Virgin Islands
Agricultural Experiment Station
Report No. 9
October 1976

VIRGIN ISLANDS FORESTRY RESEARCH

A Problem Analysis

College of the Virgin Islands
Virgin Islands Agricultural Experiment Station
Darshan S. Padda, Director
St. Croix, U. S. Virgin Islands

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College of the Virgin Islands
in Cooperation with
Seymour I. Somberg & Associates, Ltd.
Consulting Foresters, Engineers & Appraisers
Wilmington, N.C. 28401

Virgin Islands Agricultural Experiment Station
Darshan S. Padda, Director
St. Croix, U. S. Virgin Islands

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FOREWORD

This report on the Virgin Islands forestry research needs is part of a continuous effort of the Agricultural Experimental Station, College of the Virgin Islands to conduct short-range and long-range research projects for improving both the agriculture and forestry resources in the Virgin Islands. It is the ninth in a series of feasibility studies sponsored by the Virgin Islands Agricultural Experiment Station which was established in 1972.

The work was conducted under McIntire-Stennis project VI-016 by contracting the services of Dr. Seymour I. Somberg.

Forest trees have been used for a long time as windbreaks to protect and improve yields of agricultural crops. But, there is also a renewed interest in forestry as a natural resource. Forest resources hold meaning for people in relation to their interests in freshwater supplies, outdoor recreation, homes and commercial buildings, furniture, watercraft, fuel, and many other goods and services which are derived from forests. In the Virgin Islands we must have forested areas to enjoy the benefits of forest recreation, wildlife, and forested watersheds.

This project was designed with a broad scope to investigate situations in general and to answer questions as to whether our forest research needs are being met by USDA's institute of tropical forestry located in Puerto Rico or if some local research effort is needed.

This study has identified areas in which forestry research should be conducted, while keeping in consideration our commercial and socioeconomic conditions.

The Virgin Islands Agricultural Experiment Station gratefully acknowledges the assistance provided by the forestry staff of the Cooperative State Research Service of the United States Department of Agriculture.

Darshan S. Padda, Director
October 1976

ACKNOWLEDGEMENTS

It is impossible for me to acknowledge all the persons who helped me with this assignment – from the man in the street to high government officials and those in between.

Deserving of special mention are Dr. Darshan S. Padda, Director, College of the Virgin Islands Agricultural Experiment Station for affording me both the opportunity and his assistance during the investigation. I would also like to thank Dr. Frank H. Wadsworth, Director, Institute of Tropical Forestry (ITF), USDA Forest Serivce, Rio Piedras, Puerto Rico for his assistance and Dr. Tom Shubert who furnished most of the photographs used in this report; Mrs. Joanne Feheley, Librarian, supplied me with volume after volume of material on the natural resources of the Virgin Islands and her help is gratefully acknowledged.

Mr. Axel L. Frederiksen, Forest Technician, USDA Forest Service who spent many days with me in the field, driving and showing me the forestry resources of the islands. His help and assistance was greatly appreciated.

Mr. William Saalman, USDA Soil Conservation Service who permitted me to use the SCS aerial photographs. He also helped with the soils of the island and furnished photographs.

Mr. Larry Bough, Virgin Islands Department of Agriculture, was also very helpful in showing me the department's forestry efforts.

Seymour I. Somberg

SUMMARY AND CONCLUSIONS

In March 1976, a problem analysis was conducted by a consulting forester. Presently, much of the United States Virgin Islands is covered with second growth and scrubby timber composed of noncommercial species. This is due in part to the past pattern of land use, especially the cultivation of sugar cane. The rainfall or the lack of adequate rainfall is also responsible for the type of timber found in the islands. These two factors, plus others such as competition for alternate uses for land and advalorem taxes, preclude the possibility of commercial forestry in the islands.

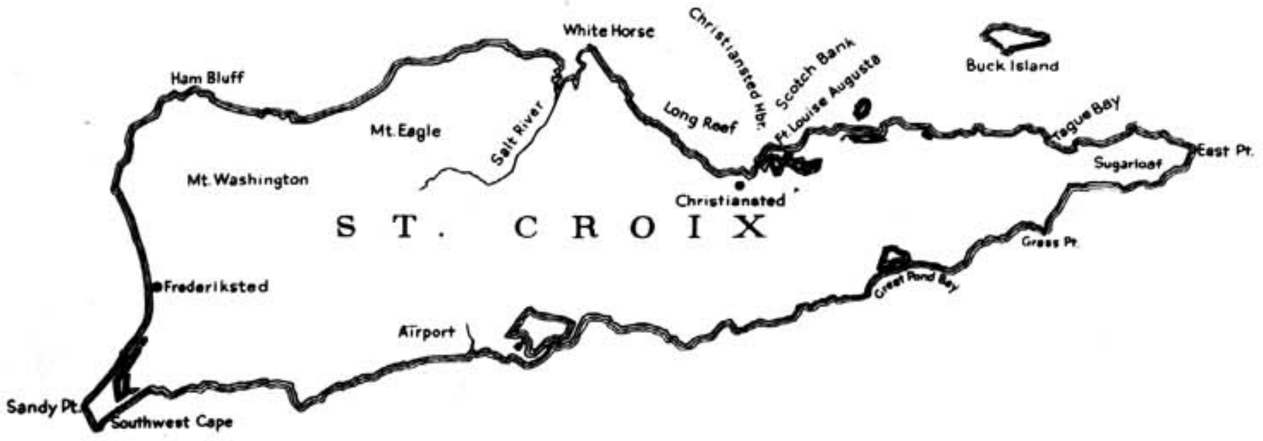
Mahogany (*Swietenia* spp.) is planted extensively in the islands. It is estimated that there is in excess of 500,000 board feet of merchantable mahogany. Since there is, for all practical purposes, no forest industry in the Virgin Islands this volume of merchantable mahogany could be exported. There is a demand for mahogany because it is one of the finest cabinet woods found in the world.

Although there is no future in the islands for commercial forestry, forest research is strongly recommended for the Virgin Islands Agricultural Experiment Station. In addition to solving research problems and informing the general public, results can be made available to many of the departments such as the Virgin Islands Department of Agriculture. The exchange of information would benefit all in the islands. These research efforts would not supplement those by other departments or agencies rather they would complement. Recommended research efforts, not necessarily in order of priority, are:

1. The testing of some 50 species of native and exotic trees for use along highways and adjacent to dwellings. Especially among these trees is mango (*Mangifera spp.*).
2. It is thought that there is a natural hybrid: West Indies mahogany *(Swietenia mahogani* Jacq.) x Honduras mahogany *(Swietenia macrophylla* King). This hybrid should be tested genetically to determine if it is in fact a hybrid.
3. Water is a very limited commodity in the islands. Research in water-shed production is needed.
4. Forest Recreation: The demand for recreation is constantly on the increase, and investigations should be conducted to determine which species would best be suited in conjunction with water oriented activities.
5. Because of past land-use patterns, there is little wildlife in the U.S. Virgin Islands. Research on natural habitat is needed.
6. There are no conifers in the islands. The traditional Christmas trees, such as pines and firs are not found in the islands. To use these trees they would have to be imported. There is a tree called the Norfolk-Island pine which is not a true pine. (*Araucaria* spp.) It is used here and in other parts of the world as a Christmas tree. The feasibility of commercial production of this species in the islands should be tested.

Cover Photo: 12-year old Mahogany (*Swietenia* spp.) after 100 percent release. Estate Bodkin (2) St. Croix, U.S. Virgin Islands. Photo by Institute of Tropical Forestry, USDA Forest Service, Rio Piedras, Puerto Rico.

40 MILES



VIRGIN ISLANDS

Courtesy of Florence Williams Public Library, Christiansted, St. Croix, U.S.V.I.

VIRGIN ISLANDS FORESTRY RESEARCH
A Problem Analysis

by

SEYMOUR I. SOMBERG

INTRODUCTION

This work was supported in part from matching funds made available under the McIntire-Stennis Act (M-S), which provides for funds to be spent on forestry research. Inasmuch as there is no forestry research at the College of the Virgin Islands or at its experiment station, a M-S project was written to provide for a problem analysis of the Virgin Islands Forestry Research Program. The project had four objectives.

1. Obtain information on Virgin Islands forest resources, forest products uses, and forest production potential.
2. Determine requirements in forest areas and forest products for the Virgin Islands based on commercial and social consideration.
3. Find out what research of other institutions and agencies lacks in meeting forestry information requirements of the Virgin Islands.
4. Determine forestry research needs by the Virgin Islands Agricultural Experiment Station.

The report that follows provides the answers to these objectives.

The U.S. Virgin Islands lie between 17° 30' to 18° 30' north latitude and 65° 15' to 64° 40' west longitude and include three major islands, St. Croix, St. Thomas, and St. John. There are in addition, over 50 smaller islands, cays and keys. This report is confined to the three major islands which have approximately 85,000 acres.

St. Croix is the largest island with 54,563 acres representing 63.9 percent of the total land area of the three islands. St. Thomas is second with 17,985 acres and 21.1 percent of the total. The smallest of the three islands, St. John, is third with 12,835 acres and 15.0 percent of the total area.

There is a national park administered by the U.S. Department of the Interior on St. John which occupies approximately three-fourths of the island.

The population of the islands was estimated in 1974 to be 100,000. This total is expected to exceed 200,000 by 1978.

The annual rainfall varies within the islands as well as among the islands. The annual rainfall on St. Croix varies from 20 to 30 inches on the eastern end to approximately 50 to 60 inches on the western end.

On St. Thomas the annual rainfall varies from 35 to 40 inches on the east and west ends of the island to 40 to 55 inches in the central portion. The tradewinds are easterly.

FOREST RESOURCES

Land

There are 85,382 acres in the three major U.S. Virgin Islands in six ecological life zones. According to Holdridge's system of classification of world life zones or plant formations, only two are found in the U.S. Virgin Islands, subtropical dry forests and subtropical moist forests. The area occupied by these life zones is shown in Table 1.

Table 1. Ecological Life Zones of the United States Virgin Islands

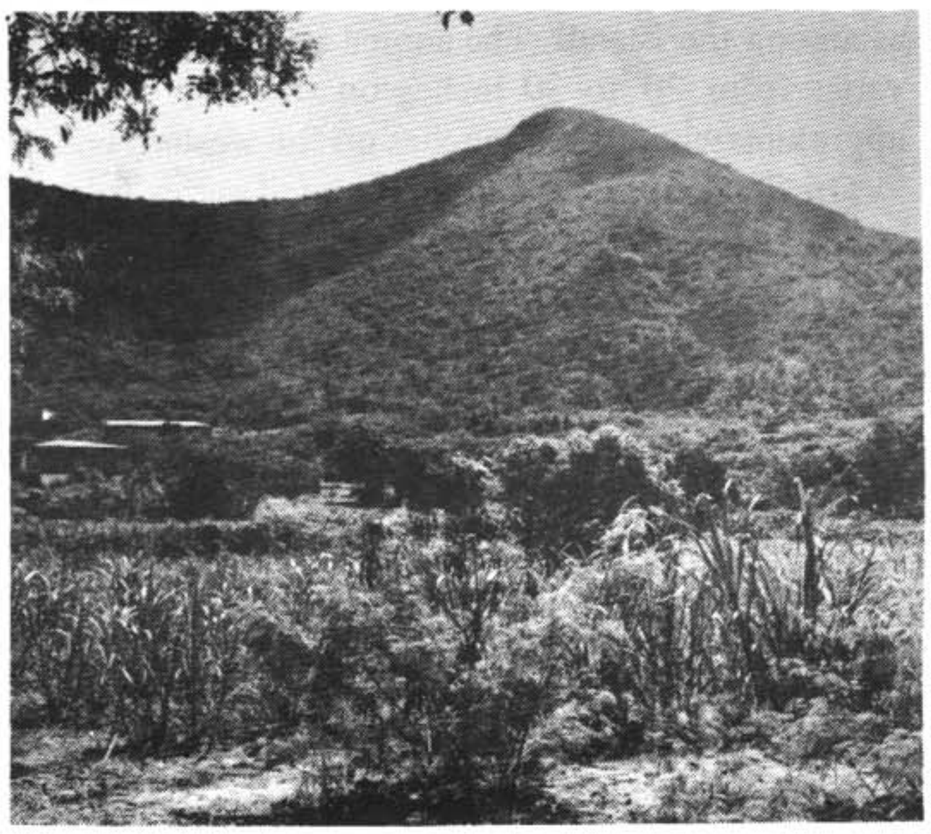
ISLAND	*SQUARE MILES*	*ACRES*	*SUBTROPICAL DRY FORESTS (ACRES)*	*SUBTROPICAL MOIST FORESTS (ACRES)*	*PERCENT OF TOTAL AREA*
St. Croix	84	54, 563	45, 469	9, 094	63.9
St. Thomas	28	17, 984	7, 001	10, 983	21.1
St. John	20	12, 835	8, 214	4, 621	15.0
TOTALS:	132	85, 382	60, 684	24, 698	
PERCENT OF TOTALS:			71.1	28.9	100.0

Of the total land area in the islands, it is estimated that 35,300 acres or 45.1 percent is classified as forests. This includes 5,000 acres of commercial forests and 15,800 acres of noncommercial forests. The remaining 14,500 acres are unclassified and are mountainous. A good portion of this unclassified area is on steep slopes.

Practically all of the forested area is in private ownerships. On St. Croix, private ownership represents approximately 95 percent of all timberland; St. Thomas, 87 percent; and on St. John, 57 percent excluding the National Parks.

With the exception of one or two large landowners, the forest lands are in small acreages and would be classified as small wood lots in the United States.

Over 500 native tree species plus several hundred introduced or exotic species are found in the islands. No inventory of the growing stock has been made. R. W. Nobles, USDA Forest Service, Institute of Tropical Forestry (ITF), estimates that there is in excess of 500,000 board feet of merchantable mahogany in the islands.



Excellent protected hillside for planting mahogany (Swietenia spp.) Estate Cane Bay, St. Croix, U.S. Virgin Islands. Photo, ITF, USDA, Forest Service, Rio Piedras, Puerto Rico.

Plant Associations

The subtropical Dry Forest Zone occupies almost three-quarters of the land area of the islands and is the driest of the life zones.

The vegetation of this life zone, according to Ewel and Whitmore, tends to form a complete ground cover and is almost deciduous on moist soils. Plants found in this life zone and considered as indicators of this zone are: turpentine tree, almácigo (*Bursera simaruba* (L.) Sarg.); mesquite (*Prosopis juliflora* (Sw.) DC.); sebucán, dildo (*Cephalocereus royenii* (L.) Britton and Rose); tachuelo, fustic (*Pictetia aculeata* (Vahl) Urban); ucar, oxhorn bucida (*Bucida buceras* L.); guayacán, common lignumvitae (*Guaiacum officinale* L.); guayacán blanco, holywood lignumvitae (*Guaiacum sanctum* L.); zarcilla, tantan (*Leucaena glauca* (L.) Benth.); tamarindo, tamarind (*Tamarindus indica* L.); tamarindo silvestre or steel acacia (*Acacia macracantha* Humb & Bonpl.); aroma, sweet acacia (*Acacia farnesiana* (L.) willd.); quenepa, kinep, Spanish-lime (*Melicoccus bijugatus* Jacq.); and five species of burro caper (*Capparis* spp.).

Plant associations and indicators of the subtropical moist forest zone are: palma real, Puerto Rico royal-palm (*Roystonea borinquena,* O.F. Cook); roble blanco, "white cedar" (*Tabebuia heterophylla* (DC) Britton); laurels, (*Nectandra* spp.) and (*Ocotea* spp.); tulipán africano, African tulip tree (*Spathodea campanulata Beauv.*); bucayo gigante (*Erythrina poeppigiana* (Walp.) O. F. Cook); guaba (*Inga vera* willd.); guaba, sweetpea (*Inga laurina* (Sw.) willd.); cedro hembra, Spanish-cedar (*Cedrela odorato* L.); algarrobo, West Indian-locust, (*Hymenaea courbaril* L.); flamboyán, flamboyant-tree (*Delonix regia* (Boja) Raf.); jagüey blanco, shortleaf fig (*Ficus laevigata Vahl*); yagrumo hembra, trumpet-tree (*Cecropia peltata* L.); yagrumo macho, matchwood (*Didymopanax morototoni* (Aub.) Decne. and Planche).

Soils

The soils of the Virgin Islands have been mapped by the USDA Soil Conservation Service located on St. Croix. Seven (7) soil associations are found on the islands.

St. Croix contains six of the seven associations; St. Thomas two and St. John one. These soil associations are:

St. Croix	Descalabrado – Jacana
	Aguilita – Fredensborg – Sion
	Fraternidad – Aquirre – Glynn
	Southgate – Parasol
	Cramer – Isaac
	Cornhill – Coamo – San Anton
St. Thomas	Cramer – Isaac
	Dorothea – Victory – Magens
St. John	Cramer – Isaac

Robert W. Nobles, ITF, U.S. Forest Service, recognizes four woodland suitability groups. They are:

Woodland Group 1: Dorothea - Victory - Magens association. Steep to very steep, well-drained soils; clay to clay loam subsoil; on mountain sides. This association does not appear on St. Croix and occupies a small area in the North Central area of St. Thomas. These soils are used mostly for terraced cultivated crops and for pasture. Mahogany (*Swietenia* spp.) should be selected for planting. Annual growth is estimated at 150 to 250 board feet per acre.

Woodland Group 2: Aguilita - Fredensborg - Sion association. Gently sloping to steep, well-drained soils; clay loam and silty clay loam material below the surface layer; shallow over soft, marly limestone; on hills, foot slopes, and terraces. This soil association is only found on St. Croix and occurs on alluvial fans. About 90 percent of the acreage in natural mahogany forests on St. Croix is on these soils. Mahogany should be favored in existing stands. In addition, teak (*Tectoma grandis* L.f.) may be planted. There is considerable competition for use of these soils by agricultural crops.

Woodland Group 3: Glynn - Lavalee - Parasol and San Anton series. Moderately fine textured, well-drained soils that are deep over stratified sediments of varying textures. All are on alluvial fans and flood plains.

These soils are generally not used for timber production but are excellent for mahogany and teak plantations. Annual growth is estimated at 250 to 350 board feet per acre. There is only a small area of these soils on St. Croix. None are present on St. Thomas or on St. John.

Woodland Group 4: Soils in this group are Cramer, Isaac, Jacana and Southgate series. These soils occupy the largest area of St. Croix and St. Thomas and all of St. John. The soils are moderately fine textured, well-drained and are moderately deep and shallow over hard, volcanic rock. The slope gradient is from 2 to 60 percent.

Annual growth is estimated at 150 board feet per acre on the upper slopes and 300 board feet per acre on the lower slopes. Mahogany is the preferred species for planting, but teak may be planted on the deep soils of the lower slopes.

COMPETITION FOR LAND

Land is the limiting factor of production in the islands with an area of only 85,382 acres. Considering that almost all of St. John is a National Park and therefore withdrawn from competition, leaves only 72,542 acres for other uses.

Tourism is the leading contributor to the Gross National Product of the U.S. Virgin Islands and usually, land use is geared to this purpose. Climate and life style are attractive and thus there is much demand for homesites. Land values are quite high. Land on St. Croix is currently being sold in Estate Cotton Grove from $6,000 to $10,000 per acre. In Estate Jealousy a recent sale of 128 acres brought $5,000 per acre. In Estate Bethlehem 30 acres sold for $70,000 or $3,500 per acre. In the area of the College of the Virgin Islands a recent sale brought $55,000 for 10 acres or $5,500 per acre. Prices are even higher on St. Thomas and St. John.

In general, the land is in small ownership containing 50 to 100 acres, except on the west end of St. Croix where there are some extensive holdings. The subtropical moist ecological zone is present in this area.

The current population is estimated at 100,000 inhabitants. The 1974 Governors' Report to the Secretary of the Interior estimates that the population of the Virgin Islands will increase to approximately 200,000 inhabitants by 1978. This will place an additional burden on the land for housing. The same report also indicated that by 1977 the demand for new low density housing on St. Croix will be 2,450 units, St. Thomas 1,950 units and St. John, 100 units. This totals 4,500 units.

There are strict zoning regulations in the islands. In accordance with these regulations, a minimum of 10,000 square feet of land per 2 units (two homes) is required under R-2. R-1 requires a minimum of 20,000 square feet of land per 2 units (two homes). Taking the lower area required of one-quarter acre per two dwellings would require 562.5 acres. This is the minimum requirement. In all likelihood more acreage will be required. It was further estimated that from 1978-1990 an additional 2,000 units would be required on St. Croix, 1,600 for St. Thomas and 100 for St. John. This totals 3,700 units, and will require an additional 460 acres. Other land uses such as forestry and agriculture cannot compete with housing, shopping centers and light industry for the use of the land.

To illustrate that the above acreage is a minimum, a subdivision of 211 lots required 160 acres or slightly more than three-quarters of an acre per unit.

Given the facts of landownership, alternate uses of

the land, soils, and topography, no commercial forestry is foreseen for the U.S. Virgin Islands.

THE FORESTS

No inventory of the growing stock has been made on the Virgin Islands. A substantial portion of the 500,000 board feet of merchantable mahogany is in roadside and on urban plots.

Aerial photographs taken in 1971 indicate that the forested areas are composed of second growth and short-bodied trees. Many have no commercial value at this time because they are of species not currently being used. In addition, a large portion of the forest is presently inaccessible and situated on steep slopes. In the mountainous areas of the islands the timber is found on the north and east slopes of the ridges.

An inventory of the growing stock of the islands may prove costly because of the ownership patterns of small acreages, steep slopes, and scattered trees. To inventory, permission would be needed to pass over the private ownership. The Attorney General's office advises, however, this might not be any problem, and indicated that most landowners would cooperate. There is also a question of land lines. An inventory would not be of much value unless volumes by ownership could be ascertained. This would be essential if the inventory was to be used as a basis for forest management.

UTILIZATION OF WOOD PRODUCTS

During the seven-year period from 1968-1974 the volume of domestic imports to the Virgin Islands declined. The dollar value of these imports has more or less remained the same. This is due in part to inflation and increased unit prices. See Table 2.

During the two year period from 1968-1970 there was considerable building trade activity in the islands. Several large housing projects were initiated. This is reflected in the volume of plywood imported from the United States. The four-year period from 1968-1971 brought approximately 9 million square feet of plywood to the islands. This is approximately 300,000 panels per year for four years or a total of slightly more than 1,200,000 4' x 8' shells of plywood. This does not take into consideration plywood imported from foreign nations such as Surinam and Taiwan. The data presented in Table 3 indicates that all domestic imports have declined. Plywood went from a high of 10,576,000 square feet in 1970 to 2,855,000 square feet in 1974. The 1974 statistic represents a decrease of 73 percent in the consumption of softwood lumber. The same trend can be seen that from a high of 12,294,000 square feet in 1968, imports dropped to a low of 3,841,000 in 1973. However, this commodity rose slightly in 1974 to 4.6 million square feet representing a decline of approximately 63 percent from the 1968 high.

On the other hand, the domestic imports of paper and paper products have steadily increased.

The future requirements for lumber and wood products are difficult to project without additional historical data. Taking into consideration the projected population increase and the projected housing requirements, needs in 1978-1980 should more than double and perhaps triple our current demand. This would bring imports to the 1968 levels when there was considerable activity in housing developments.

Table 2. Imports to the U.S. Virgin Islands of Wood and Wooden Articles from Foreign Sources, 1970

Commodity	*Value (Dollars)*	*Largest Share of the Market*	*Percent of Total Market*
Lumber	224,998	Canada	80.2
Floors, moulding	54,449	Denmark	27.9
Boxes, wood crates, packing	29,793	Italy	45.8
Household utensils of mahogany	39,255	Haiti	98.1
Household utensils of wood other than mahogany	81,473	Denmark	48.1
Wood carvings	42,078	Haiti	34.6
Moulding	5,898	France	40.0
Other wood articles	34,263	Denmark	26.8
Articles of bamboo, rattan and willow	36,211	Mexico	74.7
Wood veneers	11,306	Taiwan	100.0
Plywood	170,341	Surinam	43.9
Wood particle board	44,310	Portugal	58.4
TOTAL	$774,375		

Source: External Trade with Foreign Countries, 1970. Department of Commerce, Division of Trade and Industry.

FOREST PRODUCTION

The future for commercial forest production in the islands is not very promising. The land suitable

TABLE 3. IMPORTS OF FOREST PRODUCTS TO THE U. S. VIRGIN ISLANDS FROM THE UNITED STATES: 1968 to 1974.

COMMODITY	*Unit of Qty.*	*1968* Net Qty.	*1968* Value ($,000)	*1970* Net Qty.	*1970* Value ($,000)	*1972* Net Qty.	*1972* Value ($,000)	*1974* Net Qty.	*1974* Value ($,000)
WOOD PRODUCTS									
Charcoal; Fuel & Wood Waste	LB	–	2.2	–	49.0	66,473	3.5	39,173	5.3
Logs & Bolts in the Rough-Softwood	MBF	–	–	553	79.2	82	11.4	390	112.6
Logs & Bolts in the Rough-Hardwood	MBF	–	–	–	–	28	11.5	53	51.2
Timber, Posts, Nec. Rough	–	–	60.9	–	77.3	–	51.4	–	81.2
Cross Ties & Mine Ties	MBF	8	1.5	–	–	–	–	–	–
Lumber, Softwood	MBF	13,294	1,873.0	10,336	1,846.1	3,870	838.3	4,600	1,359.5
Lumber, Hardwood	MBF	197	40.8	155	36.3	1,594	364.9	96	35.6
Wood Pulp-Mech. & Semi Chem.	STN	–	–	–	–	–	–	8	0.6
Wood Pulp-Chem. Dissolving Grade	STN	–	–	–	–	–	–	–	–
Veneer Sheets, Wood	SFT	925,670	13.0	359,000	6.4	3,466,000	135.7	33,000	2.2
Plywood, Incl. Wd. Veneer Panels	SFT	9,624,729	1,477.5	10,576,000	1,110.2	6,424,000	1,317.6	2,855,000	744.1
Wood: Impvd. or Reconstituted	SFT	6,400	1.4	5,746	3.1	78,855	28.4	139,856	26.0
Wood, Simply Shaped or Worked	–	–	89.3	–	242.9	–	55.2	–	112.4
Boxes, Cases, Crates, Wood	–	–	2.5	–	–	–	1.0	–	2.3
Cooperage Products	–	–	118.9	–	64.0	–	8.2	–	43.3
Bldr's. Woodwork & Prefab Bldgs.	–	–	1,313.9	–	1,308.4	–	970.0	–	473.3
Domestic & Decor Articles, Wd.	–	–	120.3	–	145.1	–	104.8	–	75.1
Mfg. Articles of Wood Nec.	–	–	226.6	–	167.6	–	70.8	–	140.9
Furniture	–	–	4,087.5	–	5,278.5	–	3,937.9	–	4,528.7
PAPER PRODUCTS									
Newsprint Paper	LB	339,797	29.2	445,984	38.0	407,765	45.4	1,094,074	104.6
Paper, Print & Writ. Ex. News	LB	172,686	36.7	374,660	112.9	615,864	159.0	1,077,000	482.5
Kraft Paper & Paperboard	LB	90,668	16.4	117,792	28.8	1,024,742	93.3	17,103	13.2
Paper & Paperboard-Machine Grade	LB	–	–	179,037	50.0	307,488	66.9	176,004	61.6
Bldg. Board & Wdplp. or Veg.	LB	1,042,938	142.5	1,366,122	174.1	975,810	217.1	400,608	71.4
Papers, Handmade	LB	–	–	26,635	7.2	600	0.7	94,764	26.9
Papers & Paperboard, Mach.-Made	LB	1,128,054	185.0	–	–	–	–	–	–
Paper/Paperbrd.in Rolls Nec.	LB	342,832	74.9	625,908	123.1	1,877,288	454.7	946,143	303.8
Boxes & Other Contrs., Ppbrd.	LB	3,498,003	781.8	4,839,252	990.7	3,504,023	876.1	3,440,007	1,137.3
Paper, Correspondence, Nec.	–	–	60.8	–	39.4	–	39.1	–	36.8
Paper Statnry. Exc. Corres. Nec.	LB	222,193	142.8	133,548	124.5	193,882	122.0	193,521	133.0
Articles of Paper, Etc., Nec.	–	–	934.9	–	879.7	–	563.7	–	1,881.3

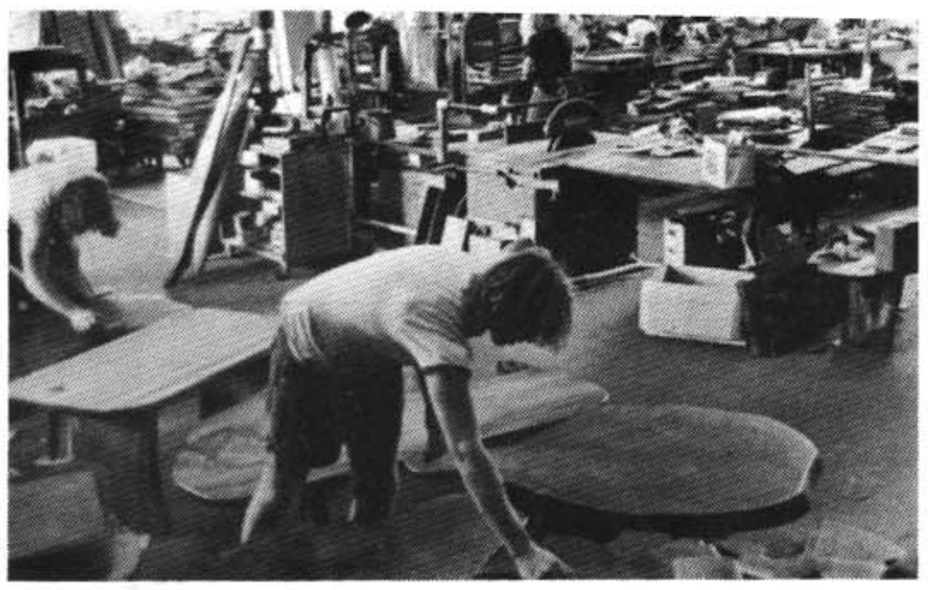
Source: U.S. Virgin Islands Department of Commerce

for forestry production is limited due to competition for alternative land uses such as housing, agriculture, hotel complexes, recreation, water shed protection, shopping centers, schools and the value of the land. In addition, the advalorem taxes on land is high. The current tax rate is 1.25 percent of 60 percent of the actual appraised value of the land. Agricultural lands under law receive a 95 percent tax rebate. Thus an acre of land used for forests valued at $8,000 would have an annual tax of $60.00.

There is a case pending in the Virgin Islands courts to determine if forest lands qualify for the agricultural land rebate. The current ruling is that only forest land used in cooperation with the U S. Forest Service for research are qualified to receive the 95 percent tax rebate.

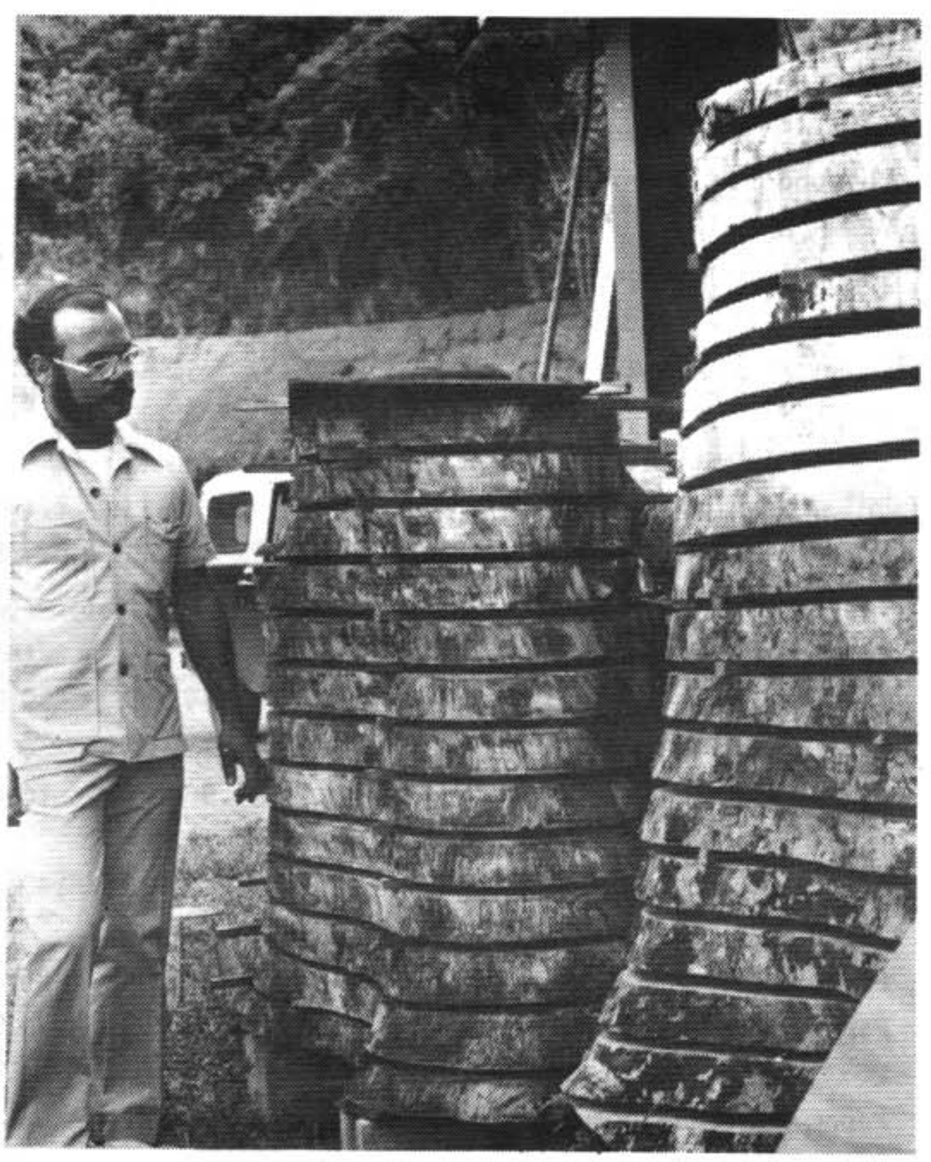
This does not mean that forestry research or other forestry activities cannot be conducted or practiced in the Virgin Islands. It does indicate that commercial forestry in the Virgin Islands is not feasible now or for the immediate future.

Interior of St. C. LEAP Plant.



Type of freeformed furniture manufactured by St. C LEAP.

Logs sawn horizontally and reconstructed for air drying. Reconstruction permits matching of figure.



Mahogany (Swietenia spp.) disks attached for air drying. These disks will be used for small table tops and stools.

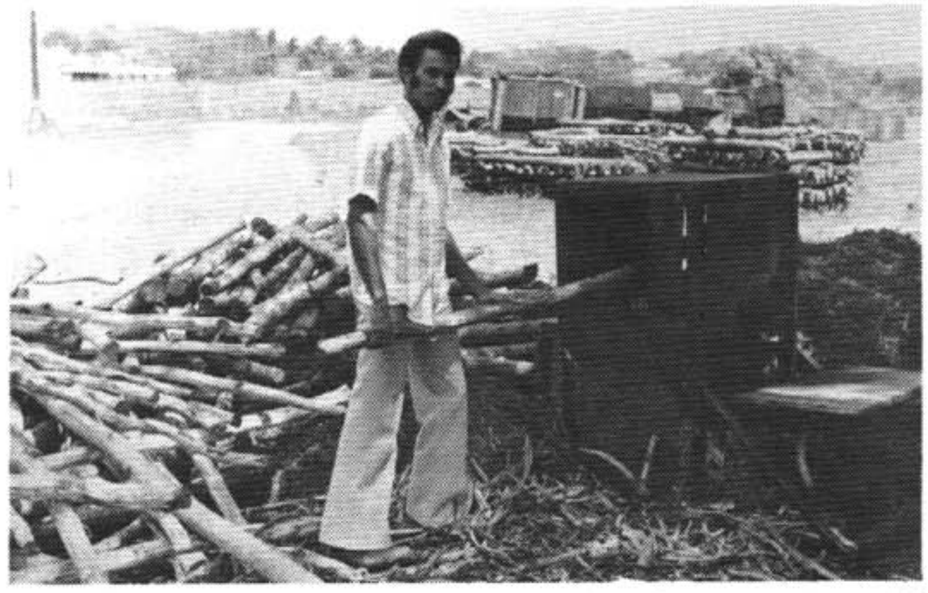
VIRGIN ISLANDS FOREST INDUSTRIES

The forest industry is very limited in the Virgin Islands. There are no sawmills, dry kilns or remanufacture plants. The forest industry on the islands consists of one manufacturer of free-formed furniture, one small charcoal kiln and one cold and hot-bath, fence post treating plant.

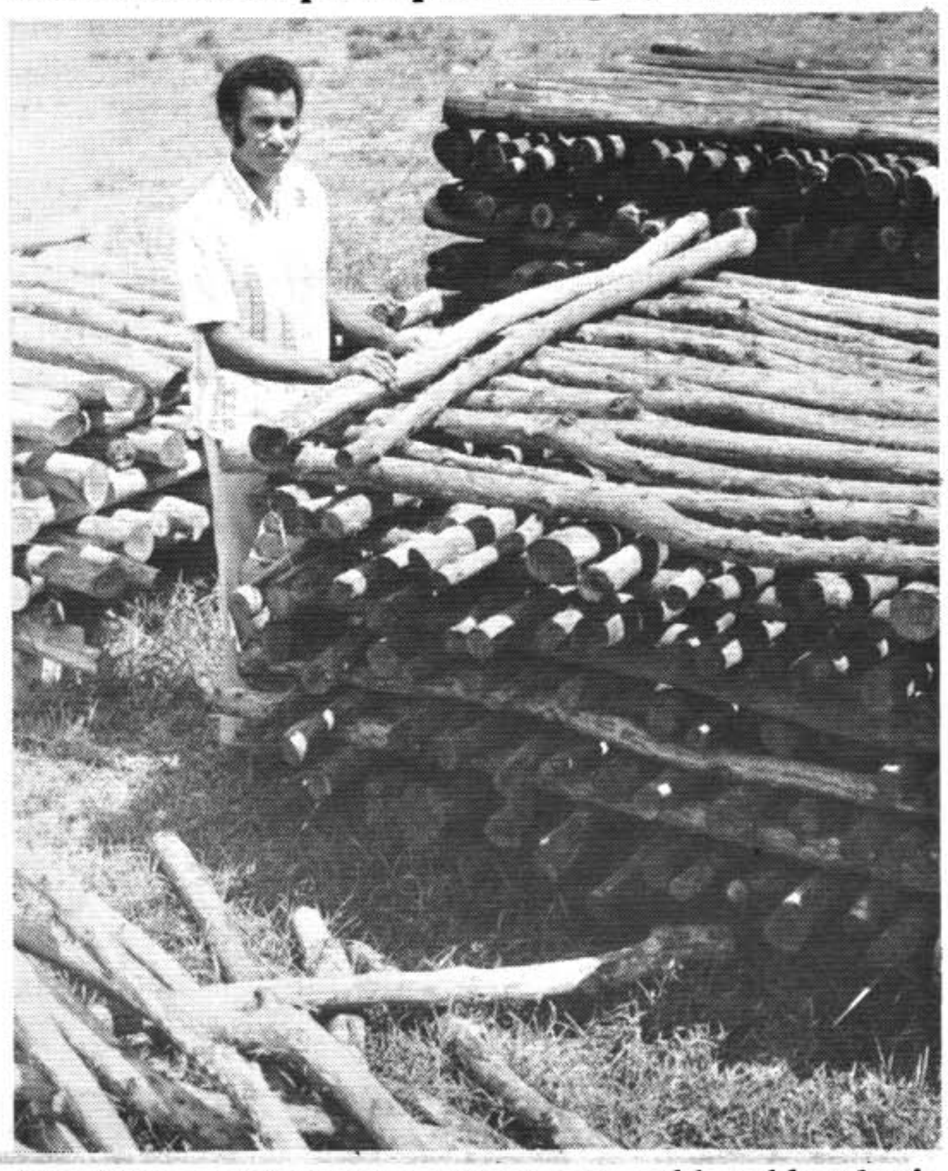
The furniture operation, St. Croix Life & Environmental Arts Project, Inc. (St. C. LEAP), is not a manufacturing plant in the true sense of the word.

They are presently using only three species of wood: mahoganies (*Swietenia* spp.), licorice, saman (*Pithecellobium saman*) (Jacq.) Benth, and thibit (tibet) (*Albizia lebbet)* (L.) Benth. It is estimated that from 30 to 40 trunks or approximately 6-8,000 board feet are used annually. St. C. LEAP is currently using an Alaskan chain saw for primary breakdown. Trees are obtained in an unique way. Whenever a tree is knocked down or being removed they go and get it, place it in the storage yard and when they receive an order for work, the log best suited for the design is selected.

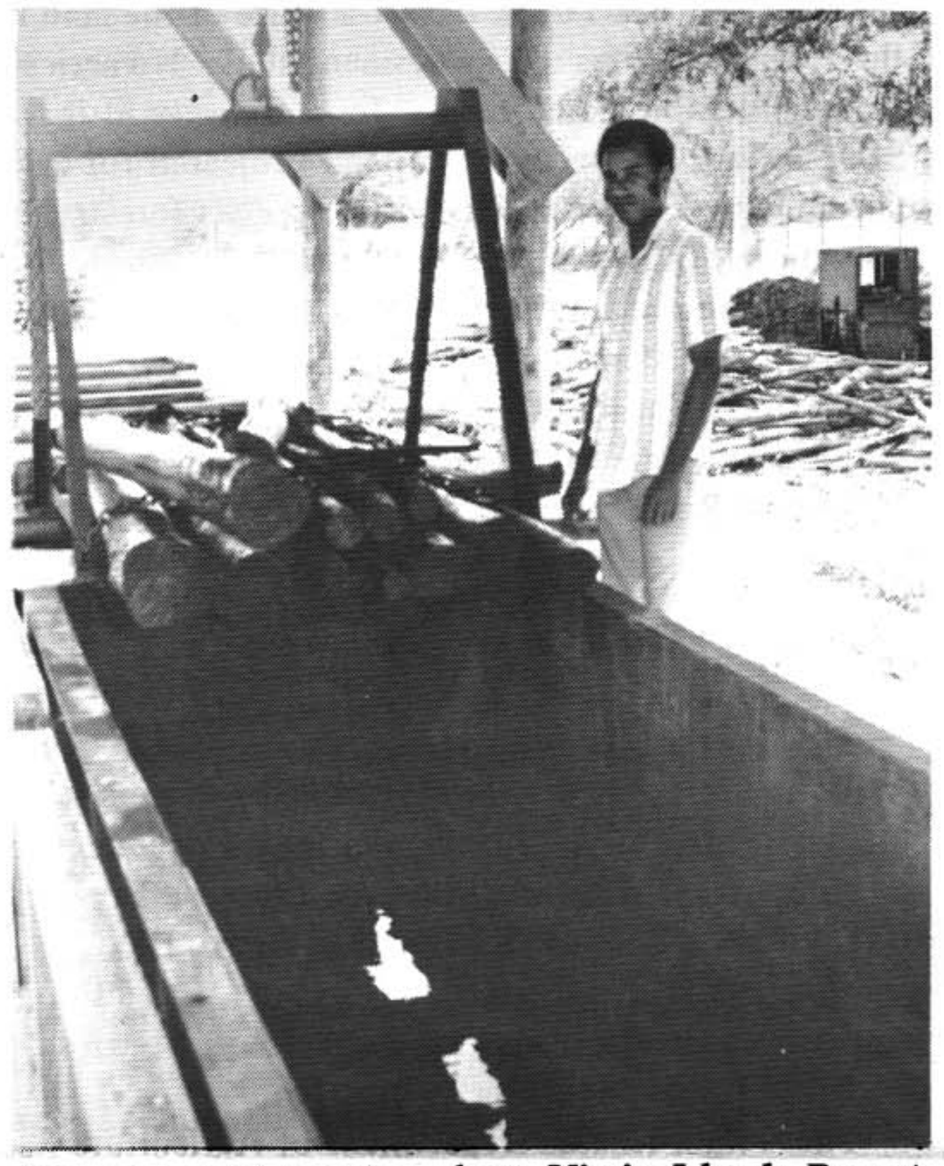
New Hampshire coal kiln utilizing casha, tan tan, and other weed species plus mahogany and teak culls.



Removing the bark from Mahogany (Swietenia spp.) posts prior to treating.



Stocking of debarked posts prior to cold and hot bath treatment.



Hot and cold treating plant, Virgin Islands Department of Agriculture, St. Croix, U. S. Virgin Islands.

The U. S. Forest Service has a small charcoal kiln on the experimental forest. It uses materials developed from timber stand improvement (TSI) work and in some cases thinnings from the experimental plantings. No volume of the charcoal produced could be ascertained. There is no schedule of operation and the kiln is used only when material is available.

The third forest industry in the islands is a cold- and hot-bath treating facility. This plant is operated by the Virgin Islands Department of Agriculture in cooperation with the ITF, USDA Forest Service. The contribution of the ITF is two-fold. The hot-bath elements were obtained through a Forest Service grant. The Forest Service provides the thinnings from the Experimental Forest. Production is approximately 2,500 posts per year with a projected annual production of 4,000 treated posts. Currently the only product being treated is posts.

REQUIREMENTS FOR FOREST AREA

Requirements for forest area and for forest production is difficult to assess with regard to produc-

tion. Commercial forest production will not be likely achieved in the islands for the many reasons previously stated.

There is no practical way of projecting the needs for forest land without further planning. Such uses as watershed protection, erosion control, recreation facilities as well as town forestry and forestry research must be predetermined.

A proposed land-use scheme for the Islands has been issued. The results are included in *Project Plan, U. S. Virgin Islands Resources, Conservation, and Development Plan.* Six land-uses are recognized. They are: Agricultural, Residential, Industrial, Business, Commercial, and Town. A vast acreage of the land in the islands is projected for residential use. No agricultural land is projected for St. John and very little for St. Thomas. The majority of land projected for agricultural use is on St. Croix. Where does forestry fit in? Some government agencies consider forestry to be included under agriculture. Others do not. Most of the land projected for agricultural use will be placed in pasture or in crops. If forestry is included in agriculture, it will be confined to land north of Mahogany Road and west of Fountain Valley.

FORESTRY RESEARCH IN THE VIRGIN ISLANDS

There are no professionally trained foresters practicing forestry in the islands. All forestry research is on St. Croix. The Institute of Tropical Forestry USDA Forest Service, Rio Piedras, Puerto Rico has a forest technician stationed on St. Croix. In addition, research scientists from ITF make frequent trips to St. Croix to conduct forestry research.

The Virgin Islands Department of Agriculture has a five-man team headed by a non-forester. They do forestry work in planting and in operating the post-treating plant. They provide manpower to ITF in research efforts. The Virgin Islands Department of Agriculture does extension-type work in town forestry, but does not engage in forestry research.

These are projects carried on by the Virgin Islands Department of Agriculture:

1. Assist and work closely with the ITF by supplying labor, materials and sometimes equipment.
2. Maintain a nursery producing from 15,000 to 20,000 seedlings annually of the hybrid mahogany (medium-leaf mahogany), a natural cross between Honduras Mahogany (*Swietenia marophylla*) (King) and West Indies Mahogany (*S. mahogani* (Jacq.). Also, seed a small quantity of Spanish cedar (*Cedrela odorata L.*).
3. Plant seedlings on public lands and provide assistance on private lands.
4. Provide woodlot management and timber stand improvement work.
5. Operate a hot and cold bath fence post treating plant in cooperation with ITF.
6. Town forestry of roadside planting. Maintainance of established trees of all species.
7. Provide forestry services for the parks on the Islands.

All forestry research in the Virgin Islands is conducted by ITF, USDA Forest Service. One of their major research efforts is the Estate Thomas Experimental Forest.

Estate Thomas is a 147-acre rectangular tract located about 4 miles west of Christiansted and about 12 miles east of Frederiksted, St. Croix. It is bounded by Estates Princess (north), Bellevue (east), Constitution Hill (south), and Sion Hill (west). In 1917 when St. Croix was purchased from Denmark, Estate Thomas belonged to the St. Croix Sugar Factory, Inc. In 1928 it was sold to the West Indies Sugar Factory, in 1931 to the DeChabert family, and in 1934 to the Virgin Islands Corporation (VICORP) of the U. S. Government. The U. S. Forest Service purchased the tract from VICORP in 1963.

Elevations range from 250 to 450 feet. Geologically, the area is one of submarine limestone sediments which have risen above the sea and subsequently eroded. The soil in the hills reaches a maximum depth of 10 inches atop the limestone. The

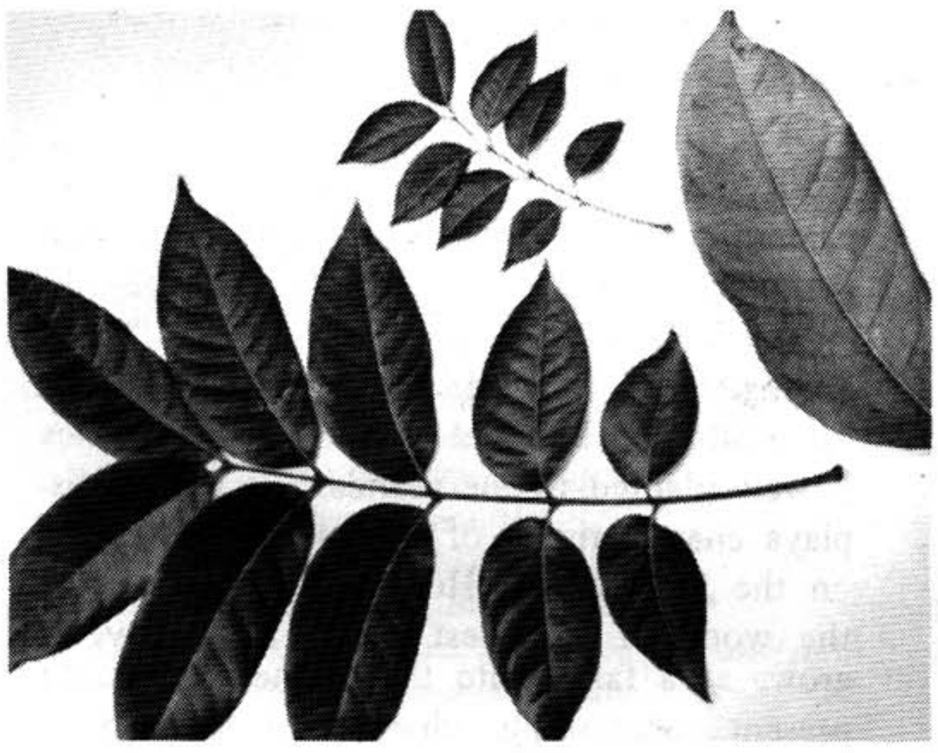
Growth study plot at Estate Thomas Experimental Forest, St. Croix, U.S. Virgin Islands showing a well-formed stand of Swietenia mahogoni (Jacq.) after timber stand improvement.

valley soils are alkaline and range from 7 to 8.5pH. Rainfall may total 40 inches a year.

Two distinct sites are apparent within Estate Thomas. They are limestone hills, and the valley bottoms. Like virtually all of the other lands in these islands, this tract had in the past been cleared and planted to sugar cane. The hills were cultivated for this purpose until 1928 and the valleys until 1953.

Mahogany was first brought to St. Croix in the 1770's. West Indies mahogany trees were planted on the ridge at Estate Bellevue and seed from these carried westward to Estate Thomas and the surrounding area – a total of about 300 acres of nearly pure mahogany. Mahogany from 8 inches in diameter upward is merchantable for a variety of uses, and brings about 50 cents per pound. There are no apparent serious insect or disease problems. The timber is well known and its figure is highly prized. A natural mahogany forest of the purity and timber value of this stand may well be the most productive use for 15,000 acres. It is a fact that timber increases in value nearly 25 times between the stump and delivery of finished products to the consumer.

The teak plantation, dating from 1955, represents an asset on a site representative of much marginal land in central St. Croix. Teak timber today is worth four times as much as mahogany. Although slower in growth on St. Croix than on more humid and deeper soils in Puerto Rico, teak proves compatible with forage production. Twelve-year old trees now average 8 inches in diameter and are 30 feet in height.



Leaf of medium leaf mahogany (Swietenia macrophylla x S. mahogani) on the bottom. Leaf of West Indies mahogany (S. mahogani Jacq.) on the top. On the upper right, a leaflet of Honduras mahogany (S. macrophylla King).

Other research projects of the Institute of Tropical Forestry on the U. S. Virgin Islands are:

1. Growth studies of mahogany (*Swietenia* spp.)
2. Control of the shoot borer in *Cedrela.*
3. Species adaptability for the Virgin Islands (inactive).
4. Thinning of West Indies Mahogany (*Swietenia mahogani* Jacq.)
5. Mahogany (*Swietenia* spp.) seed source.
6. Plum pudding effects in mahogany.
7. Teak Providence trials (*Tectoma grandis* L.f.)
8. Establishment of a *Cedrela* gene bank.

The ITF issues an annual newsletter. Excerpts from these reports for selected years, as they pertain to the activities of the ITF on the Virgin Islands are:

1971: The Virgin Islands Government, with the technical support of the Institute, was responsible for the maintenance of 265 acres of existing forest plantations on St. Croix and planted 10 additional acres during the year. A new Forestry Building was completed by the Territory with the cooperation of the Institute. A number of publicity activities were undertaken including promotion of Earth Day by the Extension Service and the Institute where 100 teachers and students attended. Included also were field trips to the forests and the preparation of displays. Both Territorial and Institute personnel attended a nurseryman's conference in Maine, joining a representative of the Puerto Rico Government.

1972: Successful planting sites also increased with the total number of mahogany, teak and *Cedrela* trees planted approaching 250,000 for the 17-year lifetime of the Virgin Islands Forestry Program.

The Division of Forestry completed a new building, and installation of a fence post treating plant – the one abandoned by the Institute nearly ten years ago.

Seed source, insect control, growth studies, quality and other research continue at a steady pace with strong evidence of a growing interest in the newly identified hybrid mahogany.

Cooperation with the Neighborhood Youth Corps is expanding and many man-hours of trainee labor is available for forestry activities on public lands.

1973: The role of the Institute in the Virgin Islands is to counsel the Territorial Government in forestry policies, provide technical guidance to ongoing forestry programs, and develop forestry practices through research.

The Virgin Islands Department of Agriculture has continued its nursery and planting program, producing 9,000 mahogany trees and establishing 37

acres of plantations on public and private lands. The Director of the Department of Conservation and Cultural Affairs was introduced to forestry work in Puerto Rico and provided with plans for outdoor recreational facilities.

The research program included establishment of *Cedrela* gene banks in the Estate Thomas Experimental Forest and on three private estates. As a part of the program of development of the Experimental Forest, boys and girls from the Youth Conservation Corps and the National Youth Corps were being trained in conservation work.

1974: Plans were completed and financing was arranged for installation of a heating element in the Virgin Islands Agriculture Department's fence post preservative treating plant at Lower Love, St. Croix. Addition of this heating element permits using the hot-cold process, and makes quality fence posts available to St. Croix farmers at a low cost, using thinnings from their own woodlands.

A management plan was completed for the Estate Thomas Experimental Forest which included areas for demonstrating management of natural mahogany forest and planted forests suitable for the islands.

The forestry section of the Virgin Islands Resource Conservation and Development Plan was revised to include practices in roadside tree improvement, Christmas tree production, stand improvement, tree planting and fence post preservative treatment.

A Cooperative Forestation project under the CM-4 Program was developed for installation of nursery irrigation equipment at Lower Love.

The Youth Conservation Program was continued and 5 enrollees worked on environmental projects on St. Croix. In addition, a grant to the Department of Conservation and Cultural Affairs permitted the initiation of a Virgin Islands YCC program which operated on all three islands with an enrollment of 65.

FORESTRY RESEARCH NEEDS BY THE AGRICULTURAL EXPERIMENT STATION OF THE VIRGIN ISLANDS

The need for forestry research in the U. S. Virgin Islands is great. The priorities will be determined by the Director of the Agricultural Experiment Station of the Virgin Islands. Research efforts by the Virgin Islands Agricultural Experiment Station will augment research by other V. I. Government Agencies and Federal Agencies. The results of forestry research could for example, make recommendations for the V. I. Department of Public Works to develop a program to plant various species of trees. Similar recommendations could be made to the V. I. Department of Conservation and Cultural Affairs, the V. I. Department of Agriculture and others. Six needs have been identified:

1. Town Forestry: Research is needed in the area of town forestry. Research of this nature would benefit not only residents but also contribute to the tourist effort which is economically important to the islands. A sample project within this research endeavor could be species trials for indigenous and exotic ornamentals, showy, and food trees. The mango (*Mangifera* spp.) should be given special consideration. It is an excellent ornamental and once established requires little attention. The mango requires a minimum of water. This is an important factor in the U. S. Virgin Islands, especially on St. Croix. In addition, the mango provides a fruit that ranks among the best known and most widely consumed fruits in the tropics.
   Residents of the islands would benefit from such a project in entrapment of water as well as prevention of soil erosion. Research could be constructed along the lines of what are the best sites for selected species in the various ecological life zones and soil types found in the islands. In support of this type of research project, the Institute of Tropical Forestry, USDA, Forest Service has suggested 50 species of trees that should be investigated for town forestry needs. The list appears in Table 4.

2. Work on medium-leaf mahogany: (*Swietenia macrophylla X S. mahogani*) thought to be a natural hybrid between Honduras mahogany (*S. macrophylla King*) and West Indies Mahogany (*S. mahogani Jacq.*). It has been established by ITF and others that this species is well adapted to the islands. The hybrid displays characteristics of both parents. It takes on the form of the Honduras mahogany and the wood of the West Indies mahogany. It grows at a faster rate than either parent. At present, phenotypic characteristics, such as leaflet and seed pod size, are being used to identify the species. Genetic research is needed to determine if the medium leaf mahogany is a separate and distinct species or if it is an extennor of the Honduras or West Indies mahoganies.

TABLE 4: FIFTY TREES FOR TOWN FORESTRY IN THE U. S. VIRGIN ISLANDS

	Names	*Page*[1]	*Adaptability*[2]	*Size*[3]	*Form*[4]	*Flowers*
1.	Almond, Indian, *Terminalia catappa*	184	S	M	R	
2.	Bamboo, *Bambusa vulgaris*	3		L	S	
3.	Bauhinia, *Bauhinia monandra*	71	D	S	S	Pink
4.	Bayrum-tree, *Pimenta racemosa**	194	D	M	C	
5.	Box-briar, *Randia aculeata**	247	S, D	S	R	White
6.	Calabash-tree, *Crescentia cujete*	232	D	S	R	
7.	Caper, *Capparis cyanophallophora**	53	D	S	R	White
8.	Cashew, *Anacardium occidentale**	130	S, D	S	R	
9.	Cassia, pink *Cassia javanica*	73		M	S	Pink
10.	Cassia, Siamese, *Cassia siamea*	74	D	M	R	Yellow
11.	Casuarina, *Casuarina equisetifolia*	11	S	L	O	
12.	Cedar, white, *Tabebuia heterophylla**	236	D	M	C	Pink
13.	Chinaberry, *Melia azedarach*	110	S, D	M	R	Purple
14.	Coconut, *Cocos nucifera*	6	S	M	C	
15.	Fig, India-laurel, *Ficus retusa*	23	S	L	R	
16.	Fig, India-rubber, *Ficus indica*	21	S	M	R	
17.	Flamboyant-tree, *Delonix regia*	75	D	M	S	Red or yellow
18.	Flamboyant, yellow, *Peltophorum inerme*	78		L	R	Yellow
19.	Frangipani, *Plumeria rubra*	218	S, D	S	R	Red or white
20.	Ginger-thomas, *Tecoma stans**	238	D	S	R	Yellow
21.	Golden-shower, *Cassia fistula*	72	D	M	S	Yellow
22.	Gregra, *Bucida buceras**	181	S, D	M	S	
23.	Guava, *Psidium guajava*	195		S	S	
24.	Jerusalem-thorn, *Parkinsonia aculeate L.*	77	D	S	R	Yellow
25.	Kinep, *Melicoccus bijugatus*	140		M	R	
26.	Lignumvitae, *Guaiacum officinale**	93	S, D	S	R	Blue
27.	Locust, West Indian, *Hymenaea courbaril**	76	D	L	R	White
28.	Mahogany, Honduras, *Swietenia macrophylla*	111		L	R	
29.	Mahogany, West Indies, *Swietenia mahogani*	112	S, D	L	R	
30.	Malay-apple, *Eugenia malaccensis*	189		M	C	Red
31.	Mammee-apple; *Mammea americana**	164		L	C	White
32.	Mammee, wild, *Clusia rosea**	163	S	M	S	Pink
33.	Mango, *Mangifera indica*	131		L	R	
34.	Manjack, *Cordia collococca**	223	D	S	S	White
35.	Milktree, *Plumeria alba**	217	S, D	S	R	White
36.	Mother-of-cocoa, *Gliricidia sepium*	85	D	S	S	Pink
37.	Otaheita, *Thespesia populnea*	152	S	S	R	Purple and yellow
38.	Palm, Royal, *Roystonea borinquena**	9	S, D	M	C	Cream
39.	Queen-of-flowers, *Lagerstroemia speciosa*	178		M	R	Purple or pink
40.	Raintree, *Pithecellobium saman*	69		L	S	Pink
41.	Santa-maria, *Calophyllum brasiliense**	161	S	M	R	
42.	Seagrape, *Coccoloba uvifera**	28	S, D	S	S	
43.	Silk-cotton-tree, *Ceiba pentandra**	153	D	L	S	Pink
44.	Star-apple, *Chrysophyllum cainito**	206		M	S	
45.	Tamarind, *Tamarindus indica*	80	D	M	R	Yellow
46.	Teak, *Tectona grandis*	229		L	R	
47.	Tibet, *Albizia lebbek*	60	S, D	M	S	White
48.	Turpentine-tree, *Bursera simaruba**	105	D	M	R	
49.	Tuliptree, African, *Spathodea campanulata*	234		M	R	Red
50.	Ylang-ylang, *Cananga odorata*	40		M	R	Green

* Native to the U.S. Virgin Islands. Not introduced.
[1] Numbers correspond to "Common Trees of Puerto Rico and the Virgin Islands", Agricultural Handbook No. 249.
[2] All species listed are adapted to more moist, fertile, and protected areas of the Virgin Islands. Those marked "S" are in addition adapted to exposure near the sea. "D" are adapted to dry and windy sites inland.
[3] "L" reaches 50 feet tall or more. "M" reaches 25 to 50 feet tall, and "S" reaches less than 25 feet.
[4] "C" means columnar, "R" means round or spherical, and "S" means spreading.

3. Forest recreation: Tourism accounts for more than 55 percent of the Island's Gross National Product. Residents of the islands as well as tourists seek recreation. Currently, all recreation facilities are oriented towards water activities. There are two well-developed recreational facilities in the islands: Cramer Park on St. Croix and a much larger more developed facility on St. Thomas at Magens Bay. St. Thomas has more tourists than St. Croix, mainly because of their harbour and port facilities. Occasionally, a cruise ship will put in at St. Croix. There are plans to provide St. Croix with better port facilities so that cruise ships will include St. Croix as a regular port-of-call. For example, 793 cruise ships made St. Thomas a port of call. Slightly more than half (51.9 percent) of all tourists' arrivals in the island is made by air. Of the 1,200,782 tourists that visited the islands in FY 1974, 622,647 were air arrivals. Thus, there are approximately 650,000 persons who are potential forest recreation users. The use of National and State forests in the United States for camping, picnicking, nature trails and esthetic use are increasing at astronomical rates. Research in this area could show the need for such facilities for overnight and prolonged visits and at the same time be able to engage in Caribbean water activities. This might induce visitors to remain in the islands for a longer period and provide recreation for residents with its attended social and economic benefits.

4. Watershed Protection: It is generally accepted that a forest is a desirable cover for a watershed. The trees help to reduce soil erosion, assist in infiltration and storage of fresh water. Past practices, such as clearing the lands for sugar cane and other agricultural uses, has denuded the land of the original forest growth. Because the islands have limited rainfall and high evaporation, drought conditions often exist in the islands. The aquifer of the islands is being depleted due to the use of subterranean reserves. Many wells are dry. There are no permanent rivers or streams in the islands, and all water comes from rainfall.

   It can be assured that past soil management practices aided in the depletion of the underground water supply. Research is needed to determine how the forests of the U. S. Virgin Islands can effectively be used to restore at least a portion of the underground water supply.

5. Wildlife: There is a little wildlife in the islands due to past and present land-use practices. The introduction of the mongoose has also deterred relative wildlife, especially birds and water fowl. There is an open season for hunting dove and deer. Studies relating to the habitat and habits of indigenous and introduced species are needed to maintain the ecological balance. Implementation of these research efforts should provide far more game birds and mammals.

6. There are no native conebearing species in the islands. There is one introduced species. Norfolk-Island-Pine *(Araucaria heterophylla* Salesk). This species should be investigated as a living Christmas tree. Since there are no native conebearing trees, such traditional Christmas trees as pines, spruces, and firs are not available to residents.

Foliage and fruit of three mahoganies. West Indies mahogany. (Swietenia mahogani Jacq.) top, medium leaf mahogany (S. macrophylla x S. mahogani) center, and Honduras mahogany (S. macrophylla King) on the bottom.

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