2240 mm (88 in) of rain annually and up to 10,160 mm (400 in), is faced with a potential serious water situation. Yet, a combination of factors makes this a probability within a relatively short period of time. The island's population is increasing at a rate of 2.2% per year comparable to other rapidly growing areas in the world. This rate exceeds that of many other Caribbean islands including Haiti, Cuba, Jamaica, and Puerto Rico. How will wastes be treated and how will the expansion of settlement toward the island's interior affect the coastal cities' water supply? Demands for a clean, reliable water source will expand with population growth. Education will increase the desire for improved living conditions and the necessity for water free from contaminants. The physical features of Dominica, the mountainous terrain with precipitous slopes and narrow river valleys, and the island's heavy rainfall, accentuate the problems of rapid water

runoff. Flash flooding with loss of property and burst water pipelines causes water shortages, soil erosion, and reduced crop yields, occurring now and will be more common in the future. Accelerated removal of the forest to accommodate random cultivation and logging without an understanding of the necessary precautions required to protect the water supply, can only aggravate water runoff and flooding conditions. Unregulated settlement without sanitation facilities in water catchment basins could quickly jeopardize the water supply for most of the island's population. In 1964, the Dominican government, assisted by the World Health Organization, completed an extensive water requirement study based on a projected population growth. In this report, water sources and water demand areas that were essential to the increasing needs of Dominica were identified and defined on maps.

However, these vital catchment basins still remain unprotected and are subject to random destruction, severe erosion and in addition to the water requirements for human consumption, the island of Dominica depends on water for its electrical power. Hydroelectric power can be as easily lost as reliable drinking water sources if the drainage area is badly disrupted through poor water management practices. Once destroyed, watersheds in Dominica will rapidly erode, carrying away the soil and depositing sediment in storage reservoirs. In addition to damaging storage capacity, cut-over and eroded watersheds tend to have rapid runoff with little retention of water, producing a highly variable streamflow. Such intermittent flow would also disturb the hydroelectric potential. Watershed Management and Soil Conservation Watershed management is the wise use and conservation of soil and water resources. It is designed to maintain the productivity of these resources at not less than their present levels and in some instances to help raise the levels to meet increasing requirements. The management of watersheds is not a new concept. It is used in many other countries, but we failed in the past to use it more extensively, because of the richness of our natural endowment and our relatively low population density. Good management has always offered the possibility of maintaining and improving the yield of watersheds and protecting streams. Now that new lands for development are getting scarce, and that the population of Dominica is growing more rapidly, we can no longer afford to let our resources deteriorate. Further, as the population shifts toward the city, an increasing load is being placed on the watersheds in northern Dominica, where erosion is an extremely serious threat and where watershed management practices need to be adopted as an integral part of basin development. Rainfall, slope of the land, and other natural factors should be taken into consideration. Human entry may set in motion forces which,

Unless they are counteracted, eventually destroy the usefulness of the lands. Cutting trees, plowing and harvesting croplands, and establishing industries which pour their wastes into the streams, all present a serious hazard. During the past decades, many of our valuable soils have been depleted due to lack of knowledge on the part of our small farmers. Poor cultivation practices, especially on steep slopes, lead to increased runoff which eventually leads to erosion. Trees which once played a role in anchorage of the soil and storage of water are no longer available. Siltation is taking place in streams and the quality of water has been reduced drastically. The effects of bare, depleted soil may be observed in the areas of Marigot, Wesley, Woodford Hill, and other parts of the island where water is lacking during the dry season. Today, because of the greater demand for water in Dominica, proper management is needed. Therefore, it is imperative that our forests, soils, and water be manipulated in such a way so that we avoid many of the problems we see today. Water is essential for humans and for the development of Dominica. In 1979, water resources in Dominica faced a hard time with Hurricane David, which caused slides and blockage in the streams. One year later, Hurricane Allen also damaged the water supply, leaving people without water for days.

OBJECTIVES OF THE REPORT

The objectives of this report are to: promote the establishment of forest reserves and watershed areas; research the commercial use of forest reserves and water resources for fishing; provide information to aid in the formulation of a water resource policy, law, and regulations; aid in the development of island zoning by land classification schemes and management planning; and determine inventory and data needs on water resource management and research for this resource. Reference was made to watershed management for St. Lucia by Augustine Charles, Alexander Forde, and Vincent Ernest (1983), "In Dominica we have...

Almost 'the same problem' as in St. Lucie, we are faced with problems where private farmers are using all kinds of chemicals on their farms, which are then poured into the water intakes during rainfalls. Over the past decades, the watersheds of Dominica have been used by many different people on the island, and there is much room for improvement in several areas of the country. Land Ownership, Use, and Development: Mostly all the lands within the working plan of the Forestry Division area are the property of the Crown. Some parts of the forests of Dominica have already been proclaimed Forest Reserves, while the remainder are private lands. Adequate legislative powers for control and management of private lands in catchment areas exist in the Forest Ordinance of 1958. One protected forest was proclaimed for the catchment serving as the main water supply source for the capital, Roseau, and the Stewart Hall Water Catchment rules were made in 1975. For various reasons, mainly lack of adequate funds for appropriate compensation payments, it has not been possible to enforce the rules. Other catchment areas on private lands do not have controls for deforestation and cultivation. The question of protecting and securing future water supplies is perhaps the most important of all the country's conservation problems. Major Watersheds: The island has twenty-one watersheds, nine major, and twelve lesser ones (Fig. D). Some are on private lands and the rest are on Forest Reserve. The 'Trafalgar' catchment was visited after Hurricane David. The forest was badly damaged by the hurricane, but there has been good recovery of ground vegetation since then. Domestic Water: There is some information available on the water used in the country collected by the Central Water Authority (CWA). The figures are not available presently. Mostly all private pipes have a tap, and additional taps or stops after the first year. Before the oil crisis in October of 1973, the cost of water in Dominica was approximately \$2.00 (ECD).

per gallon, and in 6 months it had reached 3.05 (ELD) per gallon and will obviously continue to rise in relation to the oil inflation. Water Laws The water law of Dominica was passed in 1969, and it states that it is prohibited to use chemicals in the water catchment areas of Dominica, but restrictions are not enforced in some areas. Wood and its Use Wood is used in nearly all of the country. The demand for firewood increased after the hurricane of August 1979. The rising cost of gas for cooking placed an extra demand on traditional sources of fuel. Certain traditional patterns of use have increased the pressure for wood use in other areas. The problems caused by Hurricane David in 1979 and Allen in 1980 have encouraged more people to work in charcoal making and furniture construction. Effects of Clearing on Soil and Water Resources The traditional means of treating watershed vegetation to increase streamflow have depended upon removal of woody vegetation by cutting, use of chemicals, or fire, with subsequent replacement by some other kind of vegetation. However, it may not be necessary to remove or change watershed vegetation to obtain a reduction in evapotranspiration. It may be assumed that complete clearing, even by manual methods, is detrimental to soil fertility, structure, and moisture-retaining properties. The soil is

generally fairly well covered by weed growth within four months after burning in the moist lowland forest region, but extensive sheet erosion occurs in that time, particularly where there is little debris left from the burning. Some hydrological problems confronted are the following: hazardous silting and pollution of water, including pesticides, on private lands; aggravated erosion by poor farming and other kinds of faulty land usage; contamination of streams with both organic and inorganic materials such as rubbish, timber waste, and banana wastes; contamination of the rivers with harmful chemicals such as herbicides, pesticides, and detergents; shortage of water in dry seasons.

increased treatment costs of wastes in the water; and, increased water distribution costs.

DISCUSSION In order for the Forestry Division to carry out its plan, there is need for funding. There is also a need for research, and a need for technical assistance in watershed management. For the Forestry Division to carry out an effective program there are a few steps we should take into consideration: we need more trained officers in watershed management; all critical watersheds on private lands should be restricted; and we need discussions with the farmers who have critical watersheds on their lands. Hurricanes David and Allen left our watersheds in Dominica with such damage, so now we need to control timber activities in a few of our watershed areas. We also need to control deforestation, or clearing followed by cultivation of catchment areas. If the catchment areas remain without control, it could have a very harmful effect on future water supplies in Dominica. Thus, the most serious hazard is the one currently receiving least attention from government services, and virtually no remedial action. There are many reasons for this including land tenure difficulties and related land hunger, political pressures, and scarcity of funds for compensation payments to farmers who would be adversely affected by the required remedial measures. Nevertheless, while actions are deferred, the problems will inevitably become more difficult and more costly to rectify. It is not suggested that complete exclusion of cultivation from catchment areas is always necessary. A separate management plan for each catchment area would seem desirable. The task is a difficult one and would involve the Central Water Authority catchments (including those required for hydro-electric purposes). It seems inevitable that additional efforts and available funds will be needed to concentrate on solving problems in priority areas. Current efforts are limited to only a few watersheds. The question of protecting and securing future

Water supplies are perhaps the most important of all the country's conservation problems if we are to utilize full benefit from Dominica's natural resources. Conclusions: In spite of its geographical remoteness, Dominica is beginning to experience many of the same environmental problems with which an increasing number of the world's nations are faced. The island's limited space and limited resources are undergoing pressure from a population that will double in 35 to 40 years. This pressure has caused problems of water pollution and disposal of sewage and solid wastes in the more populated areas. A growing concern for problems of public health and communicable diseases is apparent. The density of the island's population is greater than would appear from a superficial division of the island's inhabitants by 751 km (290 sq mi). The majority of the 70,000 people live within 0.8 km (half a mile) from the sea, with more than a quarter of the total population in the capital city alone. The climate and topography of the interior of the island have in the past, and will in the future, limit the distribution of the people. These factors, coupled with the fragile ecology of the rain forest and tropical soils, raise serious questions as to how much pressure the interior lands could tolerate before these would suffer rapid and catastrophic deterioration. ---Page Break--- Recommendations: There are a few recommendations that I would like to make. The resource use laws and policies of Dominica should be revised and updated. Soil and forest

conservation should occupy a place of importance in planning river basin programs. The work of the Central Water Authority responsible for watershed management activities should be coordinated with the Forestry Division into a coherent program for the country. The government should make provision for more effective management of private lands in order to improve watershed conditions. Expenditure for soil and forest conservation and other aspects of watershed management should be

increased in line with expenditure on development programs. Watershed values on private lands should be recognized. More forest officers should be trained in watershed management. Education should be a part of our daily responsibility to the public. Research should be done in several catchment areas on a priority basis for critical areas that the Government should implement land exchange where settlers currently reside.

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REFERENCES Charles, V. Ernest, and A. Forde. 1983, Watershed Management For St. Lucia, Case Study, Lad, Rey and E.W. Russell. 1979, International Institute of Tropical Agriculture, Ibadan, Nigeria. The Conservation Foundation. 1970. Dominica: A change for a choice. Washington, DC.

Trenaman, K.M, 1980, Emergency rehabilitation of agricultural and forestry sectors following Hurricane David. Forestry Program Report. Commonwealth of Dominica, 910

Figure 1: Watersheds on Dominica

A STUDY ON THE BIOLOGY AND STATUS OF THE RAMIER (*Columba squamosa*) IN DOMINICA Egbert E. Bethel Dominica

INTRODUCTION For many years the red-neck pigeon, or ramier (*Columba squamosa*) as it is locally known, has been hunted by natives and foreigners. They are hunted by natives for food since the flesh is a delicacy among locals, whereas foreigners hunt them for sport. Small numbers are also sold on the French market for cooking. Though the bird is being protected from hunting during the breeding season and a license is needed for its hunting during the open season, the rate at which they are hunted seems too high to allow

A constant harvest without decreasing the population. The pigeons are wild, and by hunting with a shotgun, a hunter can claim between 5 to 10 birds when a shot is fired at a flock. Hunting-induced mortality might be very high. Natural disasters, e.g., hurricanes, can also seriously diminish the population. Since little is known about the breeding biology of the rammier, it is not known if natural and hunting-induced mortality is compensated by birth rates. This is an area which needs deep consideration. We also need to know whether the population is increasing or decreasing by conducting population censuses. There has never been thorough censuses of rammier population in Dominica. In fact, data on the population status of most wildlife species are scant. The most detailed information available pertains to the sisserou (*Amazona imperialis*) and jacquot (*Amazona*

arausiaca) parrots. However, research on our parrots was obtained only after we realized that their numbers were on the decline. Their decline resulted through the same natural and human-induced mortality factors that are now affecting the rammier. Parrot censuses provided information that has allowed us to take the necessary measures to stop the population from declining further. It is on this basis that censuses of rammier populations shall be performed. Despite the fact that the rammier is an important game species, it also has its rightful place and a role to play in Dominica's ecosystems and should be protected with this view in mind. For example, it serves as an important food item in the diet of the chicken hawk (*Buteo platypterus*) and might be important in the processes of plant seed dispersal and seed germination. It is for these and other unknown reasons that we should not allow the rammier to become extinct. This study will help us achieve this end.

STUDY OBJECTIVES

In order to obtain the necessary information for the management and conservation of the rammier, we will conduct a study which will meet the following objectives:

determine the population status and movement of the rammier; establish baseline information to monitor the population over the years, in hunting and non-hunting areas; obtain information on the extent of mortality brought about by hunting; determine the diet of the rammiers and obtain preliminary information on the breeding success. **STUDY AREA** The rammier is widely distributed throughout Dominica, being most common in the rainforest at elevations between 457-1060 m (1500-3500 ft). These areas receive rainfall between 3810-7620 mm (150-300 in) per annum and have a mean temperature of 23-25°C. The vegetation in these areas is slightly variable and is composed of virgin forest and secondary forest with some cultivated areas around them. However, the birds are not confined to the rainforest only, being commonly seen in other habitats. In order to determine the change in abundance in populations due to hunting pressures, I have chosen three main areas with similar habitats but with different hunting pressures. These include: the D'eau Goamier or the Central Forest Reserve area with undisturbed forests, where hunting is prohibited (low hunting pressure). the Syndicate area, which contains a slightly disturbed forest reserve, but is surrounded by private properties which provide access to hunters (medium hunting pressure). The Wesley Woodford Hill area, which also contains a slightly disturbed forest reserve, but is encircled by many more private properties than the Syndicate and the Central Forest Reserves (high hunting pressure). **TECHNIQUES** Since the terrain of the island is very rugged and mountainous, I have chosen the variable circular plots to conduct population censuses. This method has proven to be the best one for such areas. With this method, I will set up points at intervals of at least two km (which can be longer or shorter depending on the area of the habitat and how intensive the study of the species is) along ridges or flat areas. In certain cases, platforms will be placed at the top of

Trees thus facilitating the sighting of birds at long distances. People will be stationed at each of the platforms, recording the time the birds are seen or heard, their direction, distance, and number of birds seen. For this reason, I will require two persons to undertake the study. The censusing representative technique will be to obtain information on the population status in the three wrens that I have chosen. I will monitor the bird movements by above canopy searches (with the aid of the platforms) and by marking nestlings. I will automatically walk selected lines in study areas to search for nests in order to obtain information on breeding success. Lastly, I will circulate questionnaires to hunters (Appendix 1) to determine harvesting rates and feeding habits. I will collect crops from hunters to analyze food remains and determine the diet.

TIME SCHEDULE. In most cases, time schedules for such studies depend on the objectives of the study. In this case, I would conduct censuses to detect any changes in population over the years. Such a study would have to be done for one and a half years in order to have a good comparison of populations for different years. However, counts will have to be temporarily adjusted in accordance with the feeding, breeding, and nesting seasons. It is known that these birds are most active in the early mornings and late evenings. For this reason, most observation periods must coincide with the periods when birds are most active.

MANAGEMENT IMPLICATIONS. In most instances, studies of this nature are normally done with some managerial objectives in mind. In our case, the information obtained will aid us in determining the following: establish bag limits for hunters; determine the hunting season; estimate the size; estimate the distance of sanctuaries to hunting areas; and manage the vegetation composition of sanctuaries and other aspects of hunting regulations. This will also allow us to maintain a healthy population of parameters and harvest it with a

Sustained yield. It is obvious that in order for such a project to materialize, it must have financial backing. However, such studies can be very costly depending on the length of time they take, the tools and materials, and the equipment they require. My study is not very complicated and will not require very expensive tools and materials. However, the part of the budget that is allocated to this study should be adequate to meet the costs of the following: salaries for AMMe (etugl trainees) for two years, transportation (a four-wheel drive vehicle for transport, personnel, and equipment), tools and materials for building platforms, notebooks, binoculars (two pairs), raincoats, flashlights, and miscellaneous items.

APPENDIX

Forestry Division
Botanical Gardens
Roseau, Dominica

HUNTERS QUESTIONNAIRE

Name

Address

Where do you hunt?

How often do you hunt? e.g., 1 day/week, 1 day/2 weeks, 1 day/month, all year round. State exact time.

How long have you been hunting?

How do you hunt? Gun, catapults, traps, other methods (specify).

How many birds do you take per hunt?

How many birds have you hunted? Give proximity for 5 years.

How many hours do you spend hunting?

What time of the year do you see the most birds?

What time of the year do you bag the most birds?

Do you see more birds now or before the hurricane?

Do pigeons cause damage to crops?

In what areas do they nest?

How successful does the ranger breed?

Other comments.

WILDLIFE MANAGEMENT FOR ST. LUCIA

Michael Bobb Jules

St. Lucia

INTRODUCTION

If you were to ask a man in the streets what does he think about the problem of a disappearing species, plant, or animal, he may say this will be a sad thing. But deep down in his mind, he will say it's only a bird, it does not change his lifestyle. In other words, he does not care about disappearing species, but he cares about many other important things like getting a new car. If the Saint Lucia parrot were to become extinct today, the sun and moon

Would still come up the next day for him. By thinking this way, too long in the future, we will face another species less on the face of the Earth. Getting this point across will take an educational drive to make the nation aware of the importance of Miihsfe n'Saine Lucia. "The word wildlife means a great deal to the Forestry Division, but we will have to look at the management work in depth. Management means "the act or manner of managing" and this is the key to our success for protecting the birds and animals in the rainforest of Saint Lucia. Highly trained persons in this field are needed as well as proper training for wildlife officers. In the wake of the growing human population in Saint Lucia and the growing need for more land for agriculture and more timber and wood for fuel, more pressure is placed on our limited amounts of forest and this can cause greater decline of our rare species in the wild, such as the national bird, the Jacquet or Saint Lucia parrot *Amazona versicolor*, which is down to about 100 birds in the wild. Therefore, in this case study the writer will try to prepare a report to help with the management needs of the island.

PHYSICAL SETTING

Saint Lucia is one of a large group of islands known as the Lesser Antilles, which separate the Caribbean Sea from the Atlantic Ocean. These are represented on a map as fragile links in a 1161 km (700 mile) chain which connects the north coast of South America with the large islands of the West Indies. Saint Lucia lies between Martinique in the north, and Saint Vincent in the south at approximately 14° latitude. The island is 43.5 km (27 miles) long, 22.5 km (14 miles) wide, and has a land area of 978.8 km² (378 mi²). The highest peak is Mount Gimie which rises to 950 m (3117 feet). Around the edge of the island there are subtropical dry forests (Holdridge 1967), particularly along the whole of the eastern coast. In the center of the island you find a Holdridge subtropical rainforest, home of most of Saint Lucia's wildlife.

Break--- objectives. The main objectives of this case study are to: keep wildlife in its natural state, and to keep its behavior unhampered by human influence as much as possible; find natural distributions, numbers, and interactions of indigenous species in the wild, and improve habitat; allow all forms of wildlife to control their forest ecosystem in the wild; develop guidelines for managing harvested species; initiate an effective education and public information program, to inform the masses of the significance of wildlife and to make them aware of the critical conditions which now exist. It will be very important to keep the wild in its natural state. A reason for saying this is that when humans arrive in an area, even a forest, and disturb the area by cutting trees and making roads, these activities have a great effect on the area; it throws the entire ecosystem out of balance. It may have an effect on the animal life, destroying the food supply and nesting sites, leading to the decrease of the species. The shortening of food supplies and the scarcity of nesting sites will force the animal to move to another site with different conditions, which may cause death and a complete disappearance of the species if a great deal of damage was done to the area. It will be better to study the area before any work is done. Both animal and plant species which might be affected or become extinct shall be looked for in the specific area. This kind of study should be

done in detail and must be precise. Persons doing a study of this kind should meet together and carefully discuss the field observations before deciding what action should be taken, on whether the area should remain as it is, or if very little work should be done. It will be of great importance to define the natural environments of the indigenous species in the wild. The habitat of the species must be located, as well as the breeding ground and the free movement area. When all of this work is done, the population must be monitored. By knowing that kind of...

Information on protecting or setting aside forest areas for the growth of wildlife species will be available. It will be better to monitor all forms of wildlife in the wild for proper management. On the other hand, there will be at least one species in the wild which will be available for hunting because of the large numbers, but special managing policies must be made, such as the hunting of the red-necked pigeon can be permitted, but for only 3 months during the year. Hunting of that species should be in the early part of the year, from March to May; no hunter should kill more than 5 at any one time; the hunting season can be closed for one year or more to replenish the species; hunters must not enter areas closed for hunting, e.g., natural reserves. Wildlife officers will be patrolling the area during the season to make sure the rules are not violated. Before opening the hunting season, the Forestry Division will educate the hunters and the masses in wildlife management and proper hunting. The means for such a program will be radio talks, newspapers, meetings with hunters in some areas, and open-air film shows for the public and at schools. Putting this educational program forward before the opening of the hunting season will help the people of the state have more concern for the species in the wild and their importance. Thus, having better control or knowing what people think about hunting will make the work of the Division easier for wildlife management in Saint Lucia.

DEMANDS ON FOREST LANDS

As early as 1638, from the time of the first settlement by the English, the forest has been exploited. This just shows the amount of valuable forest and wildlife that has been destroyed in the past centuries. In modern times the forest is still being destroyed by human activities. The population has grown, and this calls for more land for housing and agriculture, just to name a few. On a small island like ours, with the land being the main producer, that can only mean one thing: encroachment of the

Forest. With the high cost of fuel, farmers in the rural areas of Saint Lucia are utilizing the forest as a source of firewood, cutting trees to make charcoal and at the same time clearing the area for farming. One of the main reasons for forest encroachment is the poor distribution of crown lands to farmers, which are side by side to the forest reserves. This factor makes the job of the Forestry Division very difficult. The forest is also being used as an area for recreation. All in all, it's a good idea, but the flow of people must be checked, and a special route must be devised. A constant flow of visitors going through the forest weekly can have an effect on the feeding and breeding habits of the delicate wildlife species. Also, that area of forest will deteriorate with time (constant walking on small trails and the dropping of garbage). The Forestry Division might have to look into proper planning, e.g., the tourist walk, in the near future. So, due to all of these activities, the forest is on the decline. This will also make wildlife retreat deeper into the wild.

BACKGROUND OF WILDLIFE SPECIES

In the wild, we have a wide variety of plants and animals. They are all concentrated in the same area, the rainforest. The activities of these species play an important role in the forest ecosystem. Just as human beings compete with each other for food and space, the same goes on in the forest at different strata. Each species has to defend its territory, young, and area of food supply. Conditions in the wild are not easy; it is normally very wet and cold.

The Saint Lucia parrot (*Amazona versicolor*) was common and widespread, occurring in most parts of our island. Today, through human's indiscriminate felling of the forest and through illegal shooting, it is confined to the mountainous interior areas such as Quillesse and Millet. The sexes are similar in color and cannot be easily distinguished in the forest. They feed on a variety of fruits, seeds, and nuts.

such as Bots Pain Moron (*dodecapetala*). The parrot lives in cavities of very tall trees like the Gonmier (*Acryoles excelsa*). It usually lays one or two eggs. The eggs are white and glossy in color. The incubation period is usually 52 days, with the female taking charge of the sitting duties. Adult parrots can live for a very long time. It will be better to start thinking of managing for the Saint Lucia parrot. The first step to be taken should be a one-year day-to-day observation of the parrot. There are lots of habits of the parrot which are not known, especially the difference in calls between the male and the female and feeding and breeding habits. With a day-to-day observation of the parrot, a lot more will be known about the bird. More artificial parrot nest boxes should be placed in the areas where the parrots roost and must be monitored very carefully, with little disturbance, for the success of the project. The nest boxes must be placed about 6 months before the beginning of the breeding season, and all data about them must be collected. At present, there are about 6 to 8 parrots at Jersey and some in England, where scientists are carrying out a captive breeding program and finding out the habits of the bird. Officers from the Forestry Division should be sent to England for about 4 to 6 months to study the bird as much as possible. Officers can also be sent to Puerto Rico to study with Dr. Jim Wiley, who is working with the Puerto Rican parrot. The Agouti *Dasyprocta antillensis* The agouti is the largest of our wildlife species. In appearance, it looks like a rabbit with small ears, but it is, in fact, closely related to the guinea pig. It has long and coarse, slick hair which varies in color, from speckled gray to brown. The agouti lives in semi-open bushy areas on the fringes of forested country, but it is not confined to the rain forest because of the distribution of the species. There is no fixed breeding season. They can have 2 to 3 litters a year. The agouti is a species that cannot be seen in the

Forest very easily. I have been working with the division for 8 years and have seen a wild agouti only 3 times. This can only demonstrate the scarcity of the species. In all the other forest ranges on the island, the officers have hardly seen them. I think there is a need for research on the agouti. The program should: (a) find an area where the species is common or is likely to be seen; (b) try to locate the feeding ground and breeding area. By finding these areas, one can find some information about the species. All data from the field must be noted in order to come up with some type of program for increasing the species in the wild. It would take about one to one and a half years to do proper research on the species. The hunting of the agouti has been cut down to almost nothing due to the new wildlife act, so it will be a little easier to work with the species. The Iguana (*Iguana iguana*) The iguana attains a length of 1.8 m (6 ft) and has a generally compressed body surmounted, from the neck to the base of the tail, by a row of leathery spines. They have a long, slightly flattened tail, and a conspicuous throat patch. The male is greenish-gray with light red spines. The female is usually browner and considerably smaller in size. The iguana is mostly found in the subtropical dry forest areas such as Louvet, on the eastern side of the island. They mainly live in trees, where they can cling to branches with strong claws. When it is attacked by other predators, it defends itself with its tail, claws, and jaws. The iguana mates in January/February, and after a gestation period of 2 months, the female digs a hole in the ground and lays up to 90 eggs. The iguana has been greatly reduced in number through both disturbance and reduction of their habitat, and more directly through hunting for food. We also have another very important ground

lizard in the south of the island, on a small islet called Maria Island. The vegetation is scrub-like but has some large trees like white

Cedar, gromier, marron, and stone grasslands, The Lizard is very colorful, and at present, there are about 300 to 700 hundred lizards on the island. The ground lizard on Marie Islet is not as rare as the iguana on the mainland. A study has been made on the lizard by the Saint Lucia National Trust and by Dr. Cork, from England. But some research work should be done on the species again. A program similar to the agouti and iguana should be tried. The length of this project should be from about 8 months to one year. The Red-necked Pigeon (*Columba squamosa*) The red-necked pigeon, or ramier, belongs to the family of pigeons, which are stout-bodied birds with rather short necks and uniformly small heads. All have short, slender bills, usually thicker towards the tip and thinner in the middle. Their voices are a soft, plaintive cooing or booming which can become monotonously repetitive. The red-necked pigeon subsists almost entirely on vegetable food. Seeds, grains, and fruits are the favorite items of their diet. The pigeon family is likewise remarkably uniform in its nesting habits. They nest mostly in trees. Practically all pigeons construct a flimsy platform of sticks on which to lay. The ramier lays 2 eggs which are elongated, rounded uniformly at each end, and pure glossy white. Both sexes incubate, the female usually incubating at night and the male during the day, with periods lasting 12-14 days. The red-necked pigeon is one of the species which was hunted in the wild but is now protected under the 1980 Wildlife Protection Act. In the wild, the red-necked pigeon is one of the fast-growing species and can reproduce quickly. During the time when lots of hunting was being carried out, the species could be seen in the wild. Opening the hunting season for about 3 months and limiting it to 3 to 4 birds per hunter should be the policy of the Forestry Division. The hunting season should be from March to May in assigned areas in the forest. Starting a program of this kind would help solve

the illegal hunting which takes place sometimes. Also, the Forestry Division should know all hunters in the state. The hunting season should be opened or closed by the Forestry Division. The White-breasted Thrasher (*Ramphocinclus brachyurus*) The white-breasted thrasher, brownish above and white below, occurs only on the islands of Martinique and Saint Lucia and is now a rare species. They lay only 2 to 3 eggs per clutch, and the incubation period is 12-14 days. There is no clear reason why the white-breasted thrasher is so rare in Saint Lucia. It is believed they were hunted out in their habitat and could not fight to find a new habitat. Before the species is managed, more research has to be done, e.g., try to locate its present habitat. The following questions could be answered: Is the area suitable for the species' breeding and feeding habits? Are there other wildlife species competing with the white-breasted thrasher? AVAILABILITY OF FOOD SUPPLY Food is an important source of energy to all forms of life, and if this supply were to be disturbed or destroyed, it would destabilize the lifestyle of each individual species in the wild. Before Hurricane Allen (August 4, 1980), the food supply for all forms of wildlife was at its peak; lots of big wild breadfruit (*Talauma Modocapetala*), aralie, palm (*Euterpe globosa*), just to name a few, could be seen far and wide on the lush green forest. Then came the hurricane, blowing down a great percentage of trees on which birds feed. The parrot was greatly affected, having to travel to the agricultural areas for food. Other forms of wildlife could be seen hunting for food in strange areas of the forest. The forest had a fast recovery but a long time will be before blown-down trees will be replaced. The reason for this is that natural regeneration of native species takes a long time. Ground-feeding species will also have feeding problems because of the large amount of debris covering the forest floor. Movement will be hampered and feeding grounds destroyed after the

Hurricane, bird feeding areas have become larger. This suggests that the food supply is not as it

should be, making the birds cover long distances in the search for food. This can also be seen with the opossum; lots of them were being killed on the roads by vehicles, lack of food in the forest was the cause. It will take about another 4 to 5 flowering seasons to elevate the availability of the food supply in the wild. Treatment of the damaged feeding areas can be carried out by detecting important feeding species in the sampling stage and thinning the older trees to attain a better growth of young trees.

I have recommended the setting up of vegetative plots within the reserve. Such a program will be helpful for the improvement of the feeding habitat. The project can be called Tree Growth and Improvement of Feeding Ground in the Wild. About 15 to 20 research plots should be located in the reserve at Tandon. The plots should have a 0.2 ha (0.5 acre) area. Within that plot, all trees should be identified, then the species which are valuable for the food supply should be identified and marked with flagging tape. Then the regeneration of these trees should be observed. The next step would be the thinning of the plot. The reason for thinning would be to open the canopy to allow better growth of the young and healthy trees. Any tree which is too close or prevents the growth of food supplying tree species will be removed. The thinning program must be well supervised. The girth of all selected trees should be recorded as well as the crown class and the production of flowers and fruits. The plots should be remarked after 4 years to observe the increase of wildlife in the area.

AVAILABILITY OF BREEDING GROUND

It is obvious that if the feeding areas were affected, the breeding ground will suffer the same fate. As mentioned earlier, lots of trees were blown down and a great percentage of the breeding ground was destroyed. While this had an effect on the birds, it was not as great as the

Effect of Loss

The hurricane was in August, at the end of the breeding season. This had a great effect on the young, killing many birds. Birds had adequate time to search for new trees for the next breeding season. There are a number of facts to support this point. Before the hurricane, the Forestry Division initiated a program for setting up artificial parrot nest boxes in areas the parrots used for breeding. Up to this day, the nest boxes are empty; only 1 or 2 birds have nests or have attempted to nest. In my opinion, this demonstrates that the breeding ground was not badly affected. Other wildlife species were affected, including those that breed on the forest floor, but they were able to find other breeding areas.

Pollution

Pollution can be very hazardous to all forms of wildlife in Saint Lucia. Polluting the natural elements can create serious problems, e.g., affecting the fertility and makeup of wildlife species and causing death. So, people should always do their best to keep nature as best as it can be.

Water Pollution

Water pollution is not a serious problem in Saint Lucia. Water poisoning is being used by some people as a method for fishing. This method has been causing some effect on river species. Populations of crabs, fish, etc., have been decreasing. The use of chemicals by farmers close to

rivers is also having some effect on the rivers. With the growing use of chemicals, the mortality rate of aquatic animals can increase. There is an ideal example of such a problem in the town of Soufriere. An industrial plant is discharging wastes into the river; not a single fish can be seen downstream from the point of discharge. Before the plant came into operation, people from the town used to fish in the river. So, water pollution can have an adverse effect on wildlife.

Air Pollution

Air pollution is not creating a big problem for our wildlife at this moment. There is only one known problem with air pollution: the spraying of banana crops. The chemicals used kill some insects and birds.

other forms of wildlife eat them, causing infertility and other problems. Apart from this air pollution problem, the air seems free of pollution. Noise Pollution This is a minor problem at this moment, but any pollution can create serious problems. For example, the Saint Te is very sensitive to noise and can leave its nest and feeding ground if noise pollution increases. THE NATURE RESERVE By far the best way, although often the least practical, for conserving an endangered species (like our parrot) is to set aside an area of its habitat as a reserve, where it may feed and breed with minimum disturbance. The implementation of such an idea often involves high financial outlays and, at times, leads to a conflict of interests between conservationists and local agronomists. One must consider all points of view, and naturally, human welfare must be given top priority. Before allocating areas of land as reserves, careful consideration must be taken. Will the area set aside for the reserve be in demand for forest use in the future? Will the area hamper the yearly revenue of the Forestry Division for a wide variety of species? Will the Forestry Division be able to keep the public out? Some kind of conflict is bound to come up, and to minimize the problem some kind of compromise must be made by both sides. The nature reserve was established in 1978-79 by Paul Butler, Conservation Advisor to Saint Lucia, and officers of the Forestry Division Staff. The area selected can be roughly represented by a square on the map, its corners grid points being N. West 150-360 running East 4 kms to (2.5 mi), N. East 190-360 running South 4 kms to (2.5 mi), S. East 190-320 running West 4 km to (2.5 mi), S. West 150-320 running North 4 kms (2.5 mi) to the initial point. The area involved covers 16 km (6.17 mi) and may be best defined as a rain forest. The setting up of this nature reserve has made a great deal of good to our wildlife. Its protection must be of top priority because of the

alarming rate at which the forest is being cut. This ecosystem provides a habitat for not only the parrot, but also for a great variety of other fauna and flora. THE ROLE OF RESEARCH IN MANAGING RESERVES Research will play a very important role in managing any aspect in forestry, be it wildlife, or plantation. Before a natural community can be managed, its principal elements and interactions must be known. At least, a managed community should be characterized with respect to species composition, population size, and history of fluctuations of these two variables, whenever possible. Community management, to be successful, must strive to base itself on the maximum amount of ecological data, be responsive to change, not unduly influenced by rigid ecological theories and models, and must utilize the best historical information available. Managing a reserve out of ignorance can conceivably damage resources more than negligence. Until we can obtain sufficient knowledge to manage all reserves in confidence, a balance must prevail between common sense, intuitive decision, and scientifically enlightened procedure. In short, the information fast read tells us the importance of research in wildlife. Research work will play a very important role in the improvement of the habitat, and the stability of wildlife species. The most important

priority of research in Saint Lucia will be to work in increasing species population and improve the habitat of the species in the wild. I recommend research work for more species in the island i.e., the St. Lucia parrot (*Amazona versicolor*), agouti (*Dasyprocta antillensis*), red-necked pigeon (*Columba squamosa*), and the white-breasted thrasher (*Ramphocinclus brachyurus*). Some planning will have to be done with the species named above. The research work will have to be done first. It will entail determining the habitat needs of the species, population decline, increase, and trend; attempt to propose laws for protection of the area, e.g., the nature reserve which can be

"eetbettshed" to protect the iguana and other species; to know nesting areas: the reproducing population; and the holding capacity of the areas. Should we introduce hunting if the population is increasing? Then, by analyzing the field data, proper planning can be made for the species.

RECOMMENDATIONS A wildlife section should be established within the Forestry Division to carry out management duties in the reserve and other important areas around CAEN Grand. The officers in the wildlife section would have to perform duties such as managing special hunting seasons and operating checking areas in and around the reserve. The Wildlife section will be equipped at first with 4 officers. The officers would be needed to do field work in the reserves and other areas and also to analyze data. Intensive patrols must be done in the reserves weekly, all year round. The patrols will help in the protection of the endangered species, stop illegal hunting, cutting of useful timber in the forest, and also observe the activity of the species. Officers should be in pairs when patrolling. They can also help with physical work in the improvement of the habitat. Work like setting up research plots, putting up nest boxes, and others will be performed. Officers must report in writing any strange activity between species in the wild, e.g., if a parrot should be seen behaving strangely, a written report must be made. Time seen, area, direction of its flight, shall be informed to head office where the supervisor and the officer will discuss the matter. Improvement of native tree species in the wild, which is of importance to wildlife species (feeding and breeding). As mentioned earlier in the study, about 15 to 20 plots will be set up to make the most useful tree species grow faster and produce fruit. The duration for setting up the plots will take about one half to one year. A study should be carried out on ways of improving the tourist trail in the near future. The trails are becoming very popular to the outside."

World. This means more people crossing the forest. We must take into account that the trail goes through the reserve. The trail is not very wide and the area is always wet during most of the year. With the constant flow of people walking on that small trail, it will deteriorate with time and the noise can have an adverse effect on wildlife species like the parrot. A planning commission should be set up within the Forestry Division to formulate plans for the trail. The supervisor should be part of the commission. The commission should work with the important points, e.g., is the trail too long? What can be done to better it? Will the noise disturb the wildlife? Can the trail be changed?, etc. A research section should be established within the Forestry Division, which will be of great importance to the future of wildlife in Saint Lucia, bearing in mind that the disappearance of a species will not be seen ever on the island. The job of the researchers would be to look into problems such as why some species in the wild are decreasing, etc. The overall job of the research section will be to investigate all wildlife problems. The organization of the research section will cause a little problem because there are no people within the staff who are highly trained for that job. But, there are highly experienced officers who can get together and keep the section going. The supervisor will play an active role in the research section. The research section could be organized as follows: Field Research Supervisor, Field Officers, Field Supervisor. Specific training in Wildlife Management overseas should be available for wildlife officers for the better management of wildlife species on the island. Areas recommended for training are Canada and England, or any

other country which has training courses in that field. The wildlife section will need vehicles and equipment for easy movement in order to produce better results. There will be a need for 2 vehicles, one in the north and the other in the south. Equipment like

Watchtowers will be needed, as well as radios, binoculars, cameras, etc. The cost of the above will have to be estimated. A comprehensive report should be written with the overall costs and the importance of the equipment for the wildlife section, along with the work which has to be done for the improvement of wildlife. This report will be submitted to the government for approval. Other aid donors, such as the World Wildlife Fund, can be approached with copies of the report for help. The government should finance the project. Forestry and wildlife management should be taught at primary and secondary schools. Recommendations should be sent to the Ministry of Education. Teaching the above subjects at primary and secondary schools will give the young student an insight into forestry, how to protect land, to improve water quality and the production of timber. Wildlife management will give the student a broad knowledge of what is in the wild and how species could become extinct if the habitat were to be destroyed. This would help the student at that early age to love nature and go on to educate others. [EDUCATION PROGRAM FOR THE PRIMARY AND SECONDARY SCHOOLS IN FORESTRY AND WILDLIFE MANAGEMENT.] The subjects Forestry and Wildlife will be very important to the new generations. Water is one of our natural resources and is used for just about everything. With our growing population, more water will be needed. Wildlife management will teach the student the behavior of animal life within its habitat, and that the destruction of that habitat can have adverse effects which can also affect water. That shows the interrelationship between the two. My proposed education program to the schools is presented below. The subject will be taught to grades 3, 4, and 5 at secondary school, and classes 4 and 5 in primary school. Forestry and Wildlife will be taught for one school year and will be repeated for new students coming into the school the next year. Forestry will be taught for the first half of the

School year, and then Wildlife Classes will be in lecture form, about one hour long. About 5-6 classes per term will be needed. Field trips, slide shows, film shows, drawings, and lecture notes will be given to the students for a better understanding of the subjects. At the end of each term, a short test or quiz should be given to find out if the subject is being understood by the students. The lecturers will come from the Forestry Division. I would like this project to be given some kind of consideration in order to help in educating our people in forestry and wildlife. This project is open for amendments and discussion for better implementation by the Ministry of Education.

ACKNOWLEDGEMENTS

In developing this case study, my job has been to show the reader that without proper management of the wild, existing species will become extinct. I look at this case study as an opening for discussion, debates, and improved management techniques in the wild. My work will not be complete if I do not show gratitude to the following people: Dr. Ariel Lugo, Project Leader, through the U.S. Department of Agriculture, Forest Service, and the Agency for International Development who sponsored this course; Dr. Jim Wiley, advisor on my study; Mrs. Joanne Feheley, Librarian; Miss Silda Echevarria, Secretary; and to all the lecturers and staff of the Institute of Tropical Forestry.

REFERENCES

Butler, P.J. 1980. The St. Lucia Parrot: its Changing Status and its Conservation. Holdridge, L.R. 1967. The Life Zone System. Law enforcement, a tool of management. The Dodo Journal of the Jersey Wildlife Preservation Trust. No. 17. Wildlife Management in Wilderness.

WILDLIFE PROTECTION FOR ST. VINCENT

Gideon Cordice

St. Vincent

INTRODUCTION

St. Vincent is one of the four island groups that form the Windward Islands. Despite fairly frequent natural disasters such as hurricanes and volcano eruptions, a great number of wildlife species are found on the island. Some of the most...

Prominent species are the parrot, opossum, and agouti. The wildlife situation in St. Vincent is critical. Illegal hunting and capturing of wildlife for pets is a serious problem. Some are also consumed for food, and some are maliciously destroyed. The situation needs urgent attention and decisive action in order to achieve a satisfactory level of protection and conservation. The highest population of wildlife species is found in the rainforest. Animals depend on these forests for their food, shelter, and protection. It is obvious that forests are likely to have significant effects on the abundance of island wildlife, but forests are presently subject to high rates of destruction. Careful study will show that some species which once existed on the island have long disappeared. It is believed that this disappearance is due mainly to excessive human activity, which adversely affected the species' habitat, thus making it unsuitable for the animals to survive. OBJECTIVES In an attempt to protect and conserve the relic wildlife population and even to encourage new species, I propose measures that should be implemented within the framework of a national wildlife management plan with the following objectives: A general study aimed at finding out the various forms of wildlife that should be taken into account, where they are found, what they require, and the problems with which they are confronted. Determine appropriate measures and techniques to help solve those problems. Develop a sound department policy and implement effective wildlife legislation. There must be adequate means of enforcing the law. Establish a network of forest reserves and sanctuaries in areas where wildlife populations are high. Initiate an effective education program. The masses must be informed of the significance of wildlife. They must know about the critical conditions which now exist, mainly because of human activity. They must know about the protected areas and species, and the penalty for violations. Their cooperation must be

solicited. nee ---Page Break--- Discussion The need for protecting and conserving wildlife in St. Vincent does not have the same emphasis and urgency for all species. Some species are more directly important to humans for food and as pets and are consequently hunted the most. Others are destroyed because they are considered to be pests. Each has its specific problems which need to be investigated separately in order to come up with appropriate solutions. For the purpose of discussing their problems and possible solutions, wildlife may be classified into three major groups: those that are legally hunted, those that are illegally hunted, and those that suffer from habitat destruction and predation from exotic species. Management objectives for species within these three main groups may differ. Legally Hunted Species There are many species that are legally hunted, mainly for food. Two examples are the opossum (*Didelphis marsupialis insularis*) and the

agouti (*Dasyprocta antillensis*). Both are exotic species and their hunting provides an additional source of food for humans. In addition, their hunting serves as a recreational activity and a tourist attraction. The opossum lives mostly in holes and on trees. During rainy seasons, it keeps itself warm by living in holes, and during the dry season, it nests on trees. Breeding time for opossums is around March to September, when they produce about 2 to 6 young. The animal is a nocturnal feeder on bananas, mangoes, and many other fruits. It is found on the higher parts of mountains. One way we could help to protect the opossum is to limit hunting for a certain period of time. The public should know that there is a special season for hunting and that anyone found hunting out of this season will be charged or sent to prison. There is a need to conduct an in-depth study of the opossum in order to find out as much as possible about how it functions within the surrounding ecosystem. It is important to know about the effects opossums have on the native fauna.

of the island. In some areas, for example, they are harmful to wildlife. In such instances, the objective might be to eradicate them. In other areas, the opossum might not be a problem, and we may want to manage the population in such a way as to allow maximum harvest by hunters. This involves conducting censuses in order to determine population levels and distribution, production and diet, and habitat needs. This information will allow us to set back limits on how much an individual can remove at a given time of the hunting season.

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The agouti is found within the same area as the opossum, and it is more or less subjected to the same conditions. Its diet and habitat conditions vary. It usually lives in holes and feeds mostly on tanaia heads. The breeding peak is around March to August, and it produces 1 to 4 young. Agoutis are also found on the high parts of the mountain. The establishment of a hunting season and the prosecution of people who hunt out of season are necessary to protect the species. The same type of study suggested for the opossum is also necessary for the agoutis. The information thus obtained can be used similarly to determine what, if any, measures can be taken to improve the occurrence of this species.

Illegally Hunted Species

Unlike game species, the St. Vincent parrot is fully protected from hunting. Aside from the biological problems which the parrot may have, one of the main conservation problems is the enacting and enforcement of legislation to protect the parrot. This involves patrolling the protected forest areas, limiting hunting in some areas, and completely banning it in others. The public should be informed about the significance of this bird and the efforts being made to protect it. They should also know about the penalties for pilfering or stealing parrots. An effective patrolling system for protected areas must be implemented.

St. Vincent parrot (*Amazona*)

The St. Vincent parrot inhabits the humid forest in and at the periphery of the

Island's central mountains. It is found particularly in ridges and shrub areas at lower elevations where the trees are large enough for nesting. Parrots have occasionally been reported in partially cultivated sectors outside the principal mountain core. The parrots move about frequently over valleys, ridges, and mountain slopes. During breeding, they are precluded by lack of suitable places

from much of La Soufrière and from other sectors, particularly at higher elevations, where no nest sites exist. Parrots invariably announce their presence by loud "quaa-quaa" when flying, usually in pairs, high overhead or immediately upon taking wing. The adult bird is between 40-46 cm (16-18 in) in length, both sexes being of similar size. Plumage is not sexually dimorphic, which makes it virtually impossible to tell male and female apart. The male's crown feathers tend to be more ruffled than those of the female. The colors of the St. Vincent parrot are green, blue, orange, gold, violet, black, and white in its array. The breeding season extends from the beginning of April (or the middle of March in good years) to the middle of August. Activity is greater in the early months and tails off in the last two months. Parrot nests are found largely on the tall gommier trees (*Dacryodes excelsa*). The brittle nature of this tree results in limb breakage of the larger branches, and the holes thus formed enlarge throughout. The parrots further excavate these holes and use the chips as nest bedding material. Other trees in which nests are occasionally found are the waterwood, the July tree (*Delonix regia*), and the fine leaf santin (*Sloanea caribaea*). It appears that any tree with an adequately sized hole is used by the parrot for nesting. The number of eggs the parrot lays is about 2 to 3.

DEFINITIONS AND DIRECTIONS Wildlife and forest indeed go together; they are firmly linked in the minds of humankind. On the other hand, the terms "forest wildlife" and "management" may appear antithetical to some.

people. Yet, it is essential to manage our vast forests and their wildlife, if only to keep human influences from destroying the naturalness and solitude that are forest qualities. Forests and associated wildlife are perhaps the most vulnerable and fragile of all our resources. When we talk about "forest wildlife," we refer to those species, large and small, found naturally in the forest and thus set aside by Congress under official criteria in the forest acts. Wildlife management in forests may be one of the more complex and controversial parts of forest administration. How do we preserve "naturalness" on only one side of a human-made boundary? How do we balance "solitude" against growing forms of primitive recreation, including hunting, wildlife observation, and photography? A **CENTRAL PHILOSOPHY** Wildlife management should be governed by an attitude that seeks the preservation of natural ecosystems of which wildlife species are an important part, but only a part. It is important to recognize that wildlife values and uses in forests affect and are affected by a variety of activities, natural and unnatural, within or near a designated forest. Furthermore, managers must acknowledge that wildlife management and wildlife uses in forests are appropriate only when they harmonize with the special forest environment. Thus, a strong forest philosophy is the most important ingredient of forest wildlife management policy. Forest areas are unique in the sense that there is a legal commitment to preserve their naturalness and solitude. Wildlife conservation in a truly natural way depends on the strength of the forest ethic among forest wildlife managers and their constituencies.

WILDLIFE VALUES AND PROBLEMS Wildlife serves as a barometer of forest quality. Forests are crucial to the survival of many animals, particularly those with highly specialized habitat needs. Forests and their wildlife are a standard of comparison for measuring human impact on other biotic communities and are a natural "laboratory" for the

development of ecological knowledge and theory. They also provide recreational, cultural, and aesthetic values that are not less real, even if difficult to measure in dollars. Forest wildlife has helped stimulate the political "lobby" responsible for the forest acts and related legislation. There are many problems related to forest wildlife. These include different management approaches of the state resource agencies, poor funding for wildlife management programs, and conflicting laws. Any habitat manipulation for an endangered species in a forest area must blend the ecological and aesthetic factors within the forest environment. Yet, for the good of the endangered organism, more

radical intervention by people may be in order. Furthermore, the large wildlife species require a considerable home range to which arbitrary forest boundaries may not be related. PUBLIC EDUCATION The only way to conduct a successful conservation program in St. Vincent is to have an effective public education campaign. The information to be conveyed in this public information campaign should include "Reasons for conserving wildlife. People should learn about the different types of wildlife that occur on the island and their relative importance." These reasons may include: national pride, ecological balance, and economic, recreational, and educational value to conserve wildlife. This involves soliciting public cooperation in observing the conservation laws. They should act in accordance with general conservation-oriented guidelines. They should be involved actively in helping to create good habitat for wildlife, even in their own backyards. The national laws on wildlife protection should be explained as well as the penalties involved for breaking the laws. This information should be conveyed to as wide a cross-section of people as possible. It should be directed to different groups, including those likely to have some significant influence. Information should be presented in such a way that each group would

Be more receptive to it. The target major group is the general public, hunters, farmer groups, and students. Public Relations and Communications Public relations is not the same as information and education. The latter terms mean that contact with the public is made either directly or through the various media. Public relations imply much more strategic planning, research relative to the specific publics involved, and their acceptance or rejection of ideas, and evaluation of the total effort. Public relations people also counsel management and are counseled by management. They are, or should be, part of the decision-making process. Public relations should be a constant effort and not a "sometimes" thing. Most of the problems in natural resource management are people-oriented problems. This is true for problems internal to the organization (policies, personnel), as well as for external issues. The only way that problems will ever be solved is through cooperation and understanding resulting from good public relations programs. Internal publics of wildlife agencies include field officers, researchers, administrators, and office workers among others. It is easy to forget these groups are all different, with varying points of view. For example, researchers could be divided into bird, 118 ---Page Break--- External publics of natural resource agencies may include outdoor recreationists, community, students, youth groups among others. Each has a different, but common interest. A cardinal rule of good public relations is that the internal publics must accept programs first. How can a program possibly succeed if those within the organization talk against it? It is good to give all employees a voice in making the decision of seeking a policy. Media (radio, TV, newspaper) personnel constitute a special, external public. They are important because of their role in making messages attractive and available to other publics. The media has rules of operation such as time.

restraints, style, quality, and other regulations. The best media to use are picture showing and radio programs. Radio is a mass media which uses only the spoken word. Large audiences can be reached, but questions cannot be directly asked and answered. Only the sense of hearing is involved, and the involvement frequently is passive while another task is being performed, such as driving a car. TV programs or motion pictures without sound might leave much to be desired. Newspapers, magazines, pamphlets, and other written materials all involve the written word. Only the sense of sight is involved. Efforts are necessary to make the message interesting, attractive, brief, clear, and direct. It should be kept simple. Guidelines A person should have an important message or something worth saying. Objectives should be definite and well in mind. It is good to outline the message with the most important points as main headings. The outline will also serve to organize the presentation in a topical sequence. EDUCATION PROGRAM One way to develop an

educational program in St. Vincent is to start in junior and secondary schools in different areas, explaining to students the uses of trees and the values of wildlife, and then, using slide showings based on the same topics. Starting in schools will be a good idea because children will be able to explain to their parents about the program. Public meetings, including lectures and slide showings, could then be held, so that we are able to reach other groups such as farmers and hunters. But financing is needed in order to purchase the necessary equipment such as a projector, public address system, microphones, and a generator for use in rural areas. I am suggesting through my report to the Forestry Division to seek and get a loan from some foreign agencies that, with help from the Government of St. Vincent, will make funds available to purchase the needed equipment. FARMERS Farmers are the ones who cultivate the lands and by doing so a high percentage of chemicals are

used, which destroys a lot of wildlife and other animals that feed on these creatures. I am advising farmers to cut down the amount of chemicals they are using, and in doing so, save the wildlife. HUNTERS Hunters are causing great problems to our wildlife, especially to the opossum during breeding season. They may not know the difference between males and females, which may cause the shooting of females with young. This leads to a decrease in the population. I am appealing to all hunters to take heed when it is breeding season: please stop the hunting and contribute to the increase of the population. ---Page Break---

WILDLIFE IMPROVEMENT AND PROTECTION

Timothy B. Harry
Dominica INTRODUCTION Dominica is a very small island, only 790 km² (305 mi²), with a human population of 75,000; seventy percent of the island's surface is directly involved in agriculture. The average monthly income per person is about \$400 (E.C.D.). A considerable amount of meat product is being imported on a regular basis, mainly chicken parts and pork products, which the average farmer cannot afford. Therefore, he is forced to resort to wildlife hunting. I will be concentrating on the wildlife species most commonly hunted by these people. In Dominica, very little research has been done on the biology of wildlife, which could prove to Dominicans in and out of the state that in addition to uncontrolled hunting, there is an urgent need to keep wildlife free from human interference until it is safe to hunt. Only a research biologist would be able to determine this after a study of the existing habitat and a survey of populations. Management out of ignorance can conceivably damage resources more than sheer negligence. That is why, to manage a natural community, its principal elements and the principal interactions must be known. Before a research biologist can set himself to work on population surveys of wildlife, causes of certain diseases or possible ways of prevention, or even knowing how resistant certain species are to a

Particular disease, and habitat inspection, he would have to know where his funding will be coming from. He will need encouragement. A research program of that type is important for the purpose of maintaining a sustained yield and a possible increase in population so that, maybe in the future, the public can use wildlife not only as food but also as pets. Also, research can show the difference between indigenous and exotic species which sometimes can be dangerous to the fauna and flora of the state. It is also important that the public is informed of the initial plan, especially if most parts of the island are going to be involved in the research. Interviews with hunters and other people with experience, in addition to a literature review, can be helpful. All this information should be analyzed and used as a reference during the research exercise. After a biological research of that type, where the reproduction (age at first breeding, reproductive potential, clutch size, and fledging success) is known, a determination of the kind of legislation needed, in addition to the existing legislation, can be made. Finally, a monitoring program should be established to keep track of developments or failures. ---Page Break---

WILDLIFE SPECIES MOST COMMONLY HUNTED

The

agouti (*Dasyprocta antillensis*) is of southern and Central American origin. It is usually about the size of a rabbit and is mainly vegetarian. In the early 1930s it was widely distributed around the island. Few actual surveys have been done to put on record what the present population is. These animals are surface dwellers. They live in burrows which are dug under the roots of trees or where roots begin to rot, or on the edge of riverbanks where the soil is a bit soft. Their nests usually have several entrances, which helps them to escape from predators. They are rarely found in pairs except when they are young. These animals are known from elevations of 152 m (500 ft) in Dominica to 3000 m (9880 ft) in Ecuador. It has a

Relatively flexible diet, ranging from plantation crops such as bananas, plantains, breadfruit, carrots, sugar cane, wild seeds and fruits from Fain d'Epice (*Pouteria multiflora*), bois d'Inde (*Byrsonima coriacea*), gommiers (*Dacryodes excelsa*), orange trees (*Quartzia cordata*), and many more. Their main predators are the boa constrictor (*Constrictor constrictor*) and people. An elderly hunter noted that in the late 1960s he could enter a particular forested area and return with a catch of at least 5 agoutis, whereas presently he would enter that same forest without catching an agouti. In a village of 2000 people, an estimated 100 people hunt agoutis at least once a week. "Now, what is the weekly decrease of the agouti population per village of over 2000 people? Do the agoutis in that vicinity reproduce over that amount per week?" If not, what can be done about it? Most important, a series of meetings with the people should be organized. There, their questions will be answered. In addition, some pairs of agoutis should be fenced within an area where the animals themselves will not notice the slight change of habitat. This program could serve two purposes: one, to stock the forest and secondly, as an education program for the public. That kind of research is very complex because wild animals tend not to do well in captivity, but an area similar to their natural habitat, fenced with net or woven wire and some human-made burrows, enough water and food, could produce satisfactory results. To improve and protect the agouti and its habitat, substitutes should be used for trees that are seasonal (they bear fruits once a year at the beginning of the rainy season), and the use of strict patrolling should be considered. The opossum (*Didelphis marsupialis*), locally known as the manicou, is native to North and Central America. It is an omnivorous and nocturnal creature and the most heavily hunted species in Dominica. It is nocturnal, carrying its young in a pouch under its stomach. They are widely distributed.

throughout the island, but are more numerous at intermediate and lower altitudes where food is more abundant. It is about 30 cm (12 in) in length and weighs about 1.8 to 2.7 kg (4-6 lbs). Because these animals live close to agricultural plantations, they make themselves easy targets for hunters. They eat almost anything and in times of food shortage usually move about plantation buildings to feed on kitchen waste.

Opossums rarely nest on the ground. Because of their superb capability to climb, their nests are built on tree tops and in clumps of hanging vines. These animals have a very high reproductive potential. A litter of about 15 young can be produced. The young are tended by the mother for about 2 months until they are capable of collecting their own food. For research purposes, a few pairs could be fenced within an abandoned plantation where their development can be monitored. But care must be taken when erecting fences, especially net or woven wire fences. The reason is that in some cases this can restrict other wildlife from their usual water and food source or can even cause extensive mortality during extreme inclement weather.

Our largest wild mammal, the feral pig (*Sus* sp.), is widely hunted by a group of specialized hunters. It is related to those pigs found in North America, Northern Asia, and Europe. A fully grown boar

could reach up to 1.5 m (5 ft) in length and 0.9 m (3 ft) high at its shoulder, in which case it will weigh about 203 kg (448 lbs). They are omnivorous, and when they migrate to lower elevations, they feed on dasheen, tanniers, sweet potatoes, etc. This is where they enter into serious conflict with humans. They nest in hollow stumps, caves, and between the buttresses of Chatagnier and Aconat trees. The Sus' natural habitat is around the foothills of our highest peaks (609-914 m or 2000-3000 ft), and it needs a wide range to move about. Usually from September to December, the Sus, like some other wildlife, migrate towards the coast for a

reason that is not known. Some people believe that they are escaping from the cold, others say that it is because of food shortage. Presently, it is facing one problem: that of habitat deprivation. I believe that proper legislation could ensure the average citizen the maximum opportunity to enjoy our wide range of wildlife resources. The crapaud (*Leptodactylus fallax*), which is found at elevations below 365m (1200 ft), is facing a very serious problem of overhunting. These animals are nocturnal and are hunted during the late hours of the night. Without an active night patrol, it becomes very difficult to intercept crapaud thieves. The tadpole stage of the crapaud is within the egg, which is laid in any damp area or in a pool of water. It breathes by the use of gills until it loses its tail and the gills disappear, then they resort to the land. If that kind of habitat is destroyed by cutting trees and exposing the area to direct sunlight, the reproduction rate will definitely be reduced. Though a native of South America, in the West Indies it could only be found in Dominica, until it was introduced into Guadeloupe, Martinique, Puerto Rico, and Montserrat. But for some unknown reason, it is presently found only in Dominica and Puerto Rico. The body length reaches a maximum of about 15 cm (6 in) and the length from the nose to the tip of the extended hind leg may exceed 30 cm (1 ft). The width of its body may reach 10 cm (4 in). The Dominican public has still a lot to learn about the crapaud. It is not just a table delicacy. It can keep the amount of insects, which do so much damage to agricultural crops, in check. It is a natural enemy of the boa constrictor. Since the internal organs are arranged similarly to those of the human body, dissecting a frog is an excellent introduction to human anatomy. And most recently, frogs have been used in human pregnancy tests. Although 135 species of birds exist on the island, only one bird is sought for during the open hunting season, that is the

Red-neck pigeon (*Columba squamosa*). Four species are protected by law and cannot be hunted. The two Ghuron parrots, the sifflour montagne (*Myadestes genibarbis*), and the chougue (*Vireo altiloquus*) were protected mainly for aesthetic and other reasons. Though the red-neck pigeon faces no immediate signs of extinction, their habitat is being drastically threatened by the velocity at which the forest is being depleted for agricultural purposes. Twenty species of freshwater and land crabs are known to exist. Of these, two species, the white crab (*Cardisoma guanhumi*), and the "Coast dene" are occasionally hunted, while the black crab (*Gecarcinus ruricola*) is extensively hunted. It can be caught at elevations of up to 106 m (350 ft) and reaches a maximum length of 12.7 cm (5 in). The ruricola is more common along the coast. On the West, it faces a serious problem where the land is being burnt yearly, sometimes for agricultural purposes. When the rains begin to fall in the rainy season, and pesticides and other deleterious substances that are used for crop improvement are carried away by water, a second death toll can be recorded, that is, on a yearly basis. This, in addition to over-hunting, has reduced the number of ruricola tremendously.

THE ROLE OF THE PROTECTION OFFICER A protection officer is very important to enforce the wildlife laws which in turn contributes to good wildlife management. Without the protection officers, illegal kills would seduce or exterminate most wildlife. Our enforcement branch of conservation officers is a small one with one guard and sometimes two or more temporary guards responsible for over a thousand acres of forest. But there is still a place for improvement within the enforcement

branch. For example, there is an acute staff shortage. The staff within the enforcement branch should be given at least two weeks of training on how to lead to the proper interpretation of the existing forest laws and courtroom procedures; they should know something about public relations; they should know

how to detect offenders of the wildlife law; proper uniform is also very important so that the public can identify these officers at a distance; transport equipped with a radio is also a priority for swift communication. The protection officer is the only person of the department that most hunters, fishermen, or even the general public will see, so the impression he leaves with them will reflect the level of public acceptance of the department's long-term projects. He, together with the research biologist, are the people responsible for locating significant wildlife values for acquisition by his department. ---Page Break--- The task of a protection officer is not an easy one. Usually, he has to deal with three types of violators: the accidental violator, the opportunist violator, and the criminal, who leaves his home with the full intention of violating the law. Each case must be handled differently. He must ask himself, will my handling of this case help conserve and stimulate the interest of this individual and his respect for law and the department? Will I warn or arrest this man? The protection officer must take an on-the-spot decision. According to his decision, he may find himself in a lawsuit for false arrest or something of that sort. One may observe that the protection officer is respected highly in his community, but he is often resented when performing his duty because the average citizen does not share the view of being told what to do, or to be apprehended for what they consider minor infractions. There are always conflicts between protection officers and wildlife managers. These conflicts are mainly due to lack of proper information and poor internal communication. Communication is important if the protection officer's participation in management is to be effective. In summary, I shall emphasize that Dominica is a small island that needs to diversify its economy, and by conserving our wildlife resources we are setting a foundation for the tourist industry. We shall not wait until

We have lost a wildlife species (e.g., the black-capped petrel - *Pterodroma hasitata*) before protective measures are taken. Finally, the destruction of a habitat is an environment that threatens wildlife, threatens humanity also.

POPULATION STUDY OF THE ST. VINCENT PARROT

Lennox Quammie

St. Vincent

INTRODUCTION

Amazona guildingii, the St. Vincent parrot, is our national bird and therefore one of our most important wildlife species. Between 1927 and 1968, parrots were well-distributed throughout St. Vincent, with several hundred in the existing forests. Since then, the parrot has become an endangered species. For the last decade, its population has declined very rapidly. The Forestry Division is aware of the problems of the parrot and is endeavoring to conserve and protect this vital species. The St. Vincent parrot is a large, beautifully colored, attractive bird found only in St. Vincent. The head is white, yellow, and violet. The neck is mostly green, the body plumage is golden brown washed in green, the wings are variegated, and the tail is green and violet-blue, broadly tipped with yellow. Adults weigh about 1.4 to 1.8 kg (3 to 4 lbs) and measure about 40.6 to 50.8 cm (16-20 in). When young, the plumage is entirely green. This is the only species of parrot found in St. Vincent. The parrot lives in the rainforest, but it also nests in dry forested areas at high elevations (914-1219 m or 3000-4000 ft). However, they are mostly found in the dense natural

forest located in the central mountains. For example, parrots are common in the Hermitage mountains, Vermont forests, Newfoundland forests, Petit Wallibore, and mountains on the leeward side of the island, Frenton mountains, Majorca forest, and the South River mountains on the windward side. Parrots are also seen frequently on the slopes of the La Soufrière mountain, the highest peak of the island, which measures 1233 m (4050 ft). Due to the recent eruptions of the La Soufrière volcano, the population appears to have decreased. In the most

Recent eruption: most of the parrot habitat in this area was destroyed, and carcasses of parrots were found in nearby areas. The parrots do not visit areas below the mid-elevation of the Grey forest. They are becoming more afraid of humans because of constant harassment by intruders. Parrots maintain a rotational feeding pattern, flying from areas with food shortages to others where there is a good supply of food. They feed on a large variety of fruits of forest trees. In addition to the natural food, there is also abundant agroforest fruits on which they feed. Though many parrots are kept as pets, a greater population continues to live in the wild. Because there is no effective forest policy or legislation, it is a very difficult task for the Forestry Division to protect this endangered bird. The protection of the parrot has recently become one of the Forestry Division's main functional objectives. The need for action to save the St. Vincent parrot is required by a wide cross-section of the Vincentian public. All Vincentians are aware of the economic benefits brought about by the parrot. The parrot is one of the attractions for tourism in the industry. However, the exploitation of the parrot by private individuals is producing a negative effect on the population. St. Vincent parrots are sold for high prices locally and elsewhere. It is said that they are sold for over \$3,000 (U.S.). Consequently, over the years hunters have been capturing the birds for sale on the black market. The parrot population is also reduced by other factors. It is shot for food by irresponsible persons. The young parrots suffer greatly. In most cases, the chicks are taken from their nest at a very immature state, and they often die. There is a local demand for parrots to keep as pets. When the natural forest ecosystems are destroyed, the parrot also suffers. I am aware of the damage that may result to the parrot population in the future if this exploitation continues. In an attempt to try to...

Prevent the extinction of the parrot population, I request that a study be conducted to determine the status of the parrot population in St. Vincent and to obtain baseline data about its biology.

OBJECTIVES The main objectives of this study would be to: establish a network of census points to determine the status of the population and monitor population trends over a period of time; determine the range of the parrot in order to establish a parrot sanctuary; determine the movements and behavior of the parrot; obtain baseline information on its diet and breeding biology; and determine the impact of human activity on the parrot's biology. **STUDY AREA** The parrot breeds mostly in the rainforest in mountainous areas with steep topography. It nests in cavities in tall mature trees. Traveling and working in parrot areas can be very difficult. The slopes are usually wet and the area where parrots mostly breed is almost continuous with a combination of agroforest areas. The habitat is virtually homogeneous throughout the study site. Tree heights decrease and rainfall increases as you ascend the mountain. The parrots live in the tallest canopy. It is almost a rule to find the nests on the sheltered slope of a mountain. Roads to the proposed study sites are in very bad condition; consequently, some valleys are not easily accessible. **TECHNIQUES** Because of the parrots' extensive movements, it will be difficult to arrive at an accurate population estimate, but good results can be obtained if the correct census method is applied. We will systematically search in the forest to identify the feeding areas, nesting areas, travel routes, and roosting areas. Stations will then be set up as census points within these areas. Platforms will be mounted with good views. The areas will be cleared to obtain a clear view horizontally as well as vertically. One

person will occupy each station and, with the aid of binoculars, will record information on field sheets, e.g., number of birds, and direction of flight.

and the flying formation. Also, color shall be recorded to identify birds individually. When feeding, we will attempt to identify the species of fruit trees eaten by the parrots. Parrots fly from their nesting site very early and return late in the evening, therefore, counts will be conducted during these times. The first will commence at 4:00 AM and again at 4:00 PM. Working two times a day will provide more accurate counts by comparing the birds seen in the morning and in the evening. By accurately noting movements and observation times, we will reduce the possibility of a particular bird being counted twice. In order to determine breeding success and to identify parrot breeding problems, we will periodically check parrot nests. Nests will never be climbed at egg or early nesting stage, as the parents are likely to desert the nest at those stages. We will also systematically examine trees to determine if they need improvement.

EQUIPMENT AND PERSONNEL: To make this study a reality and to obtain the best results possible, the Forestry Division will have to be well equipped, and its immediate needs must be fulfilled. Without this fulfillment, the study will be handicapped. Transportation - a Land Rover jeep is needed to transport the workers, their equipment, and working materials. It should be capable of handling the rough roads with heavy loads. Five pairs of binoculars are needed to improve vision in order to identify and follow the movements of the parrots. Climbing spikes are needed for climbing trees and building platforms. Radio communication - walkie-talkies are needed to make communication between stations easy. Tools and materials are needed for the construction of platforms and blinds. Cutlasses are needed for cleaning trails and dense forest areas where stations are to be established. Field and office stationeries are needed for the recording of field notes and analysis of data in the office. Haversacks are needed for easy carriage of tools and other useful items.

equipment. "Raincoats are needed to shelter us from the rain while working during rainy periods. "Flashlights are needed for easy movement through the forest at dark hours. The forestry staff will be responsible for the execution of the project. Presently, there are no trained personnel in the wildlife field. Therefore, there is an immediate need for training. It is very essential that four members of the staff pursue training courses in various aspects of wildlife study, particularly in the subject of techniques and census methods of population estimation. Also, informal training must be carried out among remaining staff. **TIME SCHEDULE** The census will be scheduled for a period of two years. The first phase will be implemented in the breeding season (March to June) in year one. Phase Two will also follow that pattern for the second year. Concluding the study during the breeding season will allow us to incorporate adults and young birds into our population estimates. Parrots are likely to be restricted to areas near the nesting site during this period. Weather conditions are also more favorable in the rainforest during the breeding **MANAGEMENT IMPLICATIONS** The results of our study will allow the Forestry Division to implement the needed measures to save the St. Vincent parrot. The data we obtain on population status and the establishment of census areas will be essential in determining the direction we must take in managing the parrot population. The study will provide information on areas to be protected and on the size of those areas. Problems faced by the parrots because of biological disturbances can also be detected. The time we have to act upon these problems and other general information will also be obtained. Projects of this nature require money. In most cases, they do not materialize because of lack of available funds. I am nonetheless very realistic, and hope that this project can be implemented. Since there are a number of national and international funding sources which help

projects, I do not envisage much difficulty in obtaining the needed support. -129- ---Page Break---

List of endangered birds in St. Vincent	Common name	Scientific name	Status	Habitat	Human Interaction
St. Vincent parrot	Amazona guildingi	native	rain forest	hunt, pets	Ramier
Columbina squamosa	native	rain forest	hunt (shoot)	Chicken hawk	Buteo platypterus
resident	rain forest	shoot	airy forest	pest	Black hawk
Buteogallus anthracinus	native	rain forest	shoot	airy forest	pest
Mountain dove	Zenaida aurita	native	mountainous	hunt more (shoot)	resident
lowlands	shoot	Egret	gaulin	Butorides	virescens

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PROTECTION OF WILDLIFE

Brenon Samuel St. Vincent

INTRODUCTION

St. Vincent is one of the four-island group which forms the Windward Islands. Despite fairly frequent natural disasters such as hurricanes and volcanic eruptions, a great number of wildlife species have survived. Some of the more prominent species include parrots, hawks, iguanas, agoutis, and opossums. The wildlife situation in St. Vincent is very critical; legal hunting and capturing of wildlife for pets is a serious problem. Various forms of wildlife are also consumed for food, and some are destroyed simply for the fun of it. The situation is one that calls for urgent attention and swift and decisive action in order to achieve a satisfactory level of protection and conservation. The highest wildlife population density and diversity is found in the rain forests. This forest serves as their habitat, and sphere of function. Animals depend on the forest for food, shelter, and protection. It is obvious, therefore, that any alteration in the structure of the forest is likely to have significant effects on the wildlife associations found therein. The forest is presently subject to high rates of destruction (removal of vegetation) to accommodate agriculture and for charcoal production. A careful look and study of records indicate that some species which once existed on the island have long disappeared. It is believed that this disappearance was due mainly to

Excessive human activity, which adversely affected the species' habitat, thus making it unsuitable for the animal to survive.

OBJECTIVES

In an attempt to protect and conserve the relic wildlife population and even to encourage new species, I propose measures that should be implemented within the framework of a national wildlife management plan with the following objectives: A general study aimed at finding out the various forms of wildlife that should be taken into account, where they are found, what they require, and the problems with which they are confronted. Determine appropriate measures and techniques to help solve those problems. Develop a sound department policy and effective wildlife legislation. There must be adequate means of enforcing the laws. Establish a network of forest reserves and zones where wildlife populations are abundant. Initiate an effective education and public information program. The masses must be informed of the significance of wildlife. They must know about the critical conditions which now exist, mainly because of human activity. They must also know about the protected areas and species, and the penalty for violations. Their cooperation must be solicited.

DISCUSSION

The need for protecting and conserving wildlife in St. Vincent does not have the same emphasis and urgency for all species. Some species are more important to humans for food and as pets and are consequently hunted more intensively. Others are destroyed because they are considered to be pests. Each species has its specific problems which need to be investigated separately in order to come up with appropriate solutions. For the purpose of discussing the problems and possible solutions, wildlife may be classified into three major groups: those that are legally hunted, those that are illegally hunted, and those that suffer from habitat destruction and predation from exotic species. Management objectives for species within these main groups may differ.

Legally Hunted Species

There are five

Species that are legally hunted, mainly for food, include the opossum (*Didelphis marsupialis insularis*), the agouti (*Dasyprocta* spp.), the green iguana (*Iguana iguana*), the ramier (*Columba squamosa*), and the mountain dove (*Zenaida* spp.). The opossum, the agouti, and the iguana are exotic animals. As already mentioned, hunting is important as it provides an additional source of food, is viewed as a recreational activity, and may also be a tourist attraction. There is a need to conduct an in-depth study of the opossum to find out as much as possible about its functions within the surrounding ecosystem and its effects on the native fauna of the island. In some areas, the opossum may be harmful to wildlife considered to be of importance and value. In such cases, the objective might be to extirpate it. In other areas, the opossum might not be a problem, and we will want to manage the population in such a way as to allow maximum harvest by hunters. This involves conducting censuses to determine population levels and distribution, production, diet, and habitat needs. This information will allow us to set bag limits on how much a hunter can remove at a given time during the hunting season.

The agouti and the iguana are found basically within the same areas as the opossum and are more or less subjected to the same conditions. However, as would be expected, their diet and habitat conditions vary, as do their specific problems and requirements. The same type of study suggested for the opossum is also necessary for these species. The information obtained can similarly be used to determine bag limits and hunting schedules. It is also important in determining what, if any, measures can be taken to improve and enhance the occurrence of these species.

The ramier population in St. Vincent does not appear to be declining. However, until we have some reliable numbers on population sizes, we will never...

Really know, censuses should be conducted for the ramier in order to determine population size, distribution, habitat, and to detect any problems that might be affecting the species. The mountain dove hunting pressure on this species is not as great as it is for the other species, but it should still be taken into account when thinking of establishing some mechanism or system of protection and conservation. The mountain dove is extremely important in some areas, and is the only species found in the open habitats preferred by hunters. Illegally Hunted Species Illegally hunted species are many and range from small an to large egrets. We will deal here with three species for which illegal hunting seems to be a major problem: the St. Vincent parrot (*Amazona guildingii*), the crab hawk (*Buteogallus anthracinus*), and the chicken hawk (*Buteo jamaicensis*). Parrot Unlike game species, which we would manage for harvesting, the parrot is fully protected from hunting. Aside from the biological problems which the parrot may have, one of our conservation problems is the enacting of legislation to protect the parrot and enforcing the laws that are established. This involves patrolling the forest areas that are protected, limiting hunting in some areas and completely banning it in others. The public should learn about the significance of this bird and the efforts being made to protect it. They should be made aware of the penalties that will be incurred upon them for killing or stealing parrots. An effective patrolling system must take into consideration the areas to be patrolled, mobility in that area and the personnel needed. Crab and chicken hawks The habitat of both of these species extends outside the rainforest. The chicken hawk is found frequently around human habitations where it likes to prey on chickens. Both species are birds of prey and destroy the eggs and young of other birds found within their range. However, it is unlikely that they are a major threat to parrots because of their

relatively small size. For the above reasons, one could conclude that the best action to take is to destroy the hawks as rapidly as possible. However, when compared with the amount of good done

by these birds in destroying other more harmful animals, the benefits outweigh the negative costs. It is necessary to conduct a census in order to determine the level of the population, the problems that are confronting them, and possible solutions. Their habitat must be protected. Habitat of Affected Species: Wildlife, suffering from habitat destruction and predation from introduced animals includes all the species discussed above along with most of the other wildlife species. It is important to conserve the different forest types that remain in St. Vincent so that they can provide the needed home for species that are adapted to it. Vincent can attract tourists who come to enjoy our native wildlife, the "whistling bird (*Catharopeza bishopi*) which is found only in St. Our native wildlife therefore, also has an economic value. Mongooses (*Herpestes* spp.) and rats (*Rattus* spp.) constitute a problem to some of our native species. We must determine how important their effects are in some areas in order to eradicate or reduce the population of these pest species. PUBLIC EDUCATION Finally, the only way to conduct an effective conservation program in St. Vincent is to have an effective public education campaign. The information to be conveyed in this public education campaign should include: reasons for conserving wildlife, why the people should learn about the wildlife of the island and its relative importance. These reasons may include: national pride, ecological balance, aesthetics, economic value, recreational values, inspirational values, and educational values. How to conserve wildlife. This involves soliciting people's cooperation in observing the conservation laws. They should act in accordance with general conservation-oriented guidelines. They should be actively involved in helping to create

Good habitat for wildlife, even in their own backyard and on their own property. The national laws on wildlife protection should be explained to them, along with the penalties involved for breaking the laws. This information should be conveyed to as wide a cross-section of people as possible. It should be directed to groups likely to have some influence and in such a way that each group would be more receptive to it. The major groups are: the general public, food and sport hunters, and school children. Obviously, each of these groups has different interests in wildlife and the information must therefore be presented in different ways. For example, hunters would view wildlife from the point of view of what is good for food (human consumption), pets, or simply fun. Farmers may view it from the point of view of what is a pest, as it damages their crops, or what is beneficial, as it destroys what they consider to be a pest, etc. To summarize, there is an urgent need to adopt measures aimed at conserving our wildlife populations. Conservation calls for a system of management that would take into account the problems and needs of individual species, and for appropriate legislation and means of enforcement. To accomplish any substantial degree of success, the public at large must be directly and actively involved. This calls for a vigorous public education program. I hope that the government, through the Department of Forestry, will pursue this matter with the greatest of urgency, in order to save our wildlife species.

PROTECTION OF FOREST AND WILDLIFE OF DOMINICA

Randolph Winston
Dominica

INTRODUCTION

Dominica, a small island in the Lesser Antilles, is situated between Guadeloupe and Martinique. Dominica is 48 km (30 mi) long and 25.6 km (16 mi) wide, and has an area of 790 km² (305 mi²). The population is about 80,000 people. Unfortunately, most of these people are dependent on agricultural crops and forest resources to survive. But the rate at which forest and wildlife are used will, in the near...

Future results may lead to the extinction of forest tree and wildlife species on the island if something is not done now to solve the situation.

FOREST TYPES ON THE ISLAND

Dominica has six forest types: secondary forest, elfin woodland, montane forest, rainforest, seasonal forest, and dry scrub woodland.

Secondary Forest

The secondary forest is found in many areas in Dominica, including coastal and montane areas. These lands are used by farmers for agriculture. Secondary forests comprise about 53% of the total acreage of Dominica's surfaces. In the secondary forest areas, the wildlife situation is most critical in the sense that the land is cultivated with various agricultural crops, especially oranges and bananas, on which wildlife like the opossum and most species of birds feed.

Elfin Woodland

The mountains above 1000 meters (3500 ft) are crowned with elfin woodlands, a gnarled mass of trees, which is formed from the montane forest. It is here that the effects of the wind on the plants can be best seen. The leaves have become smaller, thicker, and almost rigid. The elfin woodlands are found above 1000 meters (3500 ft) and cover an area of 5% of the total acreage of the land. The Diablotin (*Pterodroma hasitata*), a bird which is now presumably extinct, used to live in this area. Extinction may have probably been caused by habitat destruction.

Montane Forest

The montane forest forms a narrow band along the high ridges in the area between the rainforest and the elfin woodland. The trees are noticeably shorter and smaller than those of the rainforest because of the increased winds. This forest is distinguished by the especially gnarled form of the trunks and branches of trees. Montane forest is not as dense as in the rainforest, so more sunlight reaches the forest floor. Montane forests are found in the southeast of Dominica and cover about 2% of the total forest acreage.

Rainforest

The rainforest is the most luxuriant type of forest. It supports a great variety of plant life, from lichens and mosses, to the

Giant trees over 50.5 m (100 ft) tall, the rainforest is generally found at elevations of 300-950 m (1000-3000 ft) where the annual rainfall combined with good soil and protection from the wind provides the optimum conditions for plant growth. The rainforest is used mainly by birds, e.g., the parrots. The rainforest is found in the interior of the island and covers about 20% of the total forest land of Dominica. Seasonal Forest Seasonal forests are in the zone between the dry scrub woodland and the rainforest. Unfortunately, most of the seasonal forest has been reserved for cultivation of the land and has been replaced by secondary forest. The seasonal forest is also found on the leeward coast of the island and covers an area of about 3% of the total acreage of Dominica's forests. Dry Scrub Woodland On the leeward coast of the island between the shoreline and the seasonal forest, one finds the dry scrub woodlands. Most of the trees in this area have thick leaves which they shed during the summer dry season. The presence of prickles or spines on the trunks, stems, and leaves of the plants is typical of trees and shrubs in this area. This feature

helps the plants to survive in this dry region by helping to conserve water and by protecting them from grazing animals. The dry scrub woodland covers about 5% of the forest area of Dominica. In most of these forest types, for example, the rainforest and the montane forest, there is an abundance of wildlife that use these forest types for their habitat. They depend on the forest for food, shelter, and protection. Two endemic and endangered bird species, the red-necked parrot (*Amazona arausiaca*), and the imperial parrot (*Amazona imperialis*) live in our forests.

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WILDLIFE SPECIES Some of the most important wildlife species are: the frog or mountain chicken (*Leptodactylus fallax*), the opossum or manicomou (*Didelphis marsupialis*), the agouti (*Dasyprocta antillensis*), the feral pig, the mountain dove (*Zenaida aurita*), and the trembler (*Cinclocerthia ruficauda*).

Some of these wildlife prefer the secondary forest, e.g., the opossum, the mountain chicken, and the agouti. These animals feed mostly on fruits and vegetables which can be easily found in cultivated areas in the secondary forest. Ramier The ramier moves from the rainforest to the secondary forest in search of food when there is a shortage of food in the rainforest, but generally, it prefers the rainforest. It lives more freely and will take the hunter a long time before he can shoot it down. The ramier feeds on many different seeds in the forest. Mountain Dove The mountain dove uses both forest types, the rainforest and the secondary forest, but is mainly found in the rainforest. Most of its feeding is in the secondary forest where it feeds on seeds, insects, etc. Feral Pig The feral pig's habitat is the rainforest, but it also comes down to the secondary forest to feed. These pigs feed on provisions, fruits, vegetables, and earthworms. The animal could be very harmful if seen unexpectedly. In some cases, it will walk away or attack instantly, depending on the distance from the individual or individuals. **WHY IS IT IMPORTANT TO PROTECT FOREST AND WILDLIFE?** In Dominica, there are many human activities taking place in the forests throughout the island. After the hurricanes in 1979 and 1980, many people went into the forest in order to recultivate their lands and to utilize the timber which fell down due to the winds of the hurricanes. During this process, other adverse activities were conducted including indiscriminate hunting of wildlife, and cutting down of forest for producing more lumber. Clearing and burning of vegetation is causing a great threat to the wildlife population in the affected areas. In some cases and for certain wildlife species, if their habitat is destroyed, they will have problems finding a new and acceptable habitat. Wildlife is a valuable resource. It is the commitment of members of the wildlife management profession to exert their professional responsibilities through

Wildlife propagation. ---Page Break---

WATER AND WILDLIFE SOURCES The best source of water is the forest, and water is used mainly for human consumption, and for other uses. This is one of the reasons why protection of forests is important. Forests and wildlife go hand in hand. Without forests, there would be no wildlife, and without wildlife in the forest, there would be less regeneration. For example, birds play a very important role in any forest by transporting seeds and by assisting in pollination of trees. Therefore, it is necessary to protect and conserve these resources. Wildlife is also important to people in the sense that it provides food, which could be sold and provide revenue to the hunter, and in turn, help the economy of the country. Wildlife also provides for sports, recreation, and tourism. All these resources can bring in constant revenue if they are properly managed. **WHY IS WILDLIFE BENEFICIAL TO THE FOREST ECOSYSTEM?** In the forest, there are many wildlife species, and every one of them is important to the other. They eat harmful insects, control pest populations, and also feed on each other in a process called a

food web. Some of us may know that the forest provides water, food, fiber, timber, soil, fuel, and recreation for humans, which are used in our everyday way of life. Therefore, destruction of the forest will surely cause the loss of some of these resources. For example, the cutting down of any forest will cause habitat problems for certain species of wildlife, and in many cases will improve habitat for others. Clearing of vegetation will also cause a serious problem, where the soil would remain exposed to rain, and, depending on the volume of water, it will result in runoff of sediments, pesticides, etc., into our rivers, streams, and even into our intakes. This would also cause pollution, which will be very harmful to our health. Presently, the forest and wildlife situation in Dominica is not critical. However, illegal hunting of wildlife can cause a very serious

problem in the word "future." Because of the rate at which hunters hunt these wildlife, in both open and closed seasons, in some cases wildlife, e.g., opossums, which are found dead in the forests and streets with young ones in their stomachs, and birds get killed while searching for food for their babies, is seriously affected. Various forms of wildlife are also consumed for food and others are destroyed by members of the public during hunting. The situation is one that calls for urgent attention in order to achieve a satisfactory level of protection and conservation of forest and wildlife in Dominica. These activities are at such a level that they are very difficult to be handled or controlled by the Forestry Division, due to lack of staff, finances, facilities, and communications. In order to control these activities, we need an extension of the staff, which is required very urgently because most of the older forest officers are about to retire. We also need some type of radio system in order to communicate directly from our forest stations to the main office. In many instances, officers come down to the main office to report certain offenses and to get advice from either the director or the chief forest officer, which is a waste of time. The Forestry Division has five forest stations on the island, two in the central range, two in the eastern range, and one in the northern range, and some officers are stationed in these ranges. Wildlife could be classified into three major groups: those that are legally hunted, those that are illegally hunted, and those that suffer from habitat destruction. Animals like the mountain chicken are legally hunted, but also suffer from habitat destruction, specifically when the secondary forest is cleared for cultivation. The parrots suffer from habitat destruction when the forest supporting nest or feeding sites is destroyed. There are five legally and commonly hunted species. They are the opossum, the mountain chicken, the agouti, feral pigs, and the ramier.

Commonly known as the red-necked pigeon. These animals are specifically hunted for food.

ENDANGERED AND ENDEMIC SPECIES It is important to highlight these species because recently the Forest Division has been encountering many problems in certain areas in protecting the red-necked parrots, e.g., from an area called Vieille Case, a village situated in the north of Dominica, reports were brought to the division on shooting activities. Endemic species are species which are only found in a specific or particular place and nowhere else in the world. Endangered species are species which are protected from humans and their destruction. The red-necked parrot (*Amazona arausiaca*) and the Sisserou parrot (*Amazona imperialis*) are endemic and endangered species. The parrots are found on the northern and northeastern slopes of Mount Diablotin, an area above Syndicate Estate, a small area on the western slopes of Mount Anglais, and an area below Syndicate called Mount Plaisance. The Sisserou parrot frequents higher altitudes than the red-necked parrot. The Sisserou parrot is also a quiet, inconspicuous bird, both in feeding and in activities near nest trees. In similar activities, they are less visible than the red-necked or the two Lesser Antillean amazons, St. Lucia's parrot (*Amazona versicolor*), and St. Vincent's parrot (*Amazona guildingii*). The Sisserou parrot is the largest of the two parrots of Dominica. Its upper parts are mostly green with greenish-blue on the head, a dark violet band across the hind neck,

which appears as black, and underparts are mostly purplish violet. A red alar speculum and red on the bend of the wing are present. Habitat: Rainforest, flies to higher elevations in the region of 460-500 meters (1510-1640 ft). The Sisserou parrot is 45-50 cm (18-20 in) long and weighs about 2.5 kg (5.5 lb). It lays two or three eggs every year, providing that there is no destruction or disturbance of its habitat. Presently, the Sisserou population in Dominica is in the region of 80-100 in number. These birds make

their nests in broken branches of trees. They prefer trees of very large dimensions, for example the chatagnier (somi), and gommier (*Dacryodes excelsa*). Red-necked Parrot The red-necked parrot has been observed in many areas on the island. Some of these areas are as follows: the Syndicate, Mount Plaisance area, Bence heights, Sympa heights, and many other areas. The red-necked is a very noisy bird and can tolerate disturbances in its habitat compared to the Macaw, which is more sensitive to disturbance. The red-necked weighs approximately 1.5 kg (3.3 lbs) and feeds on almost the same seeds the macaw parrot feeds on. These birds feed on Bois cut seeds, Karkler seeds, and pain and sunflowers in their habitat. The red-necked parrot is 38-40 cm (15-16 in) long and resembles the St. Lucia parrot, but it is slightly smaller and darker. It has no maroon wash on the underparts. The red-necked patch is usually well developed in contrast with the green of the remaining feathers in the underparts. The red-necked is the smallest of the two parrots of Dominica, and its habitat is also the rain forest. It lives at lower elevations than the imperial parrot, but the two species overlap locally in the feeding and nesting habitat. METHODS OF PROTECTION Wildlife needs protection because it is part of our lives. We use them for food, we keep them as pets, etc. In the years gone by, there was no need to protect wildlife because there were fewer people on the island, but as the population increased, the demand for these animals became more crucial. To carry out an effective protection and conservation program, extension of the staff is necessary to conduct forest patrols to ensure that no one is causing illegal destruction to the forest and wildlife. These patrols should be made twice a week in different ranges. If these patrols find any person or group of persons committing an offense, the forest officer should first draw to the attention of the people that they are committing an offense and then make them aware of the

penalties of the offense. He shall explain the significance of forest and wildlife on the island. By having public meetings in villages island-wide, people could learn about the significance of forest and wildlife resources on the island, and also learn about the dangers caused by their malpractices in the forest. To have a large turnout, it would be necessary to have close relations with the village councils, in order to mobilize the people easily. The other alternative is to use the mass media to inform the villagers of a forestry and wildlife information meeting which would be held in their villages. By having these meetings, most of the farmers and hunters will be together, which would give members of the staff of the protection section the opportunity to explain the problems they are facing and how people could help to solve them. The importance of conservation should also be explained.

Forest protection officers, while on patrol, can visit farmers in order to see the techniques used for cultivating their lands and at the same time give them some advice on how to prepare the land according to its structure. These visits could also be coordinated with the agricultural extension staffs. By going to schools, specifically those belonging to the government, we will have discussions with the students of age groups from 10-13 years. The discussions would be very beneficial to the students as far as forest and wildlife are concerned. Students of the age group mentioned are the ones causing most of the destruction that affects birds. Hunter clubs should be

formed in as many villages as possible. These hunter clubs will also bring most of the hunters together to discuss the problems that we, as members of the staff of the Forestry Division, are encountering with them in order to carry out our duties effectively. Another method of protection, which I think would be very effective, is that of having some type of communication while on patrol. This would enable us to patrol in groups so each

group would know what is happening in the area that the others are patrolling, and if there were any problems one group would be able to assist the other. "In many cases forest officers go on patrol with 2 cutlasses, and hunters go out to hunt with guns and dogs. This is very dangerous to the forest officer. This is the reason why there should be some type of communication equipment available, even though at certain elevations and areas, it would be impossible to make contact. RECOMMENDATIONS Forest officers should be insured or armed, no one can protect forest and wildlife before they can protect themselves. As pointed out earlier, hunters usually carry weapons, and in other cases people dealing with drugs can be encountered. This presents a threat to forest officers' lives. My opinion is that forest officers should be able to defend themselves from any attack. Training is important for forest officers in Dominica. This training would enable the officers to have a better method of approach and techniques in dealing with forest and wildlife offenders. I recommend that proper legislation be made to protect forest and wildlife. The officers performing these duties should also be protected. One killed unexpectedly while on patrol, in and out of the forest. The protection officer should have binoculars, which could be used for two purposes, one for identifying forest offenses, and the other for monitoring the parrots. Write-ups on forest and wildlife in newspapers, brochures, etc., and the use of the mass media to inform the public of the activities of the Forestry Division should be done every month. To carry out these projects the following equipment is needed: four walkie-talkie radios; four binoculars, which would be used for identifying forest offenses without having to go into the forest in search of them; a camera, so that pictures and slides could be and schools; four telecommunication radios; extension of the staff (we need at least five men to carry out certain forest

Protection duties and 4-wheel drive vehicle, specifically if the project is approved. To carry out this project, first, a wildlife survey has to be made in order to determine the population of wildlife on the island, where they are found, if they are abundant, what they eat, at what time of the year they breed, and how many young ones they carry. Ways to improve the habitats and to increase the populations should also be studied. Forest patrols will also be made at the same time to protect these species. This project should be a 3-year project that will be very beneficial to the country of Dominica. Therefore, we kindly ask for funding for this project from the Committee for Research and Exploration, National Geographic Society in Washington.

SUMMARY

To summarize, there is an urgent need to protect and conserve forest and wildlife resources in order to have a higher production of these resources for the benefit of the country in the near future. There is also a need to encourage faster reproduction which will allow consumption by the public. It calls for a good understanding of what the Forestry Division is doing, and it also calls for appropriate legislation and an effective public education campaign island-wide. The education program will be directed to the schools so the students will get the message, which they, in turn, can pass on to their parents and friends in and out of their villages. The campaign could be held most properly every two weeks in different schools all through the islands. There is also a need to emphasize proper legislation so that persons committing offenses will not go free. There should be

legislation to protect forest and wildlife, e.g., legislation for drugs: whenever persons are caught with illegal drugs they may be charged or imprisoned, or both. This legislation will be very effective and will help to protect forest and wildlife.

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