

Towards Sustainable Forest Resource Management in the Caribbean

***Proceedings of the Sixth Meeting of Caribbean
Foresters at Martinique***

July 20-24, 1992



**A PUBLICATION OF THE INTERNATIONAL INSTITUTE
OF TROPICAL FORESTRY
RIO PIEDRAS, PUERTO RICO
1994**



**TOWARDS SUSTAINABLE FOREST RESOURCE
MANAGEMENT IN THE CARIBBEAN**

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AT MARTINIQUE**

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**A PUBLICATION OF THE INSTITUTE OF TROPICAL FORESTRY
USDA FOREST SERVICE
CALL BOX 25000
RIO PIEDRAS, PUERTO RICO 00928-2500**

1994

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SUSTAINABLE DEVELOPMENT: A CASE FOR GREATER INVESTMENT IN FORESTRY IN ANTIGUA AND BARBUDA

McRonnie Henry

INTRODUCTION

I believe that all of us in this room today are here because of our conviction regarding the importance of the theme itself: FORESTRY FOR SUSTAINABLE DEVELOPMENT. A subject, a profession, a calling, which was too often dismissed as being related only to the specialized interest of the few, is now seen as important for the relationship between people and their natural environment. At least, I hope that the recent Earth Summit held in Brazil last month, was a testimony of that realization.

In Antigua and Barbuda, as indeed the case with small island countries, competition for land, especially forest land, is often severe. The fragile nature of forest ecosystems in Antigua and Barbuda and their strategic importance for the people, for environmental stability and for options for development, requires a special effort to ensure sustainable forestry development.

Several constraints to sustainable forestry in developing countries have been identified, and we are just now beginning to translate this awareness into meaningful action programmes for doing something about it. An example in our (Antigua and Barbuda) case is the National Forestry Action Programme (NFAP) which is currently going through its development phase. Among the priority areas for action is the need for a large and sustained increase in investment in forestry. Protection of watersheds, planting for fuelwood and fodder, agroforestry development, and management and protection of forest ecosystems, are the principal targets for increased investment.

Past failures by both national government and the international community to adequately invest in forest conservation, watershed rehabilitation, soil erosion control, and other environmental protection measures, have had a

high economic and social cost. Some of the decline in agricultural productivity and environmental damage which we are facing today could have been avoided by greater political commitment in the past to invest in natural resources conservation.

I do not wish to give the impression that given additional funding, everything will come right. Clearly that is not so. There are many sociological and technical constraints to increased investment in forestry that money alone cannot solve.

ARGUMENTS IN FAVOUR OF INCREASED INVESTMENT

At this point, I wish to set out briefly some of the arguments in favour of increased investments in forestry.

Agricultural Productivity

Currently, investment in reforestation and in management of natural forests is lagging way behind the level needed to maintain an adequate stock of farm trees and forest cover and to supply human needs for fruit, fodder, poles, fuelwood, timber, and other forest products. The lack of trees and protective shelter belts for farm systems contributes significantly to a reduction in food production.

Watershed Rehabilitation

Deforestation in upland watersheds, followed by excessive grazing and cultivation of steep slopes has led to soil erosion, increased run-off, sedimentation of downstream dams, and disruptions of stream flow. There is, therefore, an urgent need to invest in the rehabilitation of these watersheds.

Fuelwood

The need for fuelwood in Antigua and Barbuda is not as acute as is the case in many developing countries, given the heavy reliance on alternative forms of fuel (gas, electricity). Nevertheless, the harvesting of fuelwood is exerting some pressure on the natural forest and is a factor to be taken into account in the conservation of the forest resource. It is also wise, in the context of national security, to establish an appropriate energy reserve in the manner of which we speak of food security from an agricultural standpoint. To this end we need to invest more in the conservation and expansion of our fuelwood base.

Industrial Forestry Protection

Any exploitation of the forest for industrial purposes without adequate safeguards for conservation and protection will contribute towards environmental deterioration. Therefore, we need to commit the necessary level of investment to ensure that those safeguards are put in place.

Preservation of Tropical Forest Ecosystems and Gene Pool

There are unique ecosystems that are threatened by agricultural encroachment, fuelwood harvesting, industrial development and pollution, etc. These ecosystems contain many plant and animal species that could eventually become extinct unless remedial action is swiftly taken. Many of the pharmaceutical drugs in world use are derived from tropical forests. These ecosystems include some of the most biologically diverse gene pool reserves remaining on the planet and their extinction would have implications of global concern. In the context of such diversity, Antigua and Barbuda might be regarded as being at the lower end of the scale. Nevertheless, the truths expressed above are very applicable.

The Need to Develop Sectorial Linkages

For most, if not all, of the countries represented here, the tourism and agricultural sectors are the principal contributors to the national economy. There is a growing recognition of the need to ensure that further development of those sectors does not proceed at the expense of the natural environment. Hence, the need to develop greater linkages between the environment, tourism, and agriculture sectors. The natural landscape, by way of eco-tourism and other uses, is seen as an area that has the scope for further development of the tourism sector and hence the national economy. Coupled with this, there is the increasing stipulation by donor agencies that projects must include an environmental impact assessment component, and that governments must make a greater local contribution. All this means that there must be an increase in the level of investment if we are to succeed in achieving any level of sustainable development.

Other arguments in favour of investment include the following: utilization of existing natural resources, desirability of decentralized and diversified industry and with it new opportunities for regional employment, necessity to guarantee a permanent flow of forest resources to a new or existing forest processing industry, assistance to the national economy by way of foreign exchange earnings or conservation of capital funds, rehabilitation of degraded environments, continuation of wildlife within forest ecosystems, and provision of recreation space.

A NEED TO BE CONVINCING

There is a widely held assumption by governments and their economic advisors that forestry investments offer a low return and that there are more modern substitutes for the products they yield. From this they conclude that its priority in the allocation of resources

should remain low. One way of attacking this prejudice is to identify projects which give high rates of return and also make a contribution towards solving the most pressing problems. There is no doubt that better project appraisal is needed. However, it would be helpful if we in the forestry profession presented a more positive view of what forestry can contribute.

Making the Case Through Forestry Sector Studies

The purpose of a sector study is to show how development of the sector could contribute to the country's political, economic, and social goals. Whatever aims have emerged in a country, a sector study should show how expansion in forestry could help achieve some of them. Although some work has been done in Antigua and Barbuda in this regard, there is need for a more up-to-date, comprehensive study; one that would place greater emphasis on a quantitative analysis of the forest resource. This should then be used as a base and linked to other sectors of the economy in such a way so to show, in measurable terms, how it can make a greater contribution.

Starting from the national goals helps ensure that the developments proposed are consistent with the main concerns of the government. Foresters tend to become pre-occupied by the "needs" of the forests. The danger is that they fail to see the scope for imaginative presentation of forestry development showing how it can contribute to community needs. They may then seem to others to be demanding more resources for no evident social purpose beyond protection of forests which are apparently not contributing much to national well-being. At a time when almost all governments are working under tight financial constraints and other urgent problems, merely producing a catalogue of the needs of the forest is hardly likely to be successful. It is what forestry and the forest can do for the country that must be demonstrated.

While forestry sector studies are essential, we need not wait for a full scale sector study before embarking on a programme of preparing forest projects. Many of the opportunities for forestry to contribute to the achievement of national goals are well established. For these, traditional and non-traditional techniques for appraising projects can be used to make the case for greater investment.

SUSTAINABLE FORESTRY IN GRENADA

Alan Joseph and Betty Ann Lazarus

INTRODUCTION

When one considers sustainable development in forestry one must also consider factors outside forestry that contribute in one way or another to sustainable development. Population and physical development as related to land use are two of those major factors. Tremendous population increases create heavy pressure on natural resources, especially forests. However, in Grenada present outward migration has prevented our population from growing explosively. Development without a land use policy allows land use patterns to be changed overnight and hence added pressures are placed on forestry.

In Grenada, because population growth is not explosive, we do not have extreme pressures on the forest reserves. However, because there is not an adequate land use policy in place, there are pressures on other forests outside the reserves. Since we have a high level of managerial practices within the forest reserves, and hence little destruction, we would therefore focus attention on the areas outside of the reserves where efforts are made to use sustainable developmental practices to manage these areas.

FUTURE WORK ON A SUSTAINABLE BASIS

We are developing a proposal to manage some lands at different locations around Grenada. The areas that are targeted belong to the Government and in some cases are under threat of indiscriminate removal of trees and a threat to wildlife. The proposal activities will be carried out in Grand Bacolet, Morne Delice, and Belvue.

The lands at Grand Bacolet may also be considered crown lands. This area was logged

by a private individual and a few remaining mahogany trees have regenerated. This area could be transformed into productive forest by transplanting mahogany seedlings and planting seedlings (hybrid mahogany).

Morne Delice is located in the southern part of the island, it also belongs to the Government and it is in danger of destruction by residents in the area through clearing for planting food crops. This area contains forests with numerous large and economically important trees. Trails could be developed and trail signs used to describe the species found there. It has good potential as a tourist site for people interested in a short visit to a natural forest. It is 15 minutes from St. Georges.

Belvue is another area of ecological importance; it is about 3-4 ha of late secondary lowland rain forest. This area should be conserved to protect the large rain forest trees and used to educate Grenadians about their country's original forests and wildlife. The forest's natural vegetation and bird life could also be of interest to the island's visitors.

ENVIRONMENTAL EDUCATION PROGRAMME

The Forestry Division has embarked on an awareness programme in schools, with community groups, with other organizations, and with the public in general. The problems of deforestation and its effects are highlighted in discussions with these groups. The Division strengthened its Education Programme by the launching of the Schools Education Programme on October, 1990 with the following objectives: create a greater awareness as to the importance of the forest, establish an early appreciation for the forest geared towards future expansion, and use the schools/school children as a link to parents to effectively get the message across.

The content of this programme in its first phase consisted of a slide show, songs on the forest (The Forest - A World Above the Ground), coining of slogans, and distribution of buttons. These activities lasted for 40 minutes and were done on a class by class basis. The second phase of the programme involved field trips to the Grand Etang Forest Reserve Centre where a lecture was given, supported with a video film. These activities were then followed by trail visits and interpretation.

FORESTRY EXTENSION: FARMERS PROGRAMME

We have recognized that farmers are harvesting, and in some areas unknowingly mismanaging mahogany stands, at an unsustainable rate which was unheard of in the past. This tree species tends to grow well at lower altitudes, most of which are private farms; hence the need to work with private farmers to restore the acceptable levels of mahogany in Grenada, Carriacou, and Petit Martinique.

The Forestry Division has been working with the Ministry of Agriculture to help farmers to plant more trees, they are planted for numerous uses. Although we have the problem with mahogany, we encourage farmers to use other species that would meet their needs. We try also to explain the long- and short-term benefits of planting those trees. We have found that the farmers are cooperating. Our officers, together with Agriculture extension officers, established contact with farmers. The proposed sites were visited and through dialogue and discussion farmers and officers were able to agree on what was best for the farmers. With the site preparation complete, the seedlings were then distributed to farmers and demonstrations of planting carried out. This has been followed up with monitoring, where periodic visits to the farmers are made to maintain contact and to provide support.

COASTAL WETLANDS

Many mangroves and fresh water wetlands which support a diversity of wildlife are at risk from development and unplanned use. Mangroves total only 470 acres in Grenada, and 98 acres in Carriacou. There are 70 acres of fresh water wetlands in Grenada. Some of these areas have already suffered damage e.g. Seamoons/Telescope, however, although the Levera area had been damaged, it is now declared a National Park and a result is its resources are well managed. It is the intention of the Forestry Division to work with users of mangrove areas to work together to sustainably manage them.

LINE-PLANTING SECONDARY FOREST MANAGEMENT IN GRENADA

A line-planting project has already been initiated (at Grand Bras) to manage forested areas outside of the forest reserves on a sustainable basis. Forest managers faced with the challenge of reducing tropical deforestation are looking to the management of secondary, unproductive forests as a means of producing sustained yields of forest products. Two major ways of managing secondary forests are the use of a thinning plan and line-planting. Thinning to improve stand composition and growth may be appropriate where species composition and stocking are adequate. Where they are not, line-planting is the best alternative. Planting lines are spaced so that the natural forest regrowth between the lines serves as a nurse for the planted trees. At maturity the planted trees form a closed canopy. Line-planting makes possible a sustainable yield of forest products and provides better protection of the forest.

In Grenada, the Forestry Department, with the support of the USDA Forest Service has undertaken a project to line-plant 18 acres of secondary forest on a tract which was formerly government-owned marginal land on the Grand

Bras Estate. The dominant species present (white cedar - *Tabebuia pallida*, maruba - *Simaruba amara*, and lowland gommier - *Bursera simaruba*) have little commercial value. However, their removal in preparation for the lines is generating some income and helping to offset the cost of preparing the land. Mahogany (*S. macrophylla x mahagani*) was chosen as the species to convert this secondary forest into a valuable plantation.

To prepare the lines for planting, merchantable trees were marked and their bases cleared to facilitate cutting by chainsaw. The trees then felled and hauled to the Forestry Department's saw mill where they were sawn. The lines being cleared are regularly-spaced parallel lines of 2.5 to 3 meters wide, with approximately 11 meters between the lines. This spacing reduces between-line competition by allowing sufficient space for mature crowns. It also saves on planting costs. The lines run east to west to optimize the amount of overhead light the seedlings receive and they are cleared so that lateral light is minimized. Within the lines, potted stock of approximately 1 meter in height are planted 2.5 meters apart. Any undesirable trees that come up between the lines, including weeds and vines, will be cut to prevent them from overshadowing the planted trees. Thinning within the lines may also be necessary.

The benefits of this method of secondary forest management are many. It provides for continuous wood resources while maintaining some forest cover. Value is obtained at all stages from trees that are cut to clear the lines, to those maturing between the lines, to the valuable mahogany at maturity and the naturally regenerated mahogany which will follow. In this way line-planting makes sustained yields a reality for secondary forests. A Peace Corps Volunteer and local counterpart experts are working on this project.

CARRIACOU: SOIL CONSERVATION AND WATERSHED MANAGEMENT DEMONSTRATION PROJECT

Carriacou is one of the small islands of the tri-island state. It has experienced serious problems with soil erosion due to over-grazing. The aim of this soil conservation project is to demonstrate to farmers how crops could be grown and at the same time conserve and protect the soil.

WILDLIFE

Our wildlife legislation is outdated which makes it difficult to enforce. Although we know that the legislation needs updating and upgrading, we are not sure about the behavior and populations nor other relevant data pertaining to our wildlife to make meaningful recommendations for amendments to the existing legislation. We therefore need some assistance in terms of research into wildlife to be able to make recommendations for legislation that would give us the power to manage wildlife on a sustainable basis.

I would like to suggest that this research be done on a regional basis if the problem exists on other islands. The planning, researchers, and funding could be sought for a regional programme which will make it more cost effective. If the research is already done on the other islands then maybe we could share information. However, using the existing legislation we are in the process of declaring the habitat of the Grenada Dove (*Leptotilla wellsi*) a protected area. This bird is our national bird and is endemic and endangered.

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A PROPOSAL FOR SECONDARY FOREST MANAGEMENT AND LINE PLANTING IN THE LESSER ANTILLES

Peter L. Weaver

INTRODUCTION

The Tropical Forest Action Plan identified five priority areas in the strategy for action in the development and conservation of tropical forest resources (FAO 1988):

- Forestry in land use: conservation of the resource base for agriculture and integration of forestry into agricultural systems (i.e., assessment of tropical forest lands, land use planning, watershed management, and agroforestry).
- Forest-based industrial development (or, utilization of products from the forest): promotion of appropriate forest industries (timber and minor forest products), intensification of forest management, and more efficient harvest and use of raw materials.
- Fuelwood and energy: determination of demand for fuelwood and restoration of fuelwood supplies through reforestation.
- Conservation of tropical forestry ecosystems (highest priority because of past destruction of tropical forest ecosystems): management of tropical plants and wild animal genetic resources through a network of protected areas, *in situ* conservation of genetic resources, urgent protection of mangroves and wetlands, and sustained yield production systems as a source of wood and wood products.
- Institutions: strengthening of public forest administrations, adequate forest policies, fiscal and other incentives to encourage forestry and agroforestry in the private sector, and technical training and extension.

Nowhere is conservation of forest resources more critical than on the small, densely populated islands of the Lesser Antilles (Fig. 1; Table 1). Barbados has lost virtually all of its forest cover and Dominica, the most rugged and heavily forested island, is slightly less than one-half forested.

Forest destruction continues today. Timber is illegally cut for housing, fenceposts, and other uses, and lands are burned for agriculture or subjected to uncontrolled grazing. Moreover, much of the existing local wood supply is lost through poor harvest techniques, poor processing, or through insect infestation due to lack of chemical treatment. The negative impacts of these policies and practices are obvious. Among the most important for the Caribbean Islands are water supply problems and their impact on domestic, industrial, and commercial developments including overnight tourism, the loss of potential jobs in forestry and wood-related industries, as well as the loss of foreign exchange that is used to purchase lumber and wood products that could be grown and processed at home.

Good forest management is a global concern today. A successful secondary forest management program would involve, in varying degrees, all of the five priority areas outlined in the action plan. The objectives of secondary forest management are: 1) to improve species composition and growth; and 2) to derive a sustained yield of timber and forest products. Basically, the intent is to increase the productive potential of idle or fallow lands.

The purposes of this proposal are to encourage: a) the assessment of secondary forests in countries of the Caribbean Basin region for the possible application of secondary forest

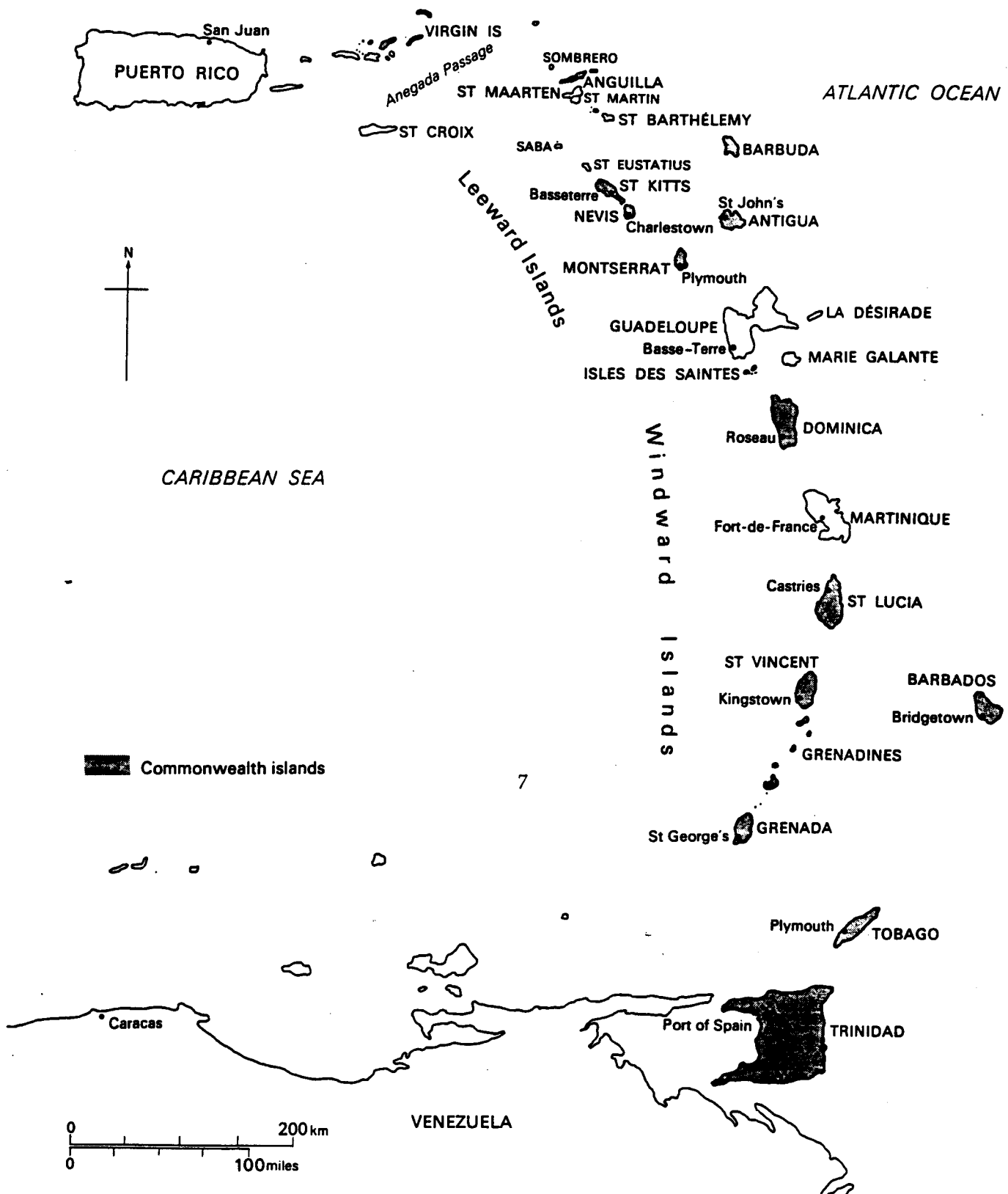


Figure 1. Puerto Rico, the Lesser Antilles, and northern South America.

Table 1. Background information for the Lesser Antilles.

Island(s)	Area* (km ²)	Maximum elevation* (m)	Precipitation range* (mm/yr)	Population estimates* (No./km ²)	Estimated woodlands† (km ²)	Forested areast (%)
Antigua- Barbuda	280 160	402 38	900-1400 900	300 6	[250]§	[15.9]§
Barbados	430	335	1150-1900	554	50	0
Dominica	751	1447	1300-7600	98	550	46.7
Grenada and Carriacou	311 34	840 290	1300-3900 1300	305 140	[70]§	[11.8]§
Guadeloupe and islands	1511 272	1485 -		210 96	NA	[34.8]§
Martinique	1102	1432		290	NA	25.5
Montserrat	102	915	1300-1800	120	35	40.0
Netherlands windwards Saba	88	884		64	NA	0
St. Eustatius						
St. Maarten						
St. Kitts- Nevis	176 93	1156 985	1000-3800 900-2300	210 103	[110]§	[16.7]§
Anguilla	91	61	1000	56	55	

Table 1. Continued

Island(s)	Area [*] (km ²)	Maximum [*] elevation (m)	Precipitation [*] range (mm/yr)	Population [*] estimates (No./km ²)	Estimated woodlands [†] (km ²)	Forested areast (%)
St. Lucia	616	950	1300-3800	226	373	21.0
St. Vincent and Grenadines	345 44	1178	1700-7000	[290]§	175	41.2
Trinidad and Tobago	4832 301	940 567	1300-2800 1000-2550	188 130	[2990]§	[44.1]§
Virgin Islands (U.K.) Anegada Tortola Virgin Gorda	155	536	1050-1400	118	33	[6.7]§
Virgin Islands (U.S.) St. Croix St. John St. Thomas	344	465	1050-1400	183	NA	[5.9]§
Summary	----- 12,038	----- 38-1485	----- 900-7600	----- 208¶	----- -	----- 33.6¶

^{*} Sources: Macpherson 1977; Caribbean Conservation Association et al. 1991 a-f.

[†] Source: Caribbean Development Bank and DFS Deutsche Forstinventur Service GmbH 1984.

[‡] Source: Lugo et al. 1981.

§ Data apply to two or three islands.

¶ ????.

NA = not available.

¶ Weighted mean.

management techniques, b) the initiation of secondary forest management techniques in typical forests, and c) the assessment of growth after treatment of the secondary stands.

BACKGROUND INFORMATION

Recent studies of tropical forests have demonstrated a notable reduction in forested areas due to migratory agriculture, logging, fuelwood harvests, and conversion to pasture lands. The consequence of deforestation include the loss of forests and their increment (Petriceks 1968), losses of flora and fauna, accelerated soil erosion, changes in water quality, quantity, and flow (Gentry and López-Parodi 1980), and alteration in climate (Salati et al. 1978). At the same time that global deforestation is underway, world use of wood and derived products is projected to rise about 135 percent between 1974 and the year 2000 (Pringle 1976). The need to reverse this trend has been pointed out (Lanly and Clement 1979, Sommer 1976).

One factor that operates contrary to deforestation is the regeneration of secondary forests on marginal or abandoned lands. Forest fallow, or forest lands that have been cleared and burnt for temporary cultivation and later abandoned, constitutes about 13 percent of the forested lands in Latin America and the Caribbean (FAO 1988). Nearly 2.3 million hectares are located in the Caribbean region alone. Much of this area is amenable to silvicultural techniques that would improve species composition and growth. Secondary forests are highly variable in structure and species composition. Climate, type of forest cover, soils, topography, and intensity and duration of previous land use, are all factors that influence the nature of secondary forest resources.

Loggers have an opportunity to favorably influence the species composition, growth, and economic potential of regenerated forests. Careful planning of timber harvest (marking of harvest trees and residual crop trees, vine cutting, and proper skid trail development to

protect existing pole size timber and regeneration) limits damage to the residual stand. Such practices along with refinement and liberation have a profound impact on growth, and ultimately, on the commercial potential of the residual stand.

The nature of the secondary forest and current demographic pressures for land and forest products determine the feasibility and range of alternatives available for management of secondary forest resources. Moreover, the objectives of secondary forest management are critical to decisions on whether or not to initiate activities. Usually, the principal objective is to economically produce and manage a future timber crop. Other objectives may include classification of forest lands and their potential, improvement of existing land use, or research and educational activities.

The management of secondary forests is most likely to be economically successful in areas where fast growing commercial timber species constitute a major component of the residual stands, labor is cheap, rainfall is abundant, and soil fertility is satisfactory. Unfortunately, many secondary neotropical forests do not have all of these attributes. The economical production of timber in secondary forests is probably not feasible in many areas today. However, dwindling supplies of timber coupled with rising demands for timber products may make secondary forest management viable in the future. In the interim, the management potential of secondary forests should be explored.

Puerto Rico's land use trends may serve as a regional example. Of the 890,000 ha of land surface, virtually all was forested at the time of discovery. Subsequent clearing for settlement and agriculture (Wadsworth 1950) reduced the forested areas to 13 percent in the mid-1940's, half of which was actually coffee shade agroforestry (Birdsey and Weaver 1982). At that time, less than 1 percent of Puerto Rico's original forests remained in pristine condition. Beginning in the late 1940's, the growth of

industry caused the abandonment of marginal agricultural lands. Migration from rural to urban areas followed, allowing the growth of secondary forests.

Successive inventories of Puerto Rico's naturally regenerated forest cover provided the first estimates of secondary forest growth on a regional basis (Birdsey and Weaver 1982, 1983; Weaver and Birdsey 1990). The volume of growing stock trees increased by 32 percent, and timber volume by nearly 36 percent, on all classes of forest land between 1980 and 1985 (Birdsey and Weaver 1987). Timber growth rates (in $\text{m}^3 \text{ha}^{-1} \text{yr}^{-1}$) varied by forest class and averaged 2.0 in young secondary forest, 6.9 in advanced secondary forest, 7.1 in abandoned coffee shade forest, and 1.2 in active coffee shade forest (agroforestry). A slight increase of valuable timber species, and human intervention in more than half the plots, were other trends recorded between surveys.

Secondary forest management has been tested on a very limited basis. Experimental work began in Puerto Rico in the mid-1950's after selective logging on the Luquillo Forest (Wadsworth, personal communication). An experimental plot was established in a residual stand that contained adequate composition. The plot was thinned periodically between the mid-1950's and 1989. When last measured, volume growth averaged $5 \text{ m}^3 \text{ha}^{-1} \text{yr}^{-1}$ over a 35-year period.

JUSTIFICATION

Secondary forests are common throughout the Caribbean region and are currently used for sporadic harvest of fenceposts and fuelwood. Unmanaged, they have limited potential for future timber production. Simple silvicultural techniques may be applied to enhance their growth and development. On lands with satisfactory composition, these techniques should cost less than reforestation by conventional plantations. On lands with partial stocking, secondary forest management combined with enrichment plantings using

appropriate timber species could achieve full stocking and provide satisfactory growth at costs below those of conventional plantations.

RISKS

Secondary forest management has many risks. They are:

- **Economics.** Investment is required immediately to assess the potential of secondary forests and bring them under management. This differs from primary forest exploitation which immediately produces a harvest, with or without subsequent management, and from plantation forestry which deals with tested techniques, known species, and enough knowledge to project returns over the long run.
- **Experience.** The technique is basically untested and runs the possibility of failure. Little silvicultural information is available on many of the secondary forest tree species to be managed.
- **Resource.** The secondary forest resource is highly variable with regard to forest size, past history, species composition, timber value, and setting. All of these will influence the approach to resource management and in turn could influence the success of the program.
- **Implementation and follow-up.** Several steps are required for successful secondary forest management (assessment, good judgement, refinement, liberation, protection) that call for a management commitment.
- **Technical matters.** Need for competent field technicians capable of recognizing valuable timber species.
- **Training.** Need for capable field technicians to implement field procedures.

- **Hazard.** Danger exists from fire or illegal cutting because secondary forest appears as natural forest to most individuals, unlike plantations where trees are in orderly rows and often exotic.

The risks of secondary forest management could be reduced considerably if management were implemented under the following conditions:

- the lands were secure from outside influence;
- trained field technicians were utilized; and
- alternatives were incorporated into the secondary management program. For example, secondary forests are managed where their composition is satisfactory. Where not feasible, line planting is implemented with fast growing secondary species. Numerous successes with enrichment planting are evident from the American tropics. At least 163 tree species in at least 12 countries have been tested. Of these, about 25 species proved suitable (Weaver 1986). Line planted mahogany on a favorable site in Puerto Rico grew $290 \text{ m}^3 \text{ ha}^{-1}$ after 20 years (Weaver and Bauer 1986). Puerto Rican taungya plantings (intercropping of mahogany and galba with foodstuffs) carried out during the late 1930's and left largely unattended for 45 years also yielded satisfactory results (Weaver 1989).

PRIOR OBLIGATIONS AND REQUISITES

Before secondary forest management activities can be initiated, the counterpart agency within the host country must assure that:

- management is committed to successful implementation of the technique. This means that the counterpart agency will supervise the field crews trained to carry out secondary forest management and collect all relevant information;

- the lands selected for secondary forest management are secure from interference by squatters, other illicit exploitation, or trespass. This may involve a permanent patrol of the properties to be managed;

- competent and trained technicians participate in the activity;

- seedlings are grown in a nursery for enrichment planting where necessary;

- adequate follow-up of techniques is implemented to assure the survival of thinned secondary stands, or line planted forest lands; and

- for enrichment plantings, that Dawkins' rules be followed.

DESCRIPTION OF PROPOSED WORK

Development of Secondary Forest Management Team(s)

Teams would be comprised of personnel from the host Government Forest Service and the Institute of Tropical Forestry (ITF) with the following responsibilities:

- ITF scientist—plan and implement program.
- Project Leader host country counterpart—same as above.
- Inventory specialist (part time)—assess secondary forest resource.
- Plant identifier—botanist or field assistant for tree identification.
- Nursery specialist (part time)—produce species for line planting.
- Forestry technicians—supervise; mark trees.
- Laborers.

Assessment of Secondary Forest Resources

- Partition country into distinct areas (climatic edaphic, cultural influences such as land use).
- Determine size and location of secondary forests.
- Determine ultimate use of forest resource (for example: national park, biological reserve, timber production area).
- Conduct a country-wide inventory of the structure and composition of the secondary forests with commercial timber potential.

- With or without above inventory, select sites with the best potential for secondary forest management for subsequent detailed assessment, that is, the most recently disturbed, humid areas, with little subsequent agriculture, grazing or burning.

Designation of Management Areas

Based on climate, soils, and cultural influences, designate particular areas for secondary forest management activities (Fig. 2). Protect the selected areas (from squatters; illicit harvest; fire).

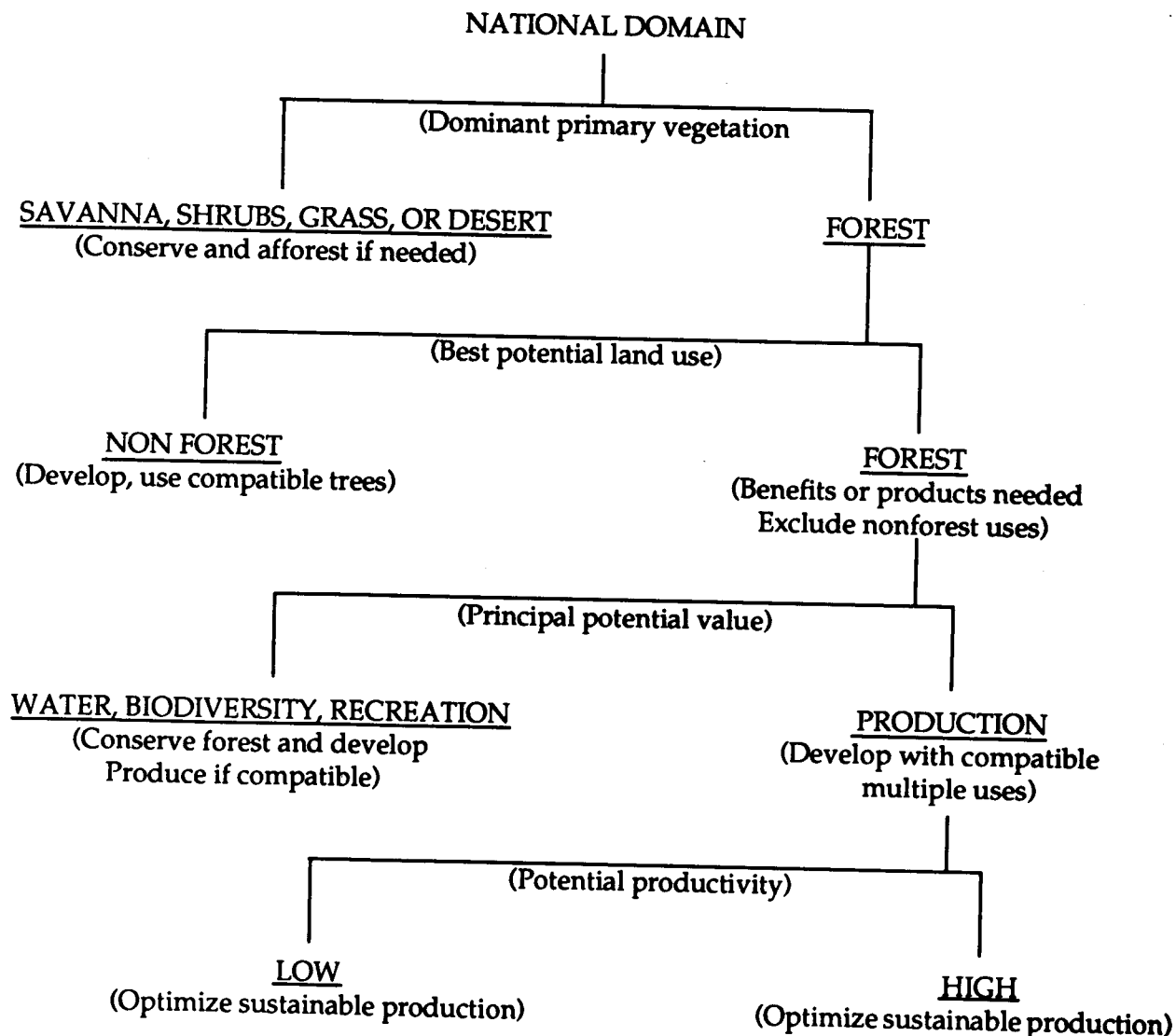


Figure 2. Natural resource land use: flow chart for forestry alternatives (adapted from Wadsworth 1966).

Silvicultural Activities

Regional Assessment

- Development of a commercial species list (for lumber, plywood, veneer, and other commercial uses).
- Development of a protected tree species list (because species rare and endangered, or because food or nesting species for wildlife).
- Arrange species hierarchically on the timber list to indicate their intrinsic value for purposes of selection during liberation or thinning.
- Compile available autecological information regarding timber species ultimately to produce a Silvics Manual for management purposes.

• Conduct an appropriate sampling of the secondary forest (Table 2) to determine whether management is feasible at the moment. The size of the sampling plots will vary according to the size of the existing secondary forest trees.

• Summarize all sampled field data (commercial species encountered; number of commercial stems; form). If 40 percent of the sampling plots in the area sampled (either overstory or understory) are stocked with acceptable timber species, then management is feasible.

Field Silvicultural Activities

These will vary depending on tree size and species composition of the existing secondary forest (Fig. 3). As a first step, all useable timber that can be economically harvested should be removed from the site.

Table 2. Plot size, sampling intensity, and number of desirable trees by size class for sampling in secondary forest.

Average tree size in secondary forest	Plot size* (m ²)	Number of sample plots†	Estimated density‡ (trees/ha)
0 to 1.5 m height	4	24	2500
1.5 m height to 5 cm dbh	9	24	1100
5 to 10 cm dbh	30	24	280
10 to 25 cm dbh	100	24	100
25 to 60 cm dbh	144	24	70

* Corresponds to a density of 1 crop tree per plot.

† Number suggested to provide an estimate of variability.

‡ Refers to the number of trees with good form of acceptable species. Lower densities may also be managed when the established trees are of commercial value. Densities as low as 40% of the desired density are sometimes considered adequate.

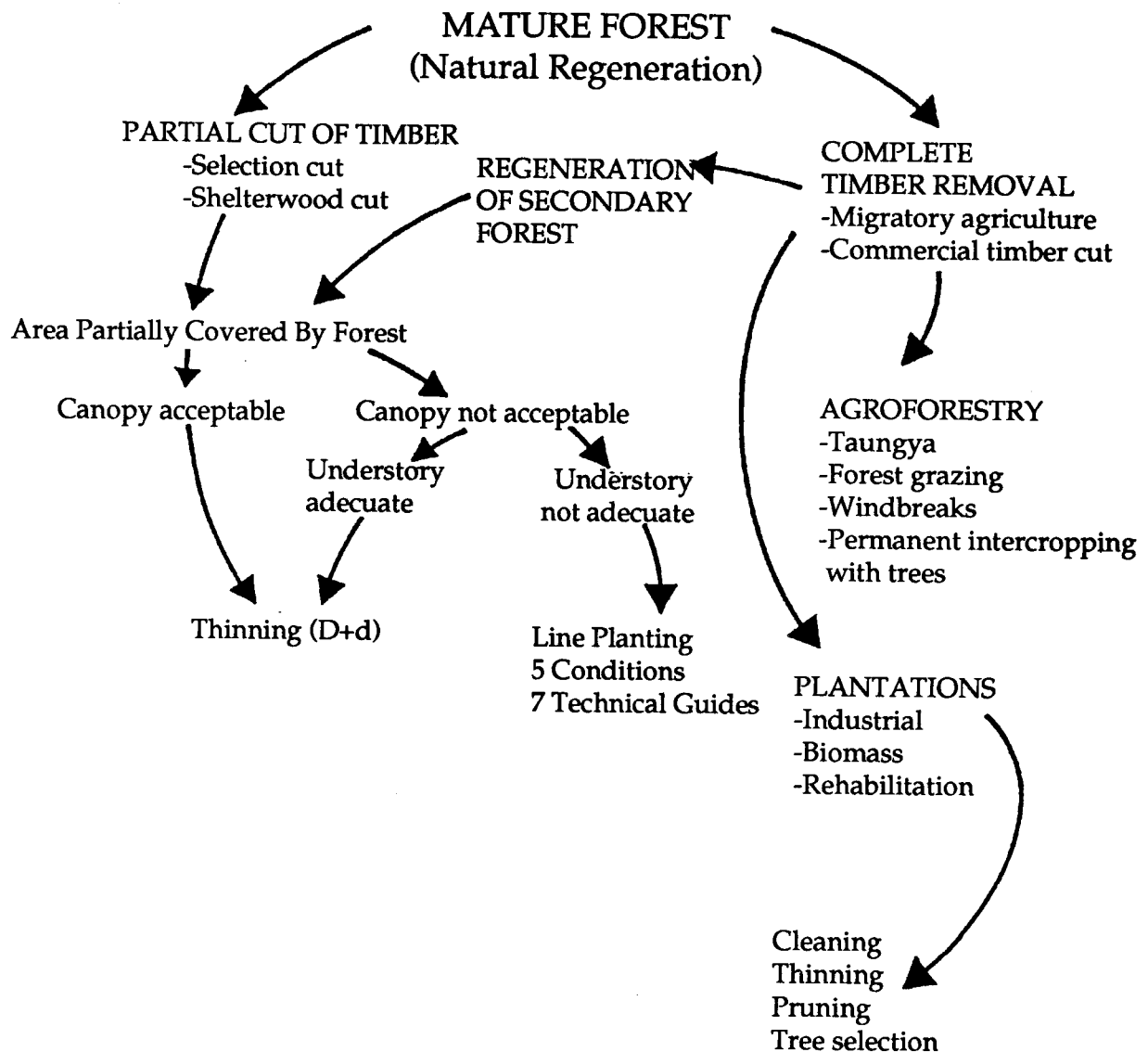


Figure 3. Flow diagram of secondary forest management alternatives. Selection of most appropriate alternative is based on local resources and needs (adapted from Wadsworth 1966).

Adequate overstory. If the overstory is adequate, then potential crop trees are released.

- select potential crop trees: using 20 x 20 m quadrants, transverse the forest and select up to 4 harvest trees per quadrant;
- criteria: crop trees are selected on the basis of species, form, and spacing, respectively. Crop trees have at least 5 m of useful wood in the trunk. Moreover, they are straight, without damage, and well spaced within the 400 m² plot.

-If trees of the same species compete, the one with the longest commercial trunk is favored.

-If trees of the same species and commercial trunk compete, then that with the largest diameter is selected.

-If all factors above are the same, then those that best utilize the available space on the plot are selected.

- register crop tree species, commercial height and diameter;
- thinning: mark crop trees (commercial timber species list, or protected tree species list) and eliminate competition using D+d technique;
- D+d technique: sum the diameters of crop trees and potential competitors in cm and compare with recommended spacings in Table 3 to determine if thinning is required;
- residual trees: all trees not competing with crop trees remain standing to reduce the costs of field operations, to maintain biological diversity, and to avoid opening the forest to vines and weed species;
- thinning intervals: every 10 to 15 years until the end of the rotation.

Inadequate Overstory. If the overstory is inadequate, then the understory is sampled to determine its management potential.

Adequate understory

- Liberation is carried out after the understory vegetation has survived the stage of vines and weed growth characteristic of forest openings. This should be implemented as soon as possible to facilitate growth.

Inadequate understory

- Leave the stand alone until regeneration and subsequent growth yield a manageable resource.
- Establish plantations or agroforestry techniques (not considered herein).
- Enrichment planting following Dawkins' rules (Table 4).

Nursery Production

About 25 tree species have been successfully used in enrichment plantings in the American tropics (Weaver 1986). Some of these may be tested along with promising local species. These species should be grown in existing nurseries if conveniently located in the areas of secondary forests.

Research

Treatment/control plots will be established on select sites to assess:

- growth differences between treatment vs control,
- effectiveness of treatment by species, site, age class, etc., where data are adequate for such analyses.

Response to treatment may not be evident for several years. Tentatively, a five year re-measurement of treatment and control plots is suggested to evaluate secondary forest management techniques. Moreover, at some stage, the economics of secondary forest treatment should be evaluated. Such an evaluation probably should not be undertaken until the organizational activities and field procedures have been tested on a preliminary basis.

The Lesser Antilles are characterized by severe land pressures and limited financial resources. Large tracts of land, however, are not a prerequisite for implementing a successful secondary forest management program. Small, favorably stocked parcels will serve adequately as a starting point. Often, secondary forest management is not implemented because its potential is not fully realized or because the management techniques are unknown. The inclusion of numerous small parcels into rural agricultural schemes would constitute an effective means to produce timber locally and simultaneously render the adjacent farming enterprises more productive.

Table 4. Dawkins' criteria for success of conversion line plantings (Lamb 1968)*

Five necessary conditions:

- Little or no demand exists for thinnings in the area being planted.[†]
- Species being planted must be fast-growing (about 1.5 m/yr in height), naturally straight and self-pruning, i.e., species that colonize gaps the forest and are light-demanding.
- An upper canopy cannot exist; only low secondary forest is suitable.
- The vegetation between the parallel lines must be nonflammable.
- Browsing animals must be scarce or lacking and have a negligible effect on planted trees.

Seven technical guides:

- Planting lines should be spaced slightly greater than the expected crown diameter of healthy crop trees at maturity to avert between-line competition, to save on planting costs, and to allow for possible selection of superior species that may arise naturally between the parallel lines.
- Seedlings should be spaced within the lines at approximately one-fifth of the spacings between lines.
- Planting lines must be well-cleared initially, about 1.8 m wide, to provide access for the planters and to remove ground competition around the seedlings. Once planted, the lines must be kept cleared and overstory vegetation must be eliminated by poisoning. Several clearings, up to four or five per year, may be required initially.
- Seedlings must begin to grow immediately - this may necessitate potted stock.
- Planting must follow immediately after line clearing, or additional clearings will be required. Poisoning the upper canopy must be timed to allow additional light at the time of planting, and not before.
- Trees arising between the lines, unless superior, must be poisoned before they compete with the planted stock.
- Thinning results in the selection of stems with superior form and height. The first thinning usually takes place within three or four years, at which time saplings are well above shrubs and climbers. Up to 50% of the trees may be removed at this time.

* With conversion line plantings, the canopy of the crop will be closed at rotation age.

† The system is designed for timber and veneer logs.

‡ Spacings commonly used in Puerto Rico are 11 m between lines and 2 m within lines.

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FORESTRY AND SUSTAINABLE DEVELOPMENT IN SAINT KITTS AND NEVIS

Patrick Williams

AN OVERVIEW OF FOREST RESOURCES

St. Kitts

In between the dozens of drainage ghauts which radiate outward from the central mountain range of St. Kitts, cane fields gracefully reach inward and upward toward the thick, deep-green canopy of tropical trees, vines, ferns, and plants that make up the heavily forested core of the island. Dominated by Mt. Liamuiga (3,793 ft./1,156 m.), the elongated steep-sided ridge consisting of the Northwest, Central, and South-east Ranges (Fig. 1.) remain to this day mostly inaccessible and undeveloped. The irregular, very steep terrain has, historically speaking, had very little regular intensive use, contrasting dramatically with three hundred years of intensive agricultural use of adjacent surrounding slopes, used traditionally for sugar cane.

However, throughout the colonial era and since independence, the forested core and especially its peripheral edge have provided

down-slope communities with a wide variety of useful goods and services such as building materials, fuel wood, natural medicines, wild fruits, and habitat for game species and other wildlife. By far, however, the most important service provided by the forest is as a reliable source of domestic water for the entire island. In a most orderly sequence, the forest catches the rainfall, stores the water, arranges for its distribution island-wide, and releases it over time at various locations.

Extent and Nature of the Forest

It is generally accepted that over 37 percent (6,475 ha) of the land area of St. Kitts is covered by forest vegetation. A land use break-down of the island can be found in Table 1. Nearly all of the forested areas, except for the South-east Peninsula, are owned by the Government. The St. Kitts forest/woodland cover of 6,500 ha can be classified as: rain and cloud forest — 2,300 ha, moist forest — 2,100 ha, and dry forest — 2,100 ha.

Table 1. Land Use in St. Kitts

Land use type	Acres	Percent
Agriculture	24,420	56.1
Forest	16,000	36.8
Urban	2,600	6.0
Other use	500	1.1

Source: McKenzie (1987).

ST. KITTS and NEVIS/VEGETATION

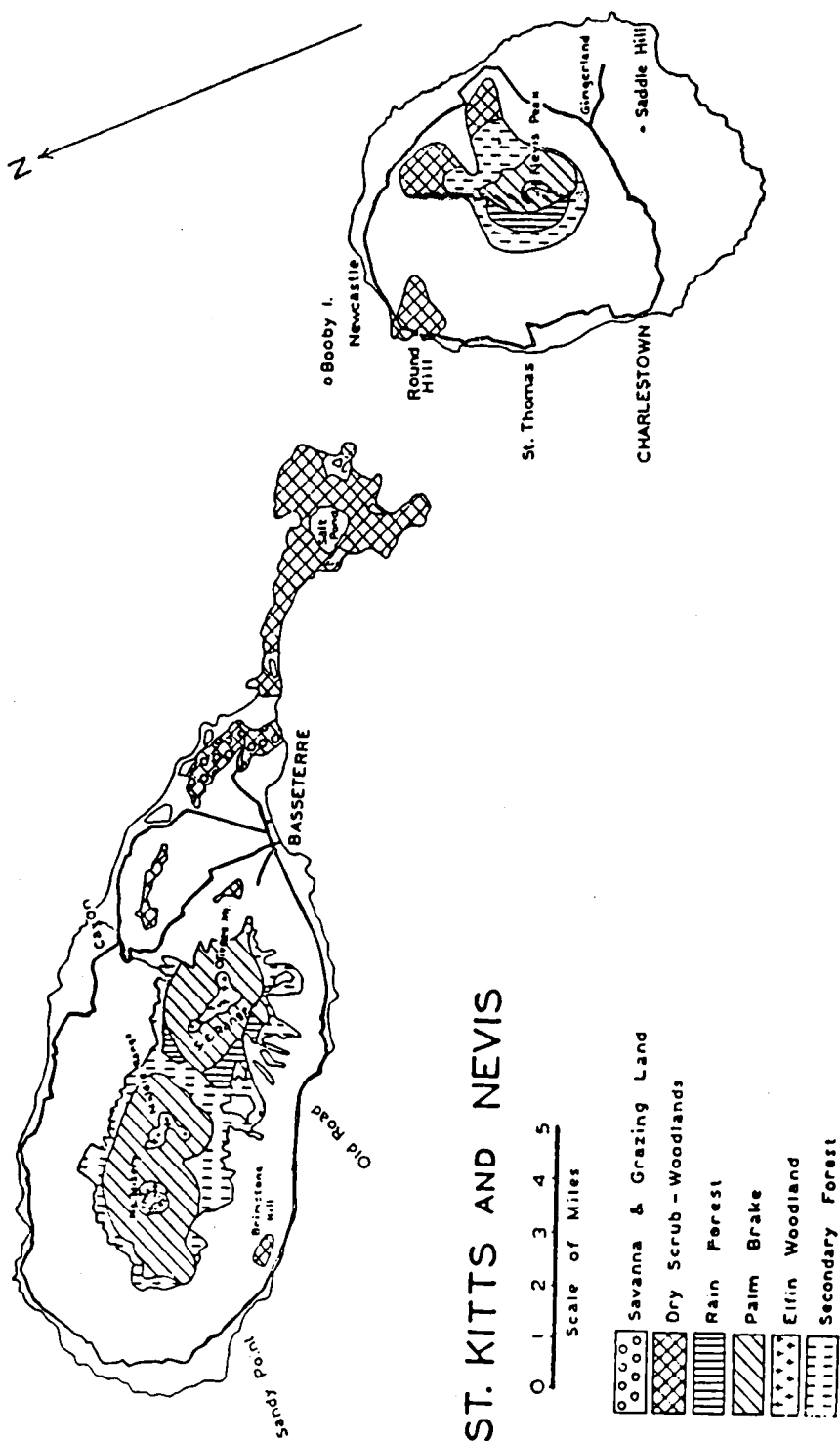


Figure 1. Vegetation map of St. Kitts and Nevis (source: Beard 1949).

Current Status and Environmental Changes

Over the years, there is evidence of continuing and progressive abandonment of agricultural land on previously cleared areas in the steep upper slopes of the island as cane production has been slowly consolidated on better sites. More recently, mechanization and the need to focus production on the most productive land have resulted in further abandonment. As a result, these hilly areas have reverted to secondary forest or have been utilized for grazing. Other areas are used for charcoal, principally because of their accessibility via abandoned, but still passable, trails used to retrieve the finished bagged charcoal. As much as 3,500 ha have been estimated to be pioneer forest which has resulted from abandonment of agricultural land. Labour shortages in the sugar industry (mostly of cane cutters at harvest time) and the concomitant shift to mechanized harvesting have accelerated this process of acreage reduction in cane. The mechanical harvesters simply cannot function efficiently—sometimes not at all—on the steep upper slopes where the fields also tend to be smaller and more irregular in shape. As a result, the upland forested areas of St. Kitts are no longer declining, but appear to be increasing through secondary growth.

Nevis

By the early 18th century, Nevis had cleared most of its forests almost to the top of the central mountains, presumably to provide fuel for the sugar cane industry and to make land available for charcoal and grazing. As large estates began to collapse in the late nineteenth century and population density decreased, abandoned lands in Nevis started to revert to a wild state. This natural forest regeneration continues in some places today, almost half the total land area of the island is covered with forest or woodland, much of it owned by the Government.

Production forest has never been a prominent industry in Nevis. At one time, cedar shingles were produced. In the 1940's,

Nevis supplied St. Kitts with large amounts of charcoal. Today, activities are limited to periodic charcoal burning, some harvesting of bamboo and screw pine for furniture and crafts, and the felling of small trees for use in fish traps, fencing, and construction poles. The remaining forest areas are not suitable for sawn timber production due to extreme slopes, erosion hazard, slow growth rates, and small tree diameters.

Fruit (banana, mango, genip, papaya, breadfruit) is harvested from naturally regenerated trees as well as domestically propagated ones. Currently, there are no agro-forestry or artificial reforestation projects in Nevis. Many lands that were formerly cleared for agricultural production are now abandoned and are naturally reverting back to wild forests.

The major problem with forestry on Nevis is the absence of an overall forest management and protection programme. Legislation has been in place for some time to regulate certain activities and to protect lands above 305 m, but it has not been actively enforced. There are no trained foresters on Nevis as vacant positions were never filled when the last forest guard died in 1970, and a forestry programme has never been developed. Forested crown lands are under the jurisdiction of the Ministry of Agriculture, but the Department is so understaffed at present that no time can be devoted to forestry. Nevis does not have an active forestry unit.

The upper elevation forests are largely intact, protected from agricultural encroachment by their steep slopes, but the lower elevation areas are subject to grazing and erosion. One threat to the higher elevation forest is not agricultural encroachment, as is common in some other Caribbean islands, but rather residential encroachment. Cooler breezes and spectacular vistas attract mainly non-Nevisians to these areas to build homes.

REGULATION AND CONTROL

During the heyday of sugar, the government of St. Kitts and Nevis played a relatively limited role in the management of forested areas. These fell principally within the purview of the sugar estates, which looked after them because they were the sole source of each estate's water supply. The estate management format, therefore, tended to be an informal watershed management process. Management and protection of upland forests were activities that commanded some level of investment of money and effort by owners and some level of planning, work, and supervision by resident estate managers. Therefore, for a very long time, it appeared that forests were self-managing resources and required nothing from Government.

But times changed, and the market place intervened in the form of pressures which encouraged each estate to expand cane production through internal efficiencies and by opening up new cane production areas. There was no place to go but uphill. The process of clearing forested upper-level estate land for cane culture, for "new" provision grounds or for fuelwood harvesting or charcoal production apparently reached its zenith about the end of the nineteenth century. After a not inconsiderable public outcry, mostly based on concern for the effects of excessive deforestation on the water supply and ghaat erosion from increased runoff and downslope flooding, a formal strategy was initiated by estate managers and developed by Government to control tree cutting and limit shifting cultivation.

In 1904, this took the form of a new Forest Ordinance. A Forestry Board composed of planters with lands extending into forested mountains was established to control cutting of vegetation. The effect of this ordinance was that it created a large central block of forest which is now mostly well-advanced second growth. Generally, estate owners and managers cooperated with the Board to implement the regulations and reforest degraded areas. But,

with the gradual decline in, and dissolution of, the estate system culminating in the nationalization of estate lands in 1975, a void slowly developed concerning forest protection and management.

The Government take-over in 1975 resulted in a sudden and rapid deterioration in active management of the forests by the Forestry Board as it failed to meet after 1974. Ten years later, under the stimulus of developing a new national environmental strategy to deal with the anticipated impacts of development the government proceeded to design a new national approach to resource management in the state. The resulting product, "the National Conservation and Environmental Protection Act" (NCEP, 1987), is a broadly-based piece of legislation designed to protect, preserve, and administer a wide range of natural resources. The principal parts of the law, as it relates to forestry, follow:

- Establishment of protected areas. Lands, including private property, can be set aside for a variety of purposes, including national parks, nature reserves, botanic gardens, and historic and scenic areas.
- Administration of protected areas. The Minister of Development is responsible for management, administration, restoration, and conservation.
- A national conservation commission is created under the Act. One of its functions is the preparation of management plans for protected areas.
- Forestry, soil and water conservation. Timber is not to be cut or felled without a permit. Forest reserves are to be established, and grazing is to be prohibited within reserves. Charcoal production is to be regulated, and export of charcoal controlled. The protection of ghauts is identified as a priority, and management and protection measures are to be enforced. Watershed conservation is to be employed to ensure

an uninterrupted supply of water for domestic, agricultural, and industrial uses.

- Regulations are to be prepared for the utilization of forest resources, to maximize productivity.
- Reforestation timber stand improvement, forest protection, forest management, and research are all to be promoted.

Whilst it is recognized that the absence of regulations will prevent the immediate implementation of the NCEP Act, the forestry sector agenda for the future can be summarized as follows:

- An urgent need to identify land, which, because of slope, location, infertility, or other reasons, should be permanently retained under tree cover;
- Adoption of a formally approved forest policy;
- A forest administration with a sufficient number of adequately-trained professionals, and equipped to perform the range of duties required.
- Exploitation of forests for fuel-wood, fence posts, and timber.
- The development of agro-forestry on large areas of former agricultural land lying idle or going to bush.
- Upgrading the primitive system of charcoal production.

MANAGEMENT OF FOREST RESOURCES

The FAO Tropical Forestry Action Plan (TFAP) is the most recent development in the Forestry Sector. This is an on-going activity and the TFAP team was recently in St. Kitts. Out of this campaign it is hoped that several programmes will materialize.

Forestry Inventory

Even though information abounds as to the forest cover in St. Kitts and Nevis, very little detailed information is known about the extent and species composition and, the standing volume and increment of the forest resources of the islands. It has been more than 50 years since a comprehensive inventory was taken of the forests of St. Kitts and Nevis. Detailed knowledge is of prime importance in view of the susceptibility of the resource to change, e.g., damage by Hurricane Hugo. Instituting a method of monitoring change which results from natural occurrences such as hurricanes and the effects of human disturbances needs to be addressed. As a first step, the forest resource will be inventoried, to include mapping the forest by type, noting slope percent, exposure to the frequent path of major storms, and a variety of other topographic details. Forest composition, volume of timber-producing species, forest products, age class, access, and other features of the forest will be collected in a field cruise based on random sample points distributed over the forested portion of the island. Analysis of field data will provide essential information for the preparation of a full forest management plan and clear designation of forest reserves. This forest inventory would be used to develop an improved management strategy for the resource which would include the demarcation and mapping of forest reserves.

Forest Reserves

Protecting the land from the effects of destructive erosive forces and protecting the supply of freshwater are the primary functions of the natural forest. In order to ensure that these benefits continue uninterrupted, the status of forest reserves will be formalized, with measures put in place to improve their management.

The composition, condition, area, and resources of the upland forest are poorly defined. The extent to which these areas are presently used, by whom, and for what purposes needs to

be evaluated and documented. The extent to which the forest supplies firewood and wood for charcoal is essentially unknown. Hence, a long-term management plan for the forest reserve will be developed, and will include the identification of areas where different uses can occur and areas where protection of the forest is to be emphasized.

The boundaries of forest reserves will be established. Survey of boundary lines and demarcation in the field will be carried out following a forest inventory and establishment of the legal framework to ensure control and regulation of the land. Figure 2 shows some of the recommended forest reserve areas.

Nature Tourism and Forest Recreation

Several tour operators and guides use the natural forest for nature excursions. Recreational trips into the forest have become popular with island visitors. The impact of increasing numbers of people and the vulnerability of locations visited on a regular basis needs to be assessed. In addition to formalizing routes frequently used, further development in the eco-tourism sector might include rehabilitation and improvements to the cross-island trail. This historic trail is an old road connecting the villages of Old Road and Molineux, via Phillips Level. Development of facilities such as interpretive signs, side paths to significant natural features, and resting stations and shelters are trail amenities which could be of interest to local residents and tourists alike. Additionally, such a trail has potential as a focus for a continuing environmental education programme suitable for a broad cross-section of the resident and non-resident population. Activities will be modelled after programmes now underway in St. Lucia, Grenada, Montserrat, and the U.S. Virgin Islands.

Forest Management on the South-east Peninsula (SEP)

Recognizing the potential threat to the unique environment of the SEP, the SEP Board

has prepared a Forestry Resources Management Plan which includes an identification and description of each vegetation type and its contribution to the overall environment of the Peninsula. Of particular concern on the SEP is the fire hazard that occurs during the dry season. Annual burning in guinea grass areas maintains the grass cover and prevents regeneration of the dry forests. The guinea grass, which was originally introduced as cattle forage, is expanding in area annually as a result of progressive burning into forested areas.

The Forestry Resources Management Plan outlines the critical relationship between vegetation and erosion on the SEP. Disruption to the natural vegetative cover in this area of low rainfall requires many years for full recovery. Additionally, the loss of dry forests could occur on the SEP as development grows. The impact of poorly-planned construction on natural cover could be essentially permanent. Negative impacts will result from three different mechanisms. First, there will be the direct losses associated with clearing of vegetation and cuts and fills for building sites, roadways, and miscellaneous facilities. Second, there will be secondary impacts caused by erosion and sedimentation from newly cleared lands and uncontrolled storm-water runoff. And third, there will be impacts associated with increased human access.

Reserve status is therefore recommended in some special treatment areas on the SEP. The intention is to establish National Parks through land purchase or donation around the most important forested areas. These include Nag's Head, Sir Anthony's Peak (upper lee slopes and Atlantic side), Salt Pond Hill (upper slopes and Atlantic side), and Scotch Bonnet (Fig. 3).

Other regulations are specified for the protection of trees and shrubs, the integrity of the ghauts, roadway design criteria to protect vegetation, fire control, landscaping, and the impact of animals. Additionally, development will be clustered whenever and wherever possible to minimize the extent of above ground

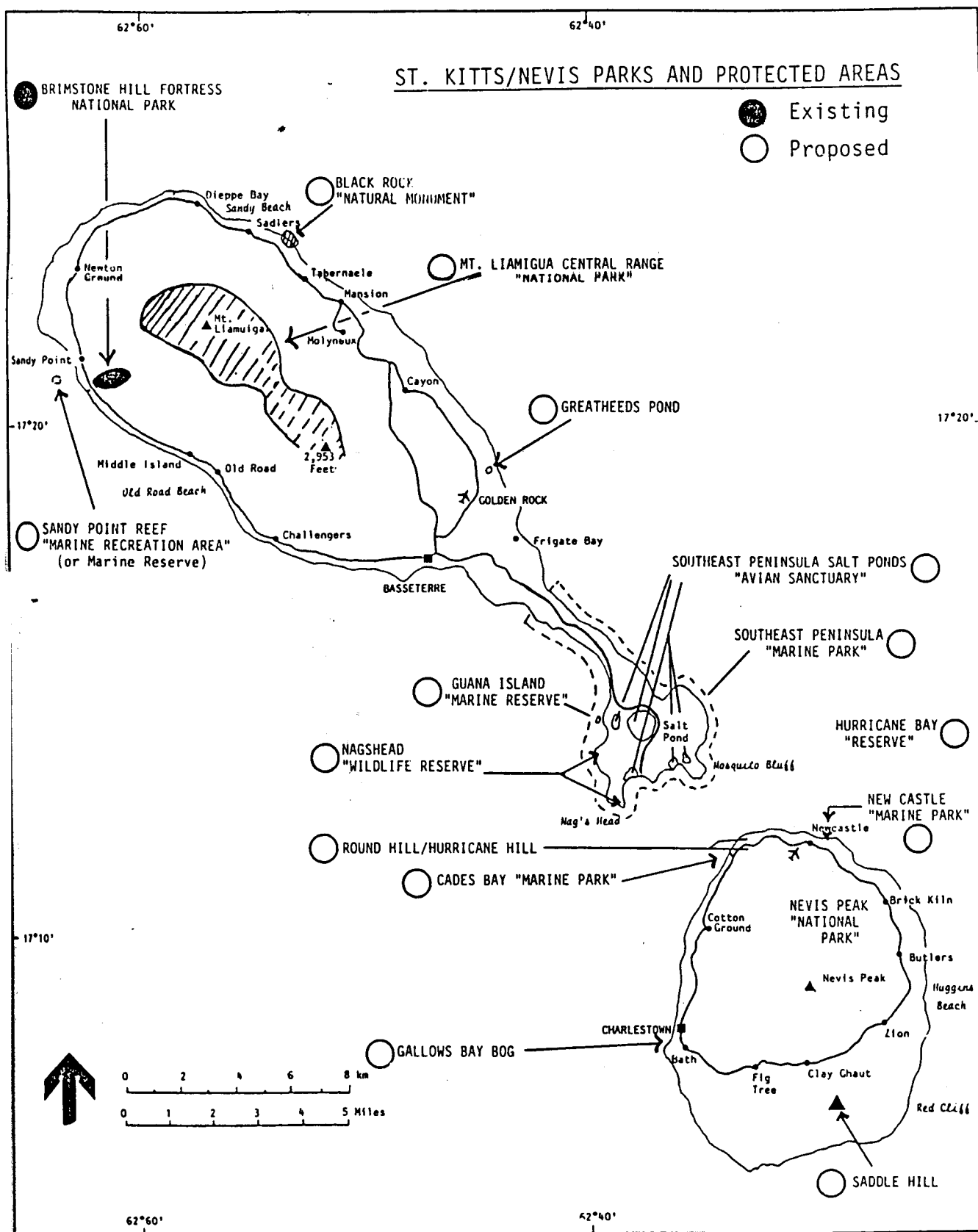


Figure 2. Parks and protected areas, St. Kitts and Nevis.

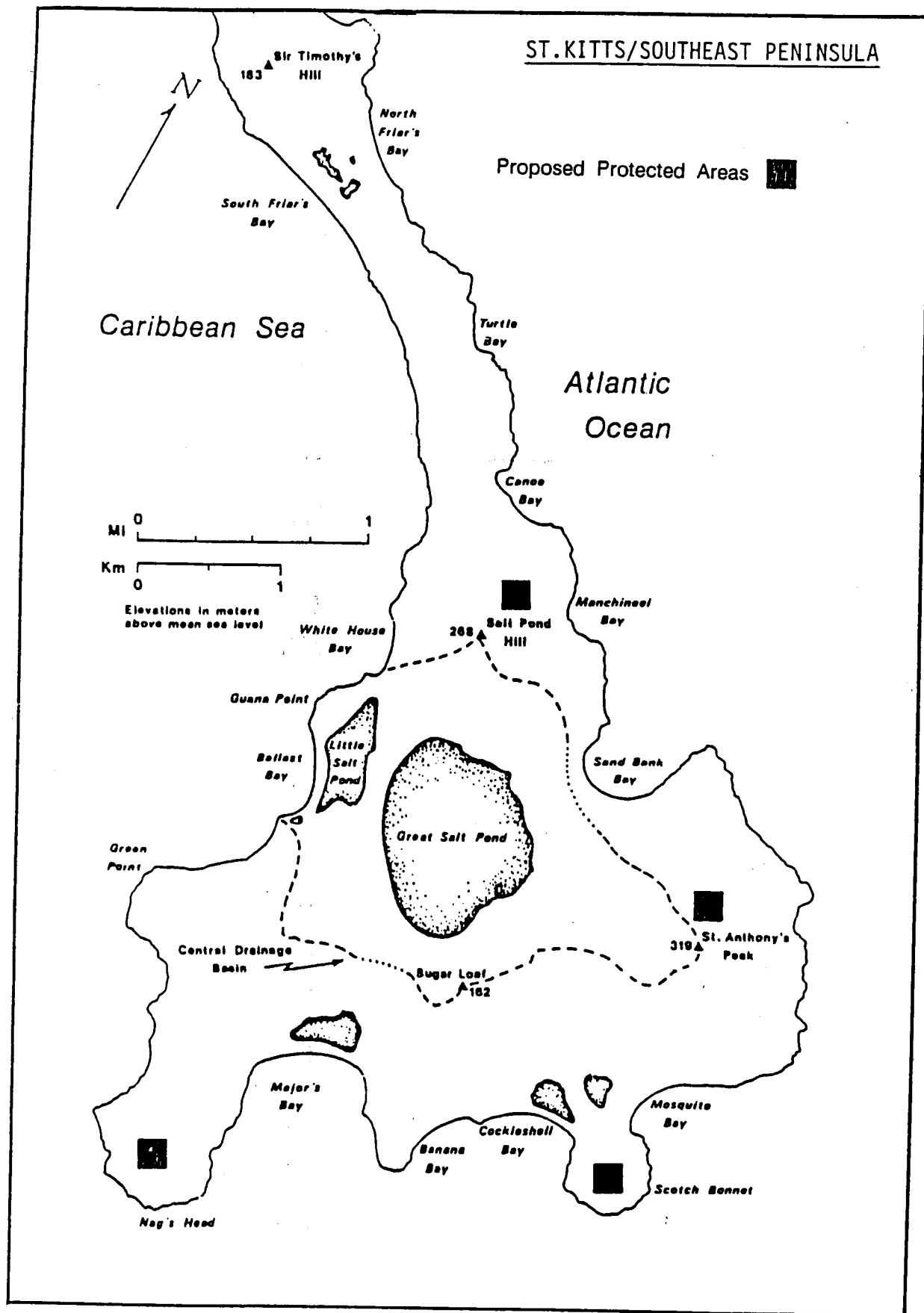


Figure 3. Location map, South-east Peninsula, St. Kitts.

clearing. Performance criteria and regulations that control the cutting of vegetation, extent of clearing, cutting and filling have been developed. Development of littoral forests, and the best examples of dry forests are strictly prohibited.

Wetland Wildlife Reserves

A resource inventory, including mapping the location and extent of remaining wetlands (both St. Kitts & Nevis), is a critical requirement which will be undertaken. As a model for other wetlands, the present plan for the establishment of a wildlife sanctuary for Greatheeds Pond at Conaree may be adapted for other critical wetland areas.

AGRO-FORESTRY AS DIVERSIFICATION

As a facet of the larger national agricultural diversification strategy, sub-elements will focus on an expanded and accelerated implementation of a programme of agro-forestry. It is of crucial significance to point out, however, that in Nevis, natural reforestation is occurring on many abandoned lands. Therefore, a large scale artificial reforestation campaign would not be the best use of available resources, except perhaps for seriously damaged or eroded sites in key watersheds.

Establishment of Industrial Plantations

Although there is no clear definition of acreage involved, there appears to be between 1,012 and 1,416 ha of land which were previously in sugar cane production. Government intends to utilize these lands in a forest plantation management programme. This will involve the identification, propagation, and out-planting of suitable forest species in multi-purpose plantations. Agro-forestry has a well defined role to play on abandoned cane lands where community needs and the requirements for environmental protection can be merged.

Although several attempts have been made to establish industrial plantations in St. Kitts,

most of them have failed primarily due to livestock and the absence of post-plantation care. In Nevis, all sawn lumber is imported. During the period 1987-1989, St. Kitts and Nevis spent approximately 10 million dollars on the importation of logs and lumber for the construction industry and the furniture trade. This trend is likely to continue in the future. In addition to meeting the local demand for sawn lumber, these plantations will have a considerable environmental impact particularly with respect to reducing soil erosion, improving conditions for agricultural development, and improving water supplies.

It is envisaged that an average of 26,000 seedlings per year will be produced in St. Kitts. Additionally, it is anticipated that at least 80 ha will be converted to forests of white cedar and mahogany plantations in both St. Kitts and Nevis.

Establishment of Bamboo/Rattan Plantations

In 1983, a feasibility study prepared by Louis Berger International Inc., and financed by UNDP, concluded the establishment of small scale Bamboo/Rattan plantations in St. Kitts was technically and economically viable. The produce can be used for furniture, fencing, scaffolding, screens and room divisions, and for handicraft articles. A considerable amount of employment in small scale industries can also result. It is hoped that the Nursery at La Guerite will produce about 25,000 plants annually, thereby, allowing the Forestry Division to plant 5 ha of Bamboo/Rattan annually.

Establishment of Fuelwood, Fodder, and Fence Posts Plantations

Although there are no accurate records of the demand for fuelwood/charcoal in Nevis, this has been estimated to be approximately 450 tones per annum. In addition, the island exports charcoal to St. Kitts, the demand for which is estimated at 550 tones per annum. This has resulted in large areas of the country, especially

on the leeward side, being heavily over-exploited, resulting in serious watershed degradation. Appropriate species have already been identified for fence posts and fuelwood production, as well as fodder to support Government's agricultural diversification policy. The plan is to establish 30 ha of fuelwood, forage, and fence posts plantations in Nevis.

Production and Treatment Split Fencing

The Ministry of Agriculture in Nevis intends to produce split fencing from poles and thinning obtained from industrial plantations in order to control the serious problem of uncontrolled grazing of cattle and goats in Nevis, and provide them to livestock farmers at a reasonable costs.

INSTITUTIONAL STRENGTHENING

St. Kitts

The functions of the Forestry Division of the Ministry of Agriculture, Lands, Housing, and Development are to provide guidance with respect to forest policy and law, to implement such policies and laws once they have been formally approved by Government, to manage the State's forests efficiently, and to provide guidance to private land owners. In order to discharge these functions the Division must have a sufficient number of well qualified staff. The existing establishment of the Forestry Division (1992 Estimates of Expenditure) consists of the following: Professionals: 1 Forestry Officer, Sub-Professionals: 1 Forestry Assistant, 1 Forestry Guard, and 4 Forest Rangers.

Of these, the Post of Forestry Assistant is new and not yet filled, the Forest Guard and one Forest Ranger have died and their positions not filled, while the three Forest Rangers are employed on a part-time basis. The objective of this programme will be to upgrade and expand the Forestry Division in order to allow it to successfully implement the functions of the Division.

Specific Considerations for Nevis

Before any serious forestry programme can be properly developed on Nevis, a Division of Forestry must be instituted within the Nevis

Agricultural Department, and at least one trained forester be employed to manage such a division. Standards for identifying, selecting and ranking prospective forest reserves should be one of the foremost responsibilities of the Nevis Division of Forestry.

Expansion and Upgrading of Central Nursery (St. Kitts) and the Prospect Nursery (Nevis)

The nursery facilities of St. Kitts are situated at the headquarters of the Agricultural Department at La Guerite. This nursery was established with the initiation of an OAS Project on Forestry Development and provided seedlings for forestry and agro-forestry activities. The forest nursery has been upgraded to produce approximately 60,000 seedlings for the establishment of a variety of plantations.

The Nevis strategy envisages an expanded forestry/agro-forestry development programme which will require a considerable number of timber and fruit-tree seedlings for the following activities: industrial plantations (20 ha/annum); fuel-wood, fodder, and fencepost plantations (6 ha/annum); and, fruit trees species for agro-forestry development (15 ha/annum).

These seedlings will be produced at the existing nursery at Prospect which will be expanded and upgraded. Such an approach will reduce the cost of establishing a separate nursery for the production of timber seedlings.

CONCLUDING REMARKS

The forests of St. Kitts and Nevis perform an essential function in regulating stream flow, protecting water supplies, preventing erosion and landslides, and maintaining a well distributed rainfall for the production of agricultural crops. The remaining natural forest owes its survival in large measure to the ruggedness of the terrain, lack of access, and, to some degree, government protection. Any management strategy must of necessity consider the resource's firewood value, its value for agro-forestry, its wildlife and biodiversity value, its water catchment and storage value, as well as its recreational and educational value. It is hoped that the strategies enunciated in this paper will conserve and protect this important resource.

IMPLICATIONS FOR FORESTRY ACTION OF A SOCIOECONOMIC STUDY IN A WATERSHED OF SAINT VINCENT

Jorge O. Trevin, Robert S. Anderson and Nigel J. Weekes

BACKGROUND

The Saint Vincent and the Grenadines Forestry Development Project, implemented with the assistance of the Canadian International Development Agency, aims to develop the capacity of the Saint Vincent Forestry Division to manage and protect the forest resources of the country. The project selected the Colinarie Watershed, on Windward Saint Vincent (Fig. 1), as a model area to build up a cooperative forest management process.

A study was conducted between 1990 and 1991 of the socioeconomic factors which influence the behavior of the major users of the watershed. The study was carried out by Vincentians, under the guidance of the project. The study focused on the attitudes and practices of the specialists or users of the forest, ten percent of the watershed households, and the major government and commercial agencies with interests and responsibilities in the watershed. The study attempted to define the socioeconomic characteristics of the resident and nonresident users of the watershed, define the users of tree crops, forest products and forest land, define the status and socioeconomic importance of uses and needs of forest products, define the effects of the population on the environment, and help to ascertain the foundations of a cooperative watershed management system.

The results of the study are contained in a recent unpublished document, (Forestry Development Project 1992). While all the results are relevant for forest management to a different extent, this paper deals with a portion of them. It discusses those findings that have direct implications for forestry action, mainly because in most cases they relate to forest "objects" or subjects, such as trees or tree planting.

THE WATERSHED

The Colinarie Watershed is one of the largest on the island of Saint Vincent, and drains an area of twenty-three square kilometers. Its highest point lies at its northwest corner, an unnamed peak 1,022 m above sea level. From the steep upper reaches of the watershed to the point where the Colinarie River enters the sea, at the village of Friendly, the distance is approximately nine kilometers.

Primary forest occupies the higher slopes, with *Euterpe* palms abundant in the palm brake, and gommier (*Dacryodes excelsa*) crowning the high canopy of the rain forest. The population has always been concentrated in the lower third of the valley, but the whole watershed is within the sphere of influence of the specialists who use its resources.

The Colinarie Watershed, like others in the country, is used extensively and intensively by community residents. Most of its 694 households operate small and medium size farms averaging five hectares in area, but ranging widely. The vast majority of them cultivate bananas. Other households are engaged in "specialist activities" such as charcoal burning and sawing logs as ways of securing a livelihood.

The watershed environment is being affected by deforestation for agriculture and extraction of forest products, water pollution by agricultural chemicals, and generally by a fairly exploitative, non-sustainable use of natural resources on public and private lands. A forest management process recognizing the priorities and capacities of the local communities should contribute to reverse these tendencies. Knowing those priorities and capacities is essential, and this was the reason for the socioeconomic study.

METHODS

Two types of data were collected by field researchers. The first was drawn from general observations of community life over a three month period, and from unstructured interviews with representatives of public and private agencies which have a presence in the watershed. Other data were obtained through structured interviews, using questionnaires with two target groups. These groups were all specialists or forest users in the watershed and a ten percent sample of the households.

The study employed persons knowledgeable about the watershed communities to assist the work of the field researchers. These persons fell into two groups. The first group established initial contact between diverse watershed users and field researchers, and was composed by teachers, nurses, shop-keepers, and senior residents, among others. The second group consisted of persons hired by the study as community consultants. They performed a more substantial role which included identifying specialists, compiling and streamlining the lists of specialists and households, providing feedback on the effect of interactions between researchers and locals, and assisting with the conduction of interviews. Generally, the community consultants helped to smooth the way for the work of the study team, and eventually gave direct assistance in the conduct of the study.

IMPLICATIONS FOR FORESTRY ACTION

The discussion of a cooperative management process takes into account all the study results, the results of other studies currently being performed in the watershed, and project experiences and objectives. The following implications for forestry action are not a substitute for that discussion. They are a component of it. They are broad inferences which flow from concrete study results dealing mostly with trees and forests. Associated findings and implications are discussed together.

Finding: Most people who own land have planted trees on it.

Implication: There are no behavioral constraints in the population toward planting trees, and there is an opportunity to develop rural participatory forestry in the watershed.

Two thirds of the people that hold land have planted trees, and nine out of ten of them think that trees should be planted on their lands. Also, 96 percent of the people think that others should plant trees. While only 8 percent of those who planted trees have planted forest species, forest tree species are mentioned among the trees that should be planted by 61 percent of the public. Most of the farmers have planted fruit trees, and seem to understand more about fruit trees, their care and management. Thus, familiarity played a role in their choices, besides their orientation to economic utility and household pleasure.

These results indicate that there is an opportunity to work with the farmers to plant trees on their lands within cooperative arrangements. There is an awareness of the benefits of planting trees. This may be due to market or public information reasons, or both. These results also suggest that there is a good base of knowledge on which to build, and that conflicts with cultural values should not affect a cooperative reforestation program, if designed in consultation with farmers.

Finding: Most farmers favor planting trees on the borders of their lands.

Implication: Opportunity to assist them with windbreaks, an agroforestry practice with which Vincentian farmers are familiar.

Sixty-four percent of the farmers who favor planting trees used the words "borders," "sides," "edges," or equivalent terms for indicating where trees should be planted. Boundary planting and windbreaks are among the most common agroforestry practices in Saint Vincent. However, in most cases, windbreaks are not

properly established. The interest expressed by the farmers justifies making these practices a priority within the project's agroforestry extension activities. Because of their importance for crop protection, windbreaks provide an opportunity to introduce multipurpose trees in those areas of the watershed in which a shift from banana cultivation is not recommended or feasible.

Finding: Half of the animal rearers cut and collect fodder for their animals, and some of them even transport the fodder in vehicles when needed.

Implication: There is an opportunity to enhance animal production through the promotion of fodder trees and cut-and-carry fodder production.

The results suggest that cut-and-carry fodder production would be a culturally accepted practice. The project should implement research and extension in this agroforestry practice, a very common silvopastoral system in the American tropics (Nair 1989). Fodder trees may be planted in blocks, as living fences, or incorporated on existing pastures. In the Colonarie, living fences are more promising than other alternatives because of the preference of farmers for planting trees on the borders of their lands.

Finding: Intercropping, the mixing of trees with other crops, is generally not favoured by a majority of farmers. However, the number of farmers favoring intercropping is still significant from a program point of view. They suggest, in most cases, that fruit trees would be combined with annual crops.

Implication: Intercropping as an agroforestry practice would require more effort to promote than other practices already mentioned.

It is worth noting that most of the reasons given by farmers against intercropping are based on experience and are technically sound: "trees shade crops," "yield (of crops) would be poor,"

"trees retain too much water," "trees rob plants of food," and others. Intercropping would not only require a higher promotion effort but also a higher research and extension effort in order to reduce risks of on-farm failure to an acceptable level. Thus intercropping, suggested by 18 percent of the farmers who own land, may be a lower priority of the project agroforestry programme. Nevertheless, successful examples of intercropping in the watershed might create an effect of imitation and innovation among some farmers.

Finding: The vast majority of the population uses charcoal as fuel, in combination with other energy resources. Charcoal produced in the watershed does not satisfy demand in the Colonarie communities. There is, however, a significant number of charcoal burners in the watershed who reported a production in the last year of 1,715 sacks of charcoal for a total value, at EC \$20 per sack, of EC \$34,300 per year.

Implication: Opportunities exist to develop charcoal making as a small scale forest industry and to use subproducts of thinning operations.

Charcoal is used by 96 percent of the respondents. Demand in the watershed is not satisfied by local producers and an important portion of the charcoal consumed is trucked from Sandy Bay, Northern Saint Vincent. Charcoal and firewood tend to be more important in poorer households. The 19 local charcoal burners are an important percentage (18 percent) of the specialists that require products from the forests, excluding farmers, and are only exceeded in number by the carpenters (20 or 19 percent). The majority of charcoal makers think that the supply of raw material may not be enough in the future, mainly because of lack of trees or restricted access to them.

The Forestry Division has ten hectares of forest plantations in the watershed which require thinning. The main limitation to carry out this required silvicultural activity has been the distance of the plantations to the nearest road.

This precludes the utilization of fallen trees. However, if thinning subproducts were used for charcoal production, the cost-effectiveness of transport would be increased by the possibility of transporting the final product. This is because charcoal may be produced close to the plantation and therefore the makers may afford to spend some time carrying sacks worth EC \$20 value to the road.

The utilization of thinning subproducts for charcoal making in the watershed would be beneficial in several ways, i.e., providing work on a needed, legitimate activity where skills already exist; reducing pressure on the natural forest; producing some revenue for the government and thus improving the economics of thinning; helping to carry out needed thinning on a plantation, thus, helping to reach a high quality forest product (sawmill timber) sooner; and might make the watershed self-sufficient in charcoal, thus contributing to community economic development (although it would mean the loss of a market for Sandy Bay charcoal makers).

This also represents an opportunity to enhance the industry of charcoal making through the introduction of more efficient technologies such as portable or other non-traditional charcoal kilns. Earlier experiments in the Caribbean showed their potential, with increased quality and production using the same volume of raw fuel (Knudson *et al.* 1988).

Finding: The supply of bamboo is reported by specialists to be a problem.

Implication: The Forestry Division should consider bamboos among the species to be established in the watershed, to fulfil multiple purposes, such as slope protection and handicraft or construction uses.

Bamboo is already planted all around Saint Vincent for the purpose of slope stabilization. Some bamboo plots were established by the Taiwanese Agricultural Mission in the watershed at South Rivers. The results of these

plantings should be reviewed. The Division should then determine further sites for successful species. There is definitely a justifiable basis for this initiative.

Finding: Reliance on forest products is common to several trades and occupations, as well as many household economies.

Implication: There exists an opportunity to enhance rural-based minor forest product enterprises.

Contrasting with the uniform firsthand image of a banana-producing area, the study exposed communities using the watershed resources in diverse, complex ways. It is important to strengthen the positive aspects of this complexity, because this will contribute to the stability of the management process.

In addition to the case of charcoal making, which was mentioned separately because of its particular implications for forest management, there are several other trades which require forest products, with a significant number of people involved in their practice. While it is expected that most of them would benefit from technological improvement, the study did corroborate that they would benefit from an improvement in the supply of materials. This is common to typical forest industries such as woodcutting and carpentry, trades which depend on non-timber forest products such as handicraft and hunting, and trades which include forest products as part of their inputs, such as baking.

A demand exists for a variety of forest products. This is beneficial to forest management because it allows for the utilization of minor products and subproducts and may contribute, as in the case of charcoal-making, to alleviating the cost of silvicultural interventions such as thinning. More importantly, the study shows that an infrastructure and a knowledge base exists for the utilization of more valuable forest products, such as sawmill-size timber, and for realizing higher added value in the economy of

the watershed communities. Further development of this infrastructure and knowledge base is recommended. A limitation on this objective is that the wood of the existing plantations has not reached desirable sawmilling sizes. On the other hand, a reason for working on this subject in the short-term is that it would increase the capacity of the specialists, particularly carpenters and woodcutters, to utilize medium-size timber resulting from intermediate interventions.

Finding: Media exposure and awareness are, like literacy, at the level of two-thirds to three-quarters of the adult population, and probably higher among youths.

Implication: Local people should be involved in any public discussion of the implications of the socioeconomic study.

The early discussion of the conclusions of the study should occur in the watershed communities. This is, after all, information about them. Additionally, they will consider the same findings, in a fresh light, if they hear it or see it treated in the newspapers, radio, or

television. Their reactions towards these two forms of presentation, direct and via the media, will become the first steps of the community engagement in a cooperative resource management process.

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CHARCOAL PRODUCTION AND USE IN SAINT VINCENT AND THE GRENADINES

David Dunkley

INTRODUCTION

Saint Vincent and the Grenadines (SVG), an archipelago stretching 100 kilometers from Saint Vincent to Grenada, has traditionally relied on wood and wood products for energy consumption, housing materials, boat building, and other related purposes (Fig. 1). Roughly 35 percent of the land base on Saint Vincent, or 12,000 hectares, is still covered with forests, due largely to the rugged and inaccessible (by road) terrain. However, with population growth and demand for more land and products, the forests are displaying signs of stress. Clearing the land in an unplanned manner has resulted in negative environmental and socioeconomic consequences in some parts of the country. Only recently have Vincentians begun to realize that their well-being is intrinsically tied to the health of the forests. The problem is, how to protect the forests and at the same time provide forest products for consumptive and non-consumptive purposes?

PURPOSE AND OBJECTIVES

This study was designed to provide data on the use and production of charcoal in order to assist the Forestry Division of SVG in making sound forest policies. Most wood on SVG is converted into charcoal and used for energy. However, little is known about the amount consumed. Without basic data on charcoal use, the Forestry Division is hampered in ascertaining what forest policies will work and what directions to take to satisfy this consumptive use of the forest. Thus, the information provided by this study is an important step to ensuring that the forest is managed.

The objectives of this study were to estimate the amount of charcoal being consumed by households and the number of Vincentians

involved in producing charcoal, in both the formal and informal economy.

BACKGROUND

Charcoal is used extensively by Vincentians for cooking and baking, though other energy sources like liquified petroleum gas (LPG) and electricity are increasingly being adopted. Charcoal is prepared in the traditional earth pit manner. This method is not generally considered a very efficient method of producing charcoal (FAO 1987, Knudson et al. 1988, UNDP/World Bank 1984), but takes very little capital input and enables the charcoal maker to be mobile.

To produce charcoal, wood is cut, stacked on the ground, and then covered with a mixture of earth and vegetation to form a mound. On Saint Vincent, the vegetation is often made up of banana stalks and leaves because of their abundance. Banana vegetation has a high moisture content and helps prevent the wood from igniting and over-burning.

On the Grenadine islands, banana vegetation is rarely used since it is not as abundant as on Saint Vincent. Because of the drier climate and lack of lush vegetation, more earth material appears to be used in proportion to vegetative material when compared to that of Saint Vincent. The vegetation that is mixed in with the earth comes from dry woodland tree species, shrubs, bushes, and grasses.

Some people who make charcoal like to burn around the full moon period, if possible, because they believe they get better quality charcoal. This tradition coincides with the belief that rainfall also occurs around a full moon period. The two theories are complementary since rainfall will help prevent the wood from overburning.

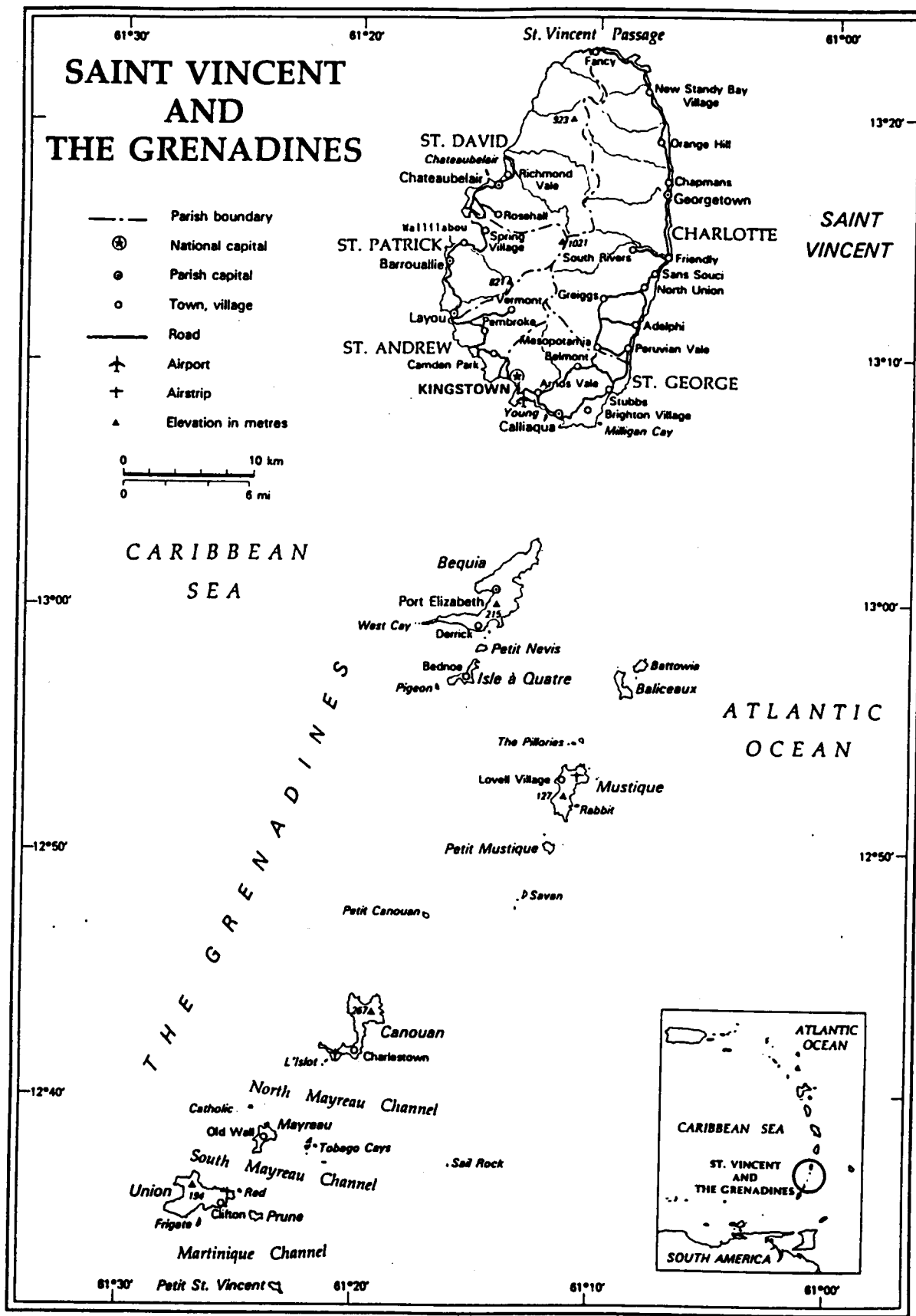


Figure 1. Saint Vincent and the Grenadines (from Government SVG 1986).

STUDY APPROACH

A household survey was designed to elicit information from householders on their use and production of charcoal based on quantity and price primarily. Generic background data was also collected on the household and respondent in order to better understand why people replied to questions in a certain way, and what the implications might be.

To ensure the statistical validity of the survey, a stratified random sampling method was employed, based on the 13 census divisions within Saint Vincent and the Grenadines. Of the 27,110 households within the country (Government of Saint Vincent and the Grenadines 1991a), 135 were interviewed, equivalent to 0.5 percent of the total household population. Census areas differed in population size, although the percent sampled in each area was the same, some had more samples than others. Upon completion of the survey, the data was aggregated to determine national wood use.

Households were randomly selected by picking house numbers from the 1991 Population and Housing Census (Ibid). When house numbers could not be found, a random selection was made by simply counting a certain number of houses from a predetermined point.

FINDINGS

The country-wide average use of charcoal for 1991 is 5.1 sacks per household, or 138,260 sacks of charcoal for the country. Assuming each sack weighs 22 kilograms, then 3,040 tons of charcoal are consumed by Vincentians. This is equivalent to approximately 18,000 cubic meters of wood annually using the FAO estimate of 167 kg of charcoal per cubic meter (FAO 1990). This figure is based on 100 percent conversion of wood to charcoal. However, this conversion percentage is unrealistic using the earth pit charcoal-making method. A more reasonable conversion is 30 percent (FAO 1987). This implies that approximately 55,000 cubic

meters of wood are consumed to produce the 138,260 sacks of charcoal. Other estimates from the early 1980's range from 25,000 to 35,000 cubic meters (Deutsche Forstinventur Service 1983) to 63,000 cubic meters (World Bank 1984) of wood.

Eighty-one percent of the households said they use charcoal for cooking and baking on a regular or part-time basis. This translates to nearly 22,000 households and illustrates the widespread use of charcoal in SVG. Prins (1986) estimated that between 70 percent to 80 percent of households used charcoal seven years ago. Since the use of LPG has increased significantly over the latter half of the 1980's, it is speculated that charcoal use was probably higher in the mid-1980's than Prins' estimate.

The average price for one sack of charcoal is \$EC 20.80. If every sack was sold for this price (some make their own charcoal), then the total value for all charcoal consumed in 1991 is \$EC 2,875,830 (138,260 sacks x \$20.80).

The reasons households use charcoal are given in Table 1. Most households use a combination of LPG and charcoal for cooking. Some households use charcoal only when the LPG runs out and there is not enough money to buy more gas. Others only use charcoal for special events that require the meals to be cooked for a long time. They use charcoal because it saves LPG and/or they prefer the taste of the food. There is a segment of the households who only use charcoal (often with fuelwood) because they cannot afford or choose not to use LPG. The older generations are more likely to use charcoal because they have cooked with it all their lives and they will not convert to other fuels.

Some households use more than the national average of 5.1 sacks of charcoal and pay significantly more per sack than the average price of \$EC 20.80. Most of these households are headed by single, unemployed women with larger than average-size families. They are forced to buy charcoal by the measure or pan

(\$EC 1.00 to 1.50 a pan) because they do not have disposable income to purchase a sack. Therefore, at 40 to 50 pans per sack, it will cost these households between \$EC 40 to 75 per sack. If these households are unable to find the financial resources to pay for charcoal, they may have to switch to alternative fuels like firewood or coconut shells, if available. This will take more of their time in collecting the fuel, and reduce their time for other tasks. Another option is to reduce the number of cooked meals they receive in a day. With large families, many of whom are children, this could pose serious social consequences.

Table 1. Why householders use charcoal.

Reason	Percent
Economics	44
Cooking preference	11
Economics and cooking preference	11
Social functions (e.g., barbecue)	05
Other reasons	10
Do not use charcoal	19

Most of those who use charcoal for social functions came from the Kingstown and Suburb census areas. These households have largely converted to LPG for cooking and probably treat charcoal as an inferior product except for these special social activities.

Fifty percent of the households using charcoal do so at any time of the year. Seventeen percent use it during the holiday season (Christmas baking), 12 percent during the dry season, 11 percent for roasting breadfruit, and 9 percent for other reasons.

Approximately 13 percent of the households produce their own charcoal. This is equivalent to 3,524 households within SVG. These

households spent nearly 21 days each in 1991 making charcoal. The total number of days to produce charcoal for all households is 74,000 days in 1991. Based on 250 working days per year, there are nearly 300 full-time charcoal-making jobs. Women make approximately 33 percent of this charcoal, equivalent to 100 jobs. It is estimated that 75 to 85 people are full-time charcoal producers who do this for a living.

Those households who produce charcoal do so for a variety of factors. Some clear land to produce agricultural crops or build a house. They utilize the wood on the property to make charcoal to supplement their income. Others make charcoal to reduce the amount of LPG they have to purchase. It is evident that not all charcoal is coming from primary forest areas. The suburbs and Calliaqua census areas had the largest population increases according to the results from the 1991 Population and Housing Census-Preliminary Results (Government of Saint Vincent and the Grenadines 1991a, b). With this population increase has come a house building spree. To make room for houses, trees were cut and converted into charcoal.

Although the information gathered is only intended for national purposes, Table 2 suggests some interesting area-wide use of charcoal. In general, the southern portion of Saint Vincent uses less charcoal. The Kingstown and Suburbs census areas are shifting to LPG and electricity for cooking. Undeveloped lands are under scrub and secondary forests. As discussed above, these lands are potential wood sources for charcoal production.

Marriaqua and Bridgetown areas use the least amount of charcoal. Most available productive land in these areas is under banana cultivation. Charcoal usually comes from outside the region, or from steeper terrain in the upper watershed areas.

The Grenadines and the northern portions of Saint Vincent, especially the leeward side, are the biggest consumers of charcoal. The standard of living in most of these areas is low based on

health, education, transportation services, income opportunities, and housing conditions (Wirt 1986). Many of these people are unable to obtain work, hence, they cannot always pay for LPG if they want to use it. Wood, on the other hand, is considered a free good by many. They can go into the forest, cut some wood, and make charcoal at no charge except for the time to make it.

Table 2. Annual charcoal use per house-hold per census area. This information should be treated cautiously. Detailed sampling per census area may reveal different figures.

Census area	Charcoal use (sacks)
Kingstown	3.1
Suburbs	4.2
Calliaqua	5.0
Marriaqua	2.3
Bridgetown	1.5
Colonarie	4.0
Georgetown	5.2
Sandy Bay	4.2
Layou	4.9
Barroullie	7.7
Chateaubelair	8.6
North Grenadines	13.4
South Grenadines	8.8

Sandy Bay, known for its exportation of charcoal to other parts of Saint Vincent, uses less charcoal than the national average. Wood and coconut shells are used primarily for cooking and baking. It is estimated that the full-time charcoal producers in the area make approximately 12,500 sacks of charcoal in total. Charcoal deliveries by truck are made once or twice a week to the south of Saint Vincent. Some boats deliver charcoal to the leeward side of the

island, especially to the Chateaubelair and Barroullie census areas.

CONCLUSIONS AND RECOMMENDATIONS

If Vincentians wish to manage their forests in a productive, constructive, and sustainable manner, they need to be aware of how much charcoal they use and produce. This paper demonstrates that the volume of charcoal consumed within the country is significant.

As the population of SVG increases and available land becomes scarcer, people will continue to clear forest lands to make a living. If mismanagement of the forest continues along the same path Vincentians have chosen over the last 50 years, the country will continue to squander opportunities to promote the development of its citizens. Severe environmental and socioeconomic consequences will result. Indeed, areas within the country already display some of these negative effects. Therefore, the Forestry Division must continue its new found vigilance and enforce the laws to protect these forested areas.

If the Forestry Division is to build on their recent successes in public awareness and education, forest recreation planning, and silvicultural activities, to include employment opportunities, they should liaise with the community, business groups, and government agencies on the best approach to develop effective and sound policies. Before acting on certain forest policies, the Forestry Division needs to examine the driving force behind the encroachment of forest areas, especially in the more remote and upper watershed areas. These areas are not being cut solely for their charcoal potential as Saint Vincent is hardly undergoing a fuelwood crisis. The fact is that many people are looking for land to grow crops, be it for bananas, provisions, or marijuana. The problem is much broader than just a wood energy issue, it revolves around development in general. Therefore, forest policies must keep this in mind to ensure that they are effective.

I recommend:

1. The Forestry Division must assess if woodlots and/or some other form of wood production methods are required to produce charcoal, based on the present consumption level. If local wood supplies need to be supplemented in this manner, will they prevent forest areas from being further depleted? There are four obvious options in which the Forestry Division can choose to proceed. These are: producing woodlots on public land, operated by the Forestry Division or some private business person; encouraging large private landowners to provide woodlots; promoting community forestry production of woodlots, encouraging management by women; and providing tree seedlings to small landowners to produce the estimated quantity of wood required for use.

Each option has its strong and weak points. The Forestry Division needs to evaluate how they will go about choosing the most appropriate methods based on equity, effectiveness, cost-efficiency, administrative simplicity, political acceptability, feasibility, and sustainability.

2. The Forestry Division needs to conduct a statistically valid survey of charcoal use in selected regions of the country census areas. A heavier sampling is necessary to accurately determine the amount of wood consumed in a particular area. It will be important to determine from what lands the wood is coming from, whether it be from forested mountain areas, agricultural areas, urban/semi-urban lands, scrub lands, secondary forests, or elsewhere. This will be beneficial to tailoring policies to the needs of the specific region of the country. It is important to differentiate wood use and forest depletion amongst areas. Census areas recommended for study are: Sandy Bay, Chateaubelair, Barroullie, Layou, Calliaqua, and the Grenadines.

3. Low-income earning women need to be targeted for any forest projects in which they can earn or generate income.
4. The Forestry Division should establish communication links with certain communities and co-op groups to assess whether forestry-related projects such as community forestry are feasible.
5. A survey should be conducted every three to five years to estimate the national use of wood and wood products to determine trends in wood consumption and production patterns.

ACKNOWLEDGEMENTS

This study was funded through the CIDA Awards Program by the Canadian Bureau for International Education.

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LET'S GET SERIOUS ABOUT MULTIPLE-USE FOREST MANAGEMENT IN TRINIDAD

Carlton Sambury

INTRODUCTION

Trinidadians and Tobagonians are privileged people! We still possess substantial tropical forests known worldwide for their complexity and utmost importance to our survival. We also have among us trained forest managers charged with the responsibility of planning for the best use of such forests for both present and future generations. Yet, environmentalists, ecologists, hydrologists, foresters, and farmers are complaining loudly that our forests are either dwindling or deteriorating. Woodworkers are similarly pleading that their livelihood has evaporated. While all this goes on, individuals continue to slash and burn for agriculture or just plain squat, decimating important ecosystems.

This paper explores the potential for solutions to some of these problems through multiple-use forest management. Essentially, its thesis is that the time has arrived when we must emphasize the multiplicity of values of our tropical forests and its potential for serving the needs of all our people through its wise management to achieve multiple benefits.

TROPICAL FORESTS - HOW VALUABLE?

Tropical forests are complex and diverse, occupying and subtly modifying a variety of environments. They contain large numbers of species, both flora and fauna, which are valuable for almost as many reasons as there are species, some of which are as yet unknown. Yes, the multiple ecologic and economic functions which tropical forests fulfill are factors we must always consider in all aspects of our forestry operations. Additionally, the list of commodities and services which people want from the forests gets longer.

Yet, we foresters do not generally appreciate the full implications of these facts. Why? We are often guilty of encouraging the management (or is it the exploitation?) of a single forest product (timber?) to the detriment of numerous other products, the sum of which may be much greater economically and ecologically than that single resource.

Perhaps we should not accept all the blame! We face endless pressure from a rapidly increasing population needing land for food production, housing, and eventually other accompanying amenities. Politicians are therefore susceptible to this pressure from its citizens needing short-term solutions—i.e., land and food for short-term farming, in addition to housing as an answer to their long-term problem—i.e., security.

Of course, economists are as responsible. For them, it is difficult, if not impossible, to put a value on items as diverse as maintenance of soil fertility in the Caroni plains or the prevention of flash flooding in the East-West corridor, even though these have directly resulted from the multi-million dollar reforestation programme taking place on the Northern Range since 1962. In recent times in particular, W.A.S.A. has received kudos and millions of dollars for its water distribution programmes. Nonetheless, the role of the forest resources and its management and protection of water catchment areas, so critical in producing the water, is hardly, if ever, considered in terms of dollars and cents.

Forest resources earmarked for parks, recreation, and related uses have similarly been undervalued. The growing demand for such experiences in our forests in areas such as the Eastern Northern Range, including Blanchisseuse, Toco, and Matelot, has increased

the value of such resources. In most cases, that value is worth many times more than the timber in such areas. The increasing importance of eco-tourism ensures that the value of these forest resources will continue to increase.

Additionally, we have historically valued wildlife resources at or near zero, thus rendering wildlife and wildlife habitat particularly vulnerable to displacement by other uses (Phillips and Adamowicz 1981). Studies have verified that the recreation potential of our wildlife resources can be converted into tremendous economic benefits. Nonetheless, our foresters and much more so the particular users, hunters, remain largely ignorant to the importance of their role in ensuring a sustainable and economic resource.

And what of the other important non-timber resources including medicines, handicrafts, and food. The economic value of these non-timber forest products are extremely significant to various rural communities in Trinidad, such as Toco, Matura, Valencia, etc., and eventually to the national economy, in terms of providing material needs, cash income, and employment. Also, a more enlightened society has placed increasing values on such things as absence of human disturbance, biological diversity, eco-tourism, and the forests' role in regulating and mitigating climatic change.

Clearly, therefore, each of the multiple uses of our forests are crucial for our survival and that of our children. The way forward for our forest management must be multiple use management. We simply cannot afford to continue the emphasis on management of our forests mainly for single uses.

MULTIPLE USE DEFINED

Multiple use forest management means the management of all the renewable surface resources of our forests so that they are utilized in the combination that will best suit the needs of all the people in Trinidad and Tobago. Such use allows for sufficient latitude for periodic

adjustments in use to conform to changing needs and conditions.

Harmonious and coordinated management of forest resources (timber, water, recreation, wildlife, handicraft, medicinal materials, etc.), with each other is necessary without impairing the productivity of the land. Due consideration must be given to the relative values of the various resources, and not necessarily the combination of uses that will give the greatest dollar return (USDA 1985).

PRESENT MANAGEMENT OF OUR FORESTS

Our tropical forests are, at present, managed under the following management systems: 1) intensively managed forests include approximately 13,000 ha of teak and pine plantations and 2,000 ha of tropical hardwood plantations; 2) approximately 13,000 ha have been managed under the block system (a system where periodic *blocks* are silviculturally marked for sale, and systematically harvested); 3) another 3,000 ha have been regenerated under shelterwood using improvement felling, enrichment, and line planting; 4) much of the remaining exploitable forests have been managed under the selection (open range) system where the emphasis is on sales and harvesting of various species according to various silvicultural characteristics; and 5) *protection* forests comprise more 50 percent of all forests and include various areas reserved for parks, watersheds, and other sensitive areas. The management of these areas range from intensive management to preservation.

The most outstanding problem in the practice of the above systems is the fact that timber production has been emphasized to the detriment of other intangible benefits.

These intangible benefits already indicated above, include: 1) protection of watersheds for the nation's water supply, prevention of hillside erosion and flash flooding in both rural and urban areas; 2) habitat for unique flora and

fauna providing food, medicines, a genetic pool for research, and future benefits; 3) a place for a wide range of recreation and related activities, such as parks and protected areas; and 4) a host of other non-timber products of major economic value both for rural households and the nation as a whole. Such value in the past has largely been ignored and neglected.

NEGATIVE EFFECTS

There have been numerous negative effects of tropical forest logging on the forest environment, local communities' welfare in general, and on non-timber forest resources and in particular their value to communities. In some of the systems used in Trinidad, notably the selection (open range) system, various forest regions have been substantially over exploited. Trees of any utilizable growth and species have been sold, leaving secondary forests of little worth. Logging has taken place in areas considered as protection forests, destroying crucial wildlife habitat, and opening up these areas to further exploitation by squatters and others.

Exacerbating the problem has been the recent severe economic hardships and resultant unemployment problems, besieging both urban and rural communities, leading to the intense commercialization of non-timber forest products. Often, anything saleable which can be found in the forest is likely to be gathered and sold, ranging from unique foliage (young stem and flowers of palmiste) to the fruits and seeds of various species.

THE SOLUTION: MULTIPLE USE FOREST MANAGEMENT

It has been recognized in other tropical countries worldwide that the management of such non-timber forest resources must be an integral component of a sustainable, multi-purpose forest management system (De Beer and Mc Dermott 1989). We in Trinidad, must therefore seriously integrate the management

of non-timber products with timber management and at the same time, as has been done in other countries, provide an incentive for and a means of lessening the environmental, economic, and social damage.

Multiple-use forest management is the answer to degradation caused by exploitation for single products, and may include the following techniques:

- Policy orientation—increased attention to non-timber forest products. Exploitation of any area for timber must, as a matter of policy, first consider the economic and ecological consequences of the non-timber resources.
- Improved harvesting, storage, transport, processing/manufacturing methods, and marketing of non-timber products.
- Greater diversity of products marketed especially as non-timber.
- More agro-silvi-pastoral practices (integration with agriculture). We must practise meaningful agroforestry instead of token agroforestry at our hillside stations.
- Community involvement in management and protection of forests—certain communities e.g., Eastern Northern Range (ENR), if involved in the management of the forests will willingly protect these forests. All forest users must be encouraged to participate actively as equal partners in forest planning and in appropriate decisions. We must develop creative and sincere partnerships among forest users to include woodworkers/sawmillers and other wood users, environmentalists, recreationists, and other related expertise. Resources simply cannot satisfy all users, so the consequences of specific practices as indicated by Brooks and Grant (1992) must be discussed and evaluated in order to make difficult choices.

- Integration with conservation management—a prefelling inventory of both timber or non-timber resources (including wildlife and watershed effects) is necessary in order to maximize the long-term productivity of the total range of outputs.

- Increased investment in research and extension— research must be meaningful and must be translatable into actions in the field. Do we do any meaningful forestry research?

- Efficient management for timber—it should be emphasized, however, that management of the forests for timber is an essential aspect of a country's forest policy. Within the constraints of its resources, the industrial sub-sector must be given appropriate support by the government of the country.

Multiple-use management will ensure that the supply of timber products will be maximized in the short-run without expanding the harvesting areas. Options will include: 1) increasing the number of species to be extracted, 2) utilizing more of the volume felled, and 3) increasing the recovery rate in the industry.

Areas of forest will be devoted to intensive silvicultural management (including teak and pine plantations), with the aim of increasing the volume and value of the production. The choice of such areas must be made on both economic and ecological considerations, and not purely on the basis of a policy to establish a set quantity of plantations annually.

- Review of education and training programmes for all purposes and for all officers—this is necessary in order to ensure appropriate emphasis on multiple forest resource values and management. Relevant short courses, seminars, or workshops are necessary at this time to sensitize long-serving officers. An essential goal of these

programmes will be to help our forest officers to understand both: 1) the importance of the economic-investment approach to forestry; and more importantly, 2) the need to make the welfare of our people and their communities the central goal in forest management.

AN IMPORTANT BEGINNING

Such multiple use forest management is now the focus of planning for the forestry sector in the Eastern Northern Range Plan (ENRP).

An area of approximately 57,000 ha, the ENR still contains natural resources both on the coastal as well as upland areas, including the interior forested region. Crucial fishing grounds, beautiful beaches such as Salybia, Matura, and Balandra, and critical wildlife habitat, abound along the coastal areas. Other recreation, such as the proposed Madamas and the Matura National Parks, major forest reserves, several watersheds including the watershed of famous Hollis reservoir, form part of the interior forested areas. In addition, large expanses of agricultural lands cultivated in food crops as well as abandoned cocoa and coffee plantations can be found.

The ENRP was initiated in June of 1989 by the Government of Trinidad and Tobago with technical assistance from the Organization of American States. The main thrust of the project has been to prepare an Integrated Sectoral Development Plan to include Agriculture, Forestry, Fisheries and National Parks, Recreation, and Tourism. The project is designed to ensure the long-term productive capacity of the forest resources and to avoid the misuse of this area of the Northern Range as has occurred on the Western portion of the Range. The ENRP will therefore ensure that such multiple uses will be guaranteed.

The ENRP will include the above multiple-use forest management techniques. Areas of special attention will incorporate guidelines outlined by the International Bank of Restruction

and Development (World Bank 1991) and will include the following areas:

Poverty Alleviation

While we intensify efforts to protect the forests, priority has to be given in the interim to increasing the agricultural productivity in the populated areas especially those areas close to forested areas and to expanding non-farm employment opportunities in these areas. To accomplish this goal, planning is quite advanced for the following projects: beekeeping in ENR forests, parks and recreation projects, small farmers organization project, marine fisheries improvement project, and small agro-based cottage industries.

In all of these projects, the communities have been involved in the planning and will be fully incorporated during in the implementation phases.

Land Use and Classification Plan

A planned inventory and land classification exercise with the necessary approval of Town & Country Division will provide a realistic assessment of what is technically feasible and guidelines for overall land use. Resources in the ENR are limited, but it is essential to protect certain forests from exploitation and to manage these exclusively as water catchment, parks, recreation, and related areas. Access to and use of all lands (including private) will be regulated to ensure that adequate areas remain under tree cover especially in environmentally sensitive areas.

Rationalizing of Incentives

It is recommended that timber sales and concession arrangements be restructured to ensure more control over logging in sensitive areas, and consideration of the true value of non-timber resources in timber sales and concession agreements. This would include both a revision of royalty rates and management and harvesting guidelines for multiple products.

Coordinating Role of the ENRP Unit

It is proposed that an ENRP unit (and later, a Development Company) be set up comprising

of expertise from all appropriate agencies which will coordinate, plan, monitor, and implement projects in the entire region. Many public investments will be channelled through the unit/company and will of necessity be preceded by careful environmental assessments. In this multi-disciplinary and integrated approach, environmental problems will therefore be avoided.

CONCLUSION

Such an integrated approach to the management of our major forest regions is the only way forward. Forestry practised for the sake of forestry is no longer in style. The needs of society as well as the individual, both for the present and for future generations, must be met. Surely, multiple-use management of our forest areas is, if properly implemented, the only serious answer to our forest management problems.

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COMMUNITY FORESTRY: RESOURCES USERS AS PARTICIPATORY MANAGERS

Floyd Homer

ABSTRACT

Community forestry has been emerging as an approach to meet the forest resource needs of the rural poor in developing countries. In Dominica and St. Lucia two ongoing community forestry projects serve as examples where participatory management, and the provision of scientific training and information to the resource users, have significantly influenced the level of success. Suggestions are made for promoting and building upon community forestry initiatives in the Caribbean.

La foresterie communautaire apparait comme une nouvelle approche de la gestion et de l'exploitation des ressources forestieres dans les pays en voie de développement. En Dominique et a Sainte Lucie, la participation des exploitants et des intervenants de la filiere a fortement contribué au succes de deux projets de foresterie communautaire en cours. Des suggestions sont formulées pour la promotion et le développement des initiatives de foresterie communautaire dans la Caraïbe.

La silvicultura comunitaria está surgiendo como un método de satisfacer las necesidades en recursos silvestres de las poblaciones rurales pobres en los países en vía de desarrollo. En Dominica y en Santa Lucia existen dos proyectos en progreso que son ejemplares y donde se practica un manejo cooperativo. El hecho de haberle proporcionado a los usuarios de recursos una información y un adiestramiento científico ha influenciado significativamente el nivel de éxito. Se indican sugerencias para fomentar e incrementar las iniciativas caribeñas hacia una silvicultura comunitaria.

INTRODUCTION

During the last decade or so, community forestry, often used interchangeably with social forestry, has been emerging as an approach to meet the forest resource needs of the rural poor in developing countries. Community forestry refers to a wide range of tree or forest related activities undertaken by individuals or groups in a community, with or without technical and financial assistance from outside agencies, e.g., a forestry department or a non-governmental organization. These activities may include the management of natural forests and mangroves to meet local needs, as well as tree planting for live-fences, erosion control, windbreaks, fuelwood lots, beautification, timber production, and non-timber products. A community can be defined as a group of people who consciously share a common functional or moral link, such

as kinship, occupation, place of residence, religion or values (Renard and Hudson 1992).

In the Caribbean, deforestation is a major environmental problem, as it is in most of the developing world, and the traditional approach by state departments to combat this problem has not been very successful. While much attention has been paid to the management of forest resources which are under the responsibility of governmental agencies, there have been only a few cases of deliberate efforts towards the involvement of communities in forest resource management. Yet, it has now become clear that the sensitization and motivation of rural and urban communities to plant trees and maintain forests for their benefit can achieve significant results in many developing nations.

Experience indeed shows that initiatives which respond to the perceived needs of communities and place some of the responsibility in the hands of local institutions can obtain significant results. In the insular Caribbean, there are now a limited number of examples of community forestry efforts which demonstrate the relevance and feasibility of the approach, but which need to be documented, expanded and built upon. This paper will define the major principle for successful community forestry programmes and will use examples from Dominica and St. Lucia to illustrate the importance of scientific training and information as tools for building the management capability of the resource users.

THE PRINCIPLE OF PARTICIPATORY MANAGEMENT

Community forestry has challenged planners of forestry programmes to rethink their roles and expand on their concept of forestry to include goals relating to trees as a resource to satisfy local needs. Instead of starting with experts and imposing technologically complex or seemingly appropriate solutions to problems identified by outside advisors, these planners must now begin with the views and needs of farmers, local forest resource users, and other interest groups. Together, they will explore local views, define local resources, opportunities and constraints, and determine local needs. The projects and specific activities derived from this approach can be socially and economically acceptable and improve the chances of management success on the ground. This, in essence, is the foundation of participatory management.

One of the many advantages of this participatory process is that it provides opportunities for the exchange of information about the resource between the traditional users and the forester or forestry consultant. However, quite often the knowledge of the resource users is taken to build on the scientific learning of the experts and is either incorporated into technical

reports or filed away for use in another consultancy. In very few cases are the users of forest resources given scientific training or scientific information in a meaningful form, to improve on their management experience. The two examples which follow, illustrate the value of scientific training and information in the participatory process.

COTTAGE FOREST INDUSTRIES AND SCIENTIFIC TRAINING

The Dominica Cottage Forest Industries Project (CFI) is a collaborative undertaking of the Caribbean Natural Resources Institute (CANARI), the World Wildlife Fund-US, the Government of Dominica, and a group of sawyers. The project seeks to demonstrate the economic and ecological viability of a sustainable, community-based approach to forestry. The CFI is made up of a community of formerly independent sawyers, both part-time and full-time, who cut boards and planks with chainsaws from trees on Dominica's steep and rugged terrain. These boards and planks are manually carried along temporary footpaths through the forest to the nearest roadside for vehicular transportation. The harvesting process ensures that damage to the surrounding vegetation is minimal and unused biomass is left on site and contributes to nutrient cycling.

The timber is purchased by CFI from its members at a guaranteed price. It is then dried before it is sold to hardware stores and furniture manufacturers. Selection of merchantable timber on crown lands is usually random. After the sawyers have identified suitable trees they apply for a license to harvest from the Division of Forestry and Wildlife. Specific guidelines for extraction are set by the Chief Forest Officer which prohibit cutting on very steep slopes, and watershed areas along streams and roads.

Through awareness and conservation education, CFI members have adopted this approach for all cutting activities, even those on private lands where most timber extraction

occurs and is not regulated by law. Members of the CFI have also agreed to contribute 40 hours per year to reforestation.

The concept of a demonstration plot where ecologically sound harvest and timber stand improvement techniques could be refined and taught to sawyers was introduced by Dr. Frank Wadsworth of the Institute of Tropical Forestry, Puerto Rico. Initially a tract of forest was identified for the establishment of the demonstration plot by the Forestry Division, but the sawyers found the area a difficult location and lacking in sufficient marketable species, so they rejected the site.

Recently a sawyer had identified another area of secondary forest better suited for a demonstration plot. A forestry consultant was then contracted to survey this new area and he was assisted in the inventory by sawyers who had local knowledge of species, relative timber value, and volume (Geoghegan 1991). The sawyers in turn were taught the methodology of inventory and became familiar with the botanical names of many species, thereby reducing ambiguity among the Creole names of some tree species. This site, guided by the local knowledge of the sawyer and the results of the inventory, proved to be acceptable to CFI and the Forestry Division for establishing a demonstration plot with an area of 112 hectares.

Although trees for harvesting were usually selected by size and species based on demand from prospective buyers, with the exception of the conservation measures described earlier, no other silvicultural guidelines were followed. In order to build on the sawyers' experience, initially two sawyers were trained on site as paraforesters. This training included systematic recording of measurements, identification and marking of future crop trees, identification and removal of competitive non valuable trees, and block rotation. Training is on-going and soon other sawyers will have similar exposure with the main purpose being to manage the demonstration plot. It should be noted, however, that these paraforesters will also continue to be

part-time sawyers, the activity from which their main income is derived.

Participatory management, through active collaboration among sawyers, forestry consultants, and the Division of Forestry has equipped the resource users to pursue the lead role in carrying out mutually acceptable management objectives, with a reduced need for policing by forest officers. Community forestry therefore, requires that the skills of the forester, as appropriate to the needs of the resource users, are transferred not only in a manner that is easily understood by the community, but also in a style that motivates their desire to learn more or improve management techniques.

CHARCOAL PRODUCERS AND SCIENTIFIC INFORMATION

The Aupicon Charcoal and Agricultural Producers Group in St. Lucia evolved from a collaborative undertaking of the Department of Forest and Lands, the Caribbean Natural Resources Institute (CANARI), the National Research and Development Foundation, and the formerly independent charcoal producers in and around the village of Aupicon. This group was formed primarily to establish and manage a fuelwood lot of fast growing species for the supply of charcoal. This strategy was an attempt to minimize dependence on mangrove cutting for charcoal and therefore prevent further degradation of this finite and valuable wetland resource.

Charcoal is widely used as a cooking fuel in St. Lucia and more so in the south of the island. Mangrove wood makes good charcoal because it is dense and contains no resin. It is also free, abundant, and readily available in the Mankote Mangrove, hence its popularity among the Aupicon charcoal producers. There are nine active producers who together have an average monthly output of 100 to 150 bags. The bags normally come in two sizes; large, with an average weight of about 25 kg, and small, with an average weight of about 15 kg.

After consultation with, and mobilization of, the producers, the fuelwood plantation was started about seven years ago at a site located about one kilometer inland from Mankote. Here *Leucaena leucocephala* was planted as the major species, since it was commonly used elsewhere for charcoal. Labour for establishing the plantation was supplied by the producers, although most wages were paid by the Department of Forestry. Some voluntary labour was also rendered. The producers were taught planting techniques and activities necessary for maintenance of the plantation. They were enthusiastic about the project because they recognized themselves as the primary beneficiaries.

During the time lag from planting to production the producers continued to harvest mangroves for charcoal because it provided their major source of income. They were also encouraged to pursue vegetable farming on land adjacent to the woodlot as an economic alternative (Walters and Burt 1991). Some of them started mariculture of a seaweed locally used in the preparation of milk based beverages. Sea moss farming, as this process is commonly called, was becoming popular and lucrative due to declining wild stocks.

The producers group were led to believe that within 5 to 7 years they would be able to produce much of their charcoal needs from this woodlot. However over the past year the woodlot has yielded less than 50 bags of charcoal. The *Leucaena* did not perform as expected because of the following bio-physical reasons: shallow, poor soils on rocky slopes; intense dry seasons; Aupicon is located in one of the lowest rainfall areas in St. Lucia; and *Leucaena* was not inoculated with its particular strain of *Rhizobium* before planting. Signs that *Leucaena* would grow very slowly under those conditions would have been clear within 3 to 4 years after planting, yet no serious attempt was made to remedy the situation.

Scientific information necessary to explain the poor performance of the chosen species, and

information on appropriate alternatives or strategies were not passed on to, or discussed with the producers at that time. The main reason for this was the lack of adequate scientific input for species selection and monitoring of species growth. While the producers were quite eager to share in the responsibility for management of the woodlot, their operations can be no better than the quality and quantity of information received from the project advisors. Recently, there has been an attempt to select fuelwood species better adapted to site conditions at Aupicon. The producers have understood the shortcomings of the project and are assisting in trials with both native and exotic trees. They still remain supportive of the idea and approach for a fuelwood lot, despite the setbacks and disappointments.

Community forestry cannot be a one way transfer of technical knowledge from the forestry advisor to what is often perceived as a passive and uneducated rural community. It must be developed into a process of social listening and social learning, where the relationship between the forester or the project planner and the community is one of interactive mutual learning (Gilmore et al. 1989).

CONCLUSION

Community forestry and participatory management are nice catchphrases that can become little more than a disguise for the usual top down, technocratic approach to forestry projects or programmes. However, with the approach described earlier, and a genuine concern for fulfilling rural forest resource needs, community forestry programmes can be successful.

The Caribbean is at a turning point where we now have the opportunity, through a number of regional and national initiatives, including the Tropical Forestry Action Programme, to design and implement people-centred projects. Projects that cater to the needs of communities and incorporate their concerns and experience into the management strategy, while at the same

time expanding their ability to wisely husband the resources essential to their development.

Perhaps the role of professional foresters may no longer be just that of privileged custodians of the community forests, but rather to serve as facilitators who can guide the communities towards viable solutions for their forest resource needs and management problems. We should, therefore, make use of these chances, including this 6th Caribbean Foresters Meeting, to promote, expand and build upon community forestry efforts in the region.

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