Forestry Department
Food and Agriculture Organization of the United Nations

GLOBAL FOREST RESOURCES ASSESSMENT 2010

COUNTRY REPORT

UNITED STATES VIRGIN ISLANDS

FRA2010/224
Rome, 2010

The Forest Resources Assessment Programme

Sustainably managed forests have multiple environmental and socio-economic functions important at the global, national and local scales, and play a vital part in sustainable development. Reliable and up-to-date information on the state of forest resources - not only on area and area change, but also on such variables as growing stock, wood and non-wood products, carbon, protected areas, use of forests for recreation and other services, biological diversity and forests' contribution to national economies - is crucial to support decision-making for policies and programmes in forestry and sustainable development at all levels.

FAO, at the request of its member countries, regularly monitors the world's forests and their management and uses through the Forest Resources Assessment Programme. This country report forms part of the Global Forest Resources Assessment 2010 (FRA 2010).

The reporting framework for FRA 2010 is based on the thematic elements of sustainable forest management acknowledged in intergovernmental forest-related fora and includes variables related to the extent, condition, uses and values of forest resources, as well as the policy, legal and institutional framework related to forests. More information on the FRA 2010 process and the results - including all the country reports - is available on the FRA Web site (www.fao.org/forestry/fra).

The Global Forest Resources Assessment process is coordinated by the Forestry Department at FAO headquarters in Rome. The contact person for matters related to FRA 2010 is:

Mette Løyche Wilkie
Senior Forestry Officer
FAO Forestry Department
Viale delle Terme di Caracalla
Rome 00153, Italy

E-mail: Mette.LoycheWilkie@fao.org

Readers can also use the following e-mail address: fra@fao.org

Contents

Report preparation and contact persons

The present report was prepared by the following person(s):

Name (FAMILY NAME, First name)	Institution / address	E-mail	Fax	Tables
Brandeis, Thomas	USDA Forest Service Knoxville, TN 37919	tjbrandeis@fs.fed.us	(865) 862-0262	T1, T4, T6, T7, T8
Chakroff, Marilyn	Virgin Islands Dept. Agriculture, #1 Estate Lower Love, St. Croix, U.S.V.I., 00850	marilyn.chakroff@gmail.com	(340) 778-7977	T3

Introduction

(The following introduction is excerpted from Brandeis, T. J., and S. N. Oswalt. 2007. The Status of U.S. Virgin Islands' Forests, 2004. Resource Bulletin SRS-122, USDA Forest Service Southern Research Station, Asheville, NC. 61 p.)

The U.S. Virgin Islands, an unincorporated territory of the United States, are made up of St. Croix, St. John, St. Thomas and numerous smaller islands centered on the geographic coordinates of 18° 20' N by 64° 50' W. With Puerto Rico to the west and the British Virgin Islands to the east and north, the U.S. Virgin Islands lie at the eastern extreme of the Greater Antilles. Puerto Rico, St. Thomas St. John and the British Virgin Islands are all part of the Puerto Rico Bank, a area of relatively shallow water, and were connected until rising sea levels at the end of the last ice age separated the islands about 8,000 years ago (Wiley and Vilella 1998, Rankin 2002). The much deeper waters of the Virgin Islands Basin, in places greater than 2,500 m deep, may have always kept St. Croix separate from her sister islands to the north (Wiley and Vilella 1998, Rankin 2002).

St. Croix is the largest of the U.S. Virgin Islands with a total area of 219 km^2 (34 km long by 9.6 km wide). Its highest point, Mount Eagle, is 355 meters. St. John, the smallest of the three main islands, has a total area of 53 km^2 (roughly 13 km wide), and its highest point is Bordeaux Mountain at 392 m. St. Thomas is 90 km^2 (19 km long by 5 km wide), and its highest point, the highest in the U.S. Virgin Islands, is Crown Mountain at 474 m. The combined total area of these islands is roughly twice the size of Washington, D.C. (Central Intelligence Agency 2002).

Even though the U.S. Virgin Islands lie south of the Tropic of Cancer the cooling effect of the Atlantic Ocean to the north and Caribbean Sea and easterly trade winds throughout the year produce a subtropical climate with temperatures that average 25º C in winter and 28º C in the summer (Ewel and Whitmore 1973, Wiley and Vilella 1998). The U.S. Virgin Islands are generally drier than the rest of the Greater Antilles due to their lower elevations, averaging 1400 mm of annual rainfall mostly occurring in the months of July through October (Wiley and Vilella 1998). The overall lower elevations on the islands cause less orographic cooling, the process by which air cools as it is forced up the sides of mountains. As moisture-laden trade winds are forced up mountainsides, water vapor condenses, clouds form, and rainfall can result. Summer and early fall is hurricane season. Hurricanes are an important factor in the formation and dynamics of forests on many Caribbean islands (Weaver 1994, 1998b, a). In the past 20 years, 4 major hurricanes have passed through the U.S. Virgin Islands; Hugo in 1989, Luis and Marilyn in 1995, and Lenny in 1999.

History of human occupation and its impacts on the forest

Taíno, Arawak and Carib peoples occupied the islands prior to their discovery by Christopher Columbus in 1493. These indigenous Caribbean people relied on the island forests for fruit, building materials, and fuel. Before European colonization the islands were thought to be 90% forested (Haagensen 1995 as cited in The Nature Conservancy 2003). What little is known about the pre-colonization forests of the Virgin Islands comes from anecdotal descriptions by early European settlers and reports on the presence and quantity of valuable timber trees. St. Croix in particular is cited as having valuable timberland, particularly the species fustic (*Chlorofora tinctoria*), lignum vitae (Guaiacum officinale), Spanish cedar (*Cedrela odorata*), ironwood (*Krugiodendron ferreum*), and mastic (*Mastichodendron foetidissimum*) (The Nature Conservancy 2003, Weaver 2006). At this time we can only speculate about the forests that once covered the U.S. Virgin Islands based the non-technical descriptions of residents and travelers, and on the secondary forests found on the islands today.

The islands underwent a chaotic period of early colonization in which control of the islands alternated between several different European nations, trading companies and private interests until finally being sold to the Danish by the French in 1733. Organized, widespread land clearance for plantation agriculture, especially sugar cane and cotton, then began in earnest and plantation owners prospered until the 1830's (Rogozinski 2000). The progress of agricultural development on St. Croix, where the generally flatter terrain was more appropriate for the extensive agriculture practiced by European colonists, is well described by Weaver (2006). Both St. Thomas and St. John were also eventually cleared of almost all their forest cover for agricultural plantations during this time. Agriculture on the islands became less economically viable with a decline in sugar prices and the increase in production costs due to the emancipation of slaves in the 1830's and 1840's (Rogozinski 2000). Steeper terrain that was more difficult to farm was gradually abandoned. St. John was the first island to see the general abandonment of agriculture around 1848, starting the period of forest recovery on all three islands. By the time

the U.S. Virgin Islands were acquired from Denmark by the United States in 1917, it is estimated that 90% of St. Croix had been cleared for agriculture and logging of valuable timber (Ward et al. 2000). In 1979, Somberg (1976) estimated forest cover to be at 45.1% over all three of the islands.

Since acquisition of these islands by the United State, each island has followed similar economic paths, but to differing degrees. Agricultural abandonment has proceeded on St. John and St. Thomas and is largely complete, but small-scale farming and ranching still maintain a small but significant place in St. Croix's economy, with sugar cane remaining the main export through the 1950's (Rogozinski 2000).

Starting in the 1950's, tourism began to be promoted as an economic option for the islands (Weaver 2006). There were fewer than 50,000 visitors each year in the 1950's (page 294 in Rogozinski 2000). Now tourism accounts for 70% of Gross Domestic Product, with the islands hosting 2 million visitors each year (Central Intelligence Agency 2002). Increased prosperity, growing populations, and tourism-based economy has put new and increasing pressure on forest land on all islands, a pressure that was identified thirty years ago by Somberg (1976). Young forest that began to grow on abandoned agricultural land is now being cleared for residential and commercial developments, as well as tourism-related development such as resorts and golf courses.

Essentially all forests on the islands are secondary, that is, these forests have re-grown or are recovering in the wake of human disturbance. Some forests on St. John on the summit of Bordeaux Mountain and in some larger ravines around the islands were less disturbed by human activities and are more developed today (page 21 in Woodbury and Weaver 1987). There has probably been a loss of productivity due to soil erosion when steep hillsides were being farmed (Woodbury and Weaver 1987) that will have unknown consequences for the speed of forest recovery and its eventual final state.

Additionally, the forests have been extensively colonized by introduced species, many of which were brought to the islands during the colonial period for agricultural purposes. These species are now naturalized and form a substantial, permanent part of the Virgin Islands' recovering forests. Introduced feral animals such as burros, goats and white-tailed deer are also having an unknown impact on forest regeneration. The response of these new forest associations to frequent disturbance by hurricanes is as of yet unknown. The long-term implications that these additions will have for the islands' native flora and fauna, as well as for the forests' ability to provide valuable ecosystem services to Virgin Islanders, are still unknown. Despite the damage done, widespread changes and relatively early stages of recovery, the forests of the U. S. Virgin Islands still play vital ecological, economic and cultural roles.

Forest products in the U.S. Virgin Islands

While materials for arts, crafts and building could be drawn from over 500 native and introduced tree species (The Nature Conservancy 2003), a survey of forest products in the U.S. Virgin Islands showed the production of 188,500 board feet of lumber and a gross income of $600,400, which represents less than 10% of the islands' wood consumption (Pierce and Hultgren 1997). Commercial forestry has not seen as economically feasible (Somberg 1976), and at this time there is no reason to believe this situation has changed. Locally harvest forest products do have a role in the economy and culture of the U.S. Virgin Islands, however, for use in arts and crafts, botanicals and charcoal-making. Wooden arts and crafts are produced primarily for the tourist trade, particularly cruise ship passengers. Clocks, bead jewelry, bowls, spoons, and a variety of items are made not only from locally-grown wood but also from other forest products such as bamboo, tree seeds and palm fronds. But even with local artisans producing objects from local wood, most of the wood arts and crafts being sold in shops are imported from the Dominican Republic, Haiti, Indonesia, or South America. The harvest of botanicals and medicinal herbs from the forest for use in cooking, making "bush teas", and traditional herbal remedies comprise a relatively small percentage of the income derived from forest products. Despite a relatively low economic value, these products have a long history in the islands and are an important component of Virgin Islands' cultural and an expression of appreciation for the forest. A very small-scale charcoal industry on St. Croix provides for local consumption using tan tan (*L. leucocephala*) and cassia (*Cassia siamea*) (Pierce and Hultgren 1997).

Forests' role in soil and water conservation

Despite a relatively minor contribution to U.S. Virgin Islands economy through the production of commodities, forests support many aspects of the economy and society indirectly. The forest's role in watershed protection is far-reaching and critically important on all Caribbean islands. Forest cover reduces surface run-off and increases infiltration to the water table, speeding aquifer recharge. There are no freshwater lakes or ponds in the U.S.

Virgin Islands to draw upon for water, and there are few non-ephemeral streams, most of which are only small rivulets during the dry season (The Nature Conservancy 2003). Drinking water is obtained from rainfall trapped in cisterns and a few wells in rural areas, and desalinization plants in urban areas. In 1985 it was estimated that 80% of water used came from surface water supplies, and 20% from ground water supplies (Weaver 1996). Forest cover loss and increased pressure from a growing population on ground water supplies have caused some wells to go dry, some smaller streams and springs that appear on historical maps no longer exist and others have become ephemeral, only having water after heavy rains (Weaver 1996).

Terrestrial and marine ecosystems are intimately connected in the Caribbean. The benefits of healthy forest cover extend well off-shore to marine habitats such as coral reefs that benefit from the protection from soil erosion and sedimentation associated with deforestation. The risk of soil erosion is particularly high on the islands where there is a combination of steep slopes, highly erodable soils with moderately fine textures, and often torrential rainfall events. Sedimentation due to run-off from coastal development is cited as the most important threat to U.S. Virgin Island coral reefs (Rogers 1998). Researchers have documented significant decreases in coral growth associated with upland development and road construction in and around the Virgin Island National Park (Rogers 1998). Mangrove forests in particular stabilize the coastline, filtering out sediments that would otherwise cloud the waters and deposit onto coral reefs. Their labyrinthine network of prop roots provide nursery habitat for colorful Caribbean reef fish that are important to local fisheries and the tourism industry.

U.S. Virgin Islands forests as biological refuges

The Caribbean Basin is seen as one of the world's biodiversity "hotspots" due to the large numbers of endemic species found there (Myers et al. 2000). The IUCN Red List of Threatened Species lists 315 threatened and endangered terrestrial species for the U.S. Virgin Islands (International Union for Conservation of Nature and Natural Resources 2006). The Insular Caribbean islands are described as the "most important (and sometimes exclusive) wintering ground" for many declining species of warblers, including the Cape May Warbler (*Dendroica tigrina*), Black-throated Blue Warbler (*Dendroica caerulescens*), and Prairie Warbler (*Dendroica discolor*) (Birdlife International 2004). These species face continuing pressures on their wintering grounds. Habitat destruction, fragmentation, and invasive species are primary threats to the outstanding avian diversity of the Caribbean. Thus, intact island forests provide invaluable habitat for resident birds and Neotropical migrant songbirds (Askins and Ewert 1991).

Literature cited

Askins, R. A. and D. N. Ewert. 1991. Impact of Hurricane Hugo on bird populations on St. John, U.S. Virgin Islands. Biotropica **23**:481-487.

Birdlife International. 2004. The insular Caribbean: A biodiversity conservation priority. World Wide Web site: http://www.birdlife.net/print.html. [Date accessed: October 20, 2004].

Central Intelligence Agency. 2002. The World Factbook 2002: Virgin Islands. http:\\www.cia.gov/cia/publications/factbook/print/vq.html.

Ewel, J. J. and J. L. Whitmore. 1973. The ecological life zones of Puerto Rico and the US Virgin Islands. Research Paper ITF-18, USDA Forest Service Institute of Tropical Forestry, Río Piedras, Puerto Rico.

Haagensen, R. 1995. Description of the islands of St. Croix in America in the West Indies. (Translated to English by A. R. Highfield). Virgin Islands Humanities Council, St. Thomas, U.S. Virgin Islands.

International Union for Conservation of Nature and Natural Resources. 2006. IUCN Red List of Threatened Species. http://www.iucnredlist.org/.

Myers, N., R. A. Mittermeier, C. G. Mittermeier, G. A. B. da Fonseca, and J. Kent. 2000. Biodiversity hotspots for conservation priorities. Nature **403**:853-858.

Pierce, S. and P. Hultgren, editors. 1997. Forest products of the U.S. Virgin Islands. An overview of trends in forest products use. Virgin Islands Resource Conservation and Development Council, St. Croix, U.S. Virign Islands.

Rankin, D. W. 2002. Geology of St. John, U.S. Vrigin Islands. U.S. Geological Survey Professional Paper 1631, U.S. Department of the Interior, U.S. Geological Survey, Reston, VA.

Rogers, C. S. 1998. Coral reefs of the U.S. Virgin Islands.*in* M. J. Mac, P. A. Opler, C. E. Puckett Haecker, and P. D. Doran, editors. Status and trends of the nation's biological resources. U.S. Department of the Interior, U.S. Geological Survey, Reston, VA.

Rogozinski, J. 2000. A brief history of the Caribbean. From the Arawak and Carib to the present. Revised edition edition. Penguin Group, New York, NY.

Somberg, S. I. 1976. Virgin Islands Forestry Research: A Problem Analysis. Report No. 9, College of the Virgin Islands, Virgin Islands Agricultural Experiment Station, St. Croix, US Virgin Islands.

The Nature Conservancy. 2003. Forest Legacy for the U.S. Virgin Islands: An Assessment of Need. Report prepared for the Virgin Islands Department of Agriculture, St. Thomas, U.S. Virgin Islands.

Ward, S., A. Rodriguez, and R. Morgan. 2000. Estate Thomas Experimental Forest: Past, Present and Future. Pages 105-114 *in* Proceedings of the 5th Annual Caribbean Urban Forestry Conference. University of the Virgin Islands Cooperative Extension Service, St. Croix, US Virgin Islands.

Weaver, P. L. 1994. Effects of hurricane Hugo on trees in the Cinnamon Bay watershed, St. John, U.S. Virgin Islands. Caribbean Journal of Science **30**:255-261.

Weaver, P. L. 1996. Regional Forest Research Committee Report to the Seventh American Forest Congress: Puerto Rico and the U. S. Virgin Island Region. USDA Forest Service, International Institute of Tropical Forestry, Río Piedras, Puerto Rico.

Weaver, P. L. 1998a. The effects of environmental gradients on hurricane impact in Cinnamon Bay watershed, St. John, U.S. Virgin Islands. Pages 333-348 *in* F. Dallmeier and J. A. Comiskey, editors. Forest Biodiversity in North, Central and South American, and the Caribbean. Parthenon Publishing Group, Washington, DC.

Weaver, P. L. 1998b. Hurricane effects and long-term recovery in a subtropical rain forest. Pages 249-270 *in* F. Dallmeier and J. A. Comiskey, editors. Forest biodiversity in North, Central and South America and the Caribbean. Research and Monitoring. Parthenon Publishing Group, Washington, D.C.

Weaver, P. L. 2006. Estate Thomas Experimental Forest, St. Croix, U.S. Virgin Islands: Research history and potential. General Technical Report IITF-30, USDA Forest Service International Institute of Tropical Forestry, San Juan, Puerto Rico.

Wiley, J. W. and F. J. Vilella. 1998. Caribbean Islands.*in* M. J. Mac, P. A. Opler, C. E. Puckett Haecker, and P. D. Doran, editors. Status and trends of the nation's biological resources. U.S. Department of the Interior, U.S. Geological Survey, Reston, VA.

Woodbury, R. O. and P. L. Weaver. 1987. The vegetation of St. John and Hassel island, U.S. Virgin Islands. Research/Resources Management Report SER-83, U.S. Department of the Interior, National Park Service, Atlanta, GA.

1 Table T1 – Extent of Forest and Other wooded land

1.1 FRA 2010 Categories and definitions

Category	Definition
Forest	Land spanning more than 0.5 hectares with trees higher than 5 meters and a canopy cover of more than 10 percent, or trees able to reach these thresholds *in situ*. It does not include land that is predominantly under agricultural or urban land use.
Other wooded land	Land not classified as "Forest", spanning more than 0.5 hectares; with trees higher than 5 meters and a canopy cover of 5-10 percent, or trees able to reach these thresholds *in situ*; or with a combined cover of shrubs, bushes and trees above 10 percent. It does not include land that is predominantly under agricultural or urban land use.
Other land	All land that is not classified as "Forest" or "Other wooded land".
Other land with tree cover (Subordinated to "Other land")	Land classified as "Other land", spanning more than 0.5 hectares with a canopy cover of more than 10 percent of trees able to reach a height of 5 meters at maturity.
Inland water bodies	Inland water bodies generally include major rivers, lakes and water reservoirs.

1.2 National data

1.2.1 Data sources

References to sources of information	Quality (H/M/L)	Variable(s)	Year(s)	Additional comments
Brandeis, T. J., and S. N. Oswalt. 2007. The Status of U.S. Virgin Islands' Forests, 2004. Resource Bulletin SRS-122, USDA Forest Service Southern Research Station, Asheville, NC. p 61	High	Forest cover Volume Biomass	1994 and 2004	USDA Forest Service forest inventory

1.2.2 Classification and definitions

The forest inventory definition used is the same as that for FRA 2010. Below are additional forest type definitions. The forest inventories do not measure other forested land or trees on other land uses.

National class	Definition
Subtropical dry forest	Found in areas with 600 to 1100 mm of annual precipitation. Some of the native tree species that are common in subtropical dry forest in the U.S. Virgin Islands are turpentine tree [*Bursera simaruba* (L.) Sarg.], torch wood *(Amyris elemifera* L.*)*, Jamaican caper *(Capparis cynophallophora* L.*)*, orange manjack *(Cordia rickseckeri* Millsp.*)*, water mampoo *(Pisonia subcordata* Sw.*)*, lignum vitae *(Guaiacum officinale* L.*)*, white frangipani *(Plumeria alba* L.*)*, and fustic [*Pictetia aculeata* (Vahl) Urban]. The more heavily-disturbed dry forest areas have numerous, smaller stemmed tan tan

	[*Leucaena leucocephala* (Lam.) deWit], *Prosopis juliflora* (Sw.) DC., stink kasha *(Acacia macracantha* Humb. & Bonpl.*)*, and acacia [*Acacia farnesiana* (L.) Willd.] individuals.
Subtropical moist forest	Found in areas with 1000 too 2200 mm of annual precipitation. Some of the many natural indicator species of subtropical moist forest in the U.S. Virgin Islands include the dog almond [*Andira inermis* (W. Wright) Kunth ex DC.], black mampoo [*Guapira fragrans* (Dum.-Cours.) Little], dog plum *(Spondias mombin* L.*),* gre gre *(Bucida buceras* L.*),* sandbox tree *(Hura crepitans* L.*),* kapoktree [Ceiba pentandra (L.) Gaertn.], cigar box cedar *(Cedrela odorata* L.*),* bayrumtree *(Pimenta racemosa* var. *racemosa),* royal palm *(Roystonea borinquena* O.F. Cook) (on St. Croix only), stinkingtoe *(Hymanaea courbaril* L.*),* pumpwood *(Cecropia schreberiana* Miq.*)*, and pink poui [*Tabebuia heterophylla* (DC.) Britt.]. While subtropical moist forests have some of the same introduced species found in subtropical dry forest, tamarind *(Tamarindus indica* L.*)* and genip *(Melicoccus bijugatus* Jacq.*)* are also commonly found.

1.2.3 Original data

The original data for the U.S.Virgin Islands, by island and year, is presented below. (Note that this data is in hectares.)

Survey unit	Land area	Measured forest areas 1994	2004
St. Croix			
Subtropical dry	18,020	8,642	7,655
Subtropical moist	3,447	2,895	2,964
Total	21,466	*11,537*	*10,619*
St. John			
Subtropical dry	3,191	2,973	2,828
Subtropical moist	1,889	1,824	1,824
Total	5,080	*4,797*	*4,652*
St. Thomas			
Subtropical dry	2,869	2,357	2,049
Subtropical moist	5,222	4,218	3,916
Total	8,091	*6,574*	*5,966*
All islands			
Subtropical dry	24,080	13,972	12,533
Subtropical moist	10,558	8,937	8,704
Grand total	**34,637**	**22,908**	**21,237**

1.3 Analysis and processing of national data

1.3.1 Calibration

The FIA-derived national data shows a total land area of 34,637 ha in the U.S. Virgin Islands while FAO-STAT has the total at 35,000 ha. The differences are probably due to rounding so no calibration was done to the estimates.

1.3.2 Estimation and forecasting

The following figures were used to estimate and forecast forest cover in the U.S. Virgin Islands. The total change in forest area from 1994 to 2004 was used calculate annual change, by island and life zone.

Note that the FIA forest cover estimate did not separate mangrove from the other forest classes, so mangrove is not included as a separate forest type here.

	Change		Projected forest areas			
Survey unit	**10 yr. change**	**Annual change**	**1990**	**2000**	**2005**	**2010**
St. Croix						
Subtropical dry	-986.44	-98.64	9,036	8,050	7,556	7,063
Subtropical moist	68.93	6.89	2,868	2,936	2,971	3,005
Total	*-917.51*	*-91.75*	*11,904*	*10,986*	*10,527*	*10,069*
St. John						
Subtropical dry	-145.04	-14.50	3,031	2,886	2,814	2,741
Subtropical moist	0.00	0.00	1,824	1,824	1,824	1,824
Total	*-145.04*	*-14.50*	*4,855*	*4,710*	*4,638*	*4,565*
St. Thomas						
Subtropical dry	-307.40	-30.74	2,480	2,172	2,019	1,865
Subtropical moist	-301.26	-30.13	4,338	4,037	3,886	3,736
Total	*-608.65*	*-60.87*	*6,818*	*6,209*	*5,905*	*5,600*
All islands						
Subtropical dry	-1438.88	-143.89	14,547	13,108	12,389	11,669
Subtropical moist	-232.32	-23.23	9,030	8,797	8,681	8,565
Grand total	**-1671.21**	**-167.12**	**23,577**	**21,906**	**21,070**	**20,234**

1.3.3 Reclassification into FRA 2010 categories

All of the national forest classes, (which are based on Holdridge life zones), fully correspond to the FRA forest category.

FRA Categories					
National Classes	**Forest**	**OWL**	**Other land**	**Total**	**OLWTC**
Subtropical dry forest	100%			100%	
Subtropical moist forest	100%			100%	

1.4 Data for Table T1

FRA 2010 categories	Area (1000 hectares)			
	1990	**2000**	**2005**	**2010**
Forest	23.58	21.91	21.07	20.23
Other wooded land	0	0	0	0
Other land	11.06	12.73	13.57	14.40
...of which with tree cover	n.a.	n.a.	n.a.	n.a.
Inland water bodies	0	0	0	0
TOTAL	**34.64**	**34.64**	**34.64**	**34.64**

1.5 Comments to Table T1

Variable / category	Comments related to data, definitions, etc.	Comments on the reported trend
Forest	All of the national forest classes, (which are based on Holdridge life zones), correspond to the FRA forest category.	Forest area estimates from 1994 and 2004 were made using identical methods, so trend information should be reliable. There is no trend information for mangrove forests, however. The Conservation Data Center estimates there were 115.08 ha of mangrove forests in the U.S. Virgin Islands in 2000. There are no other data for other points in time for mangrove forest. However, the FIA forest cover estimate did not separate mangrove from the other forest classes, so mangrove is not included as a separate forest type here.
Other wooded land	The forest inventories did not quantify other wooded land. Any areas of other wooded land that may exist are included under other land.	No trend information is available.
Other land	All land that did not meet the definition of forest was considered non-forest, or according the FRA terminology, other land. May include some areas of other wooded land.	
Other land with tree cover	No data is available for other land with tree cover because these lands were not included in the forest inventories.	No trend information is available.
Inland water bodies	Inland water bodies occupy a small area and were already subtracted from the FIA-derived total land area.	

Other general comments to the table
There are considerable differences between the forest area estimates in FRA 2005 and FRA 2010 due to new forest inventory data used for FRA 2010 and also some differences in the classification. A detailed analysis of the differences are found in Appendix 1.

Expected year for completion of ongoing/planned national forest inventory and/or RS survey / mapping	
Field inventory	2009
Remote sensing survey / mapping	2009

2 Table T3 – Forest designation and management

2.1 FRA 2010 Categories and definitions

Term	Definition
Primary designated function	The primary function or management objective assigned to a management unit either by legal prescription, documented decision of the landowner/manager, or evidence provided by documented studies of forest management practices and customary use.
Protected areas	Areas especially dedicated to the protection and maintenance of biological diversity, and of natural and associated cultural resources, and managed through legal or other effective means.
Categories of primary designated functions	
Production	Forest area designated primarily for production of wood, fibre, bio-energy and/or non-wood forest products.
Protection of soil and water	Forest area designated primarily for protection of soil and water.
Conservation of biodiversity	Forest area designated primarily for conservation of biological diversity. Includes but is not limited to areas designated for biodiversity conservation within the protected areas.
Social services	Forest area designated primarily for social services.
Multiple use	Forest area designated primarily for more than one purpose and where none of these alone is considered as the predominant designated function.
Other	Forest areas designated primarily for a function other than production, protection, conservation, social services or multiple use.
No / unknown	No or unknown designation.
Special designation and management categories	
Area of permanent forest estate (PFE)	Forest area that is designated to be retained as forest and may not be converted to other land use.
Forest area within protected areas	Forest area within formally established protected areas independently of the purpose for which the protected areas were established.
Forest area under sustainable forest management	To be defined and documented by the country.
Forest area with management plan	Forest area that has a long-term (ten years or more) documented management plan, aiming at defined management goals, which is periodically revised.

2.2 National data

2.2.1 Data sources

References to sources of information	Quality (H/M/L)	Variable(s)	Year(s)	Additional comments
Virgin Islands Dept. of Agriculture	H	Areas with management plans	2008	

2.2.2 Classification and definitions

National class	Definition
Areas with forest management plans	Management goals of each forest management plan include control of soil erosion and prevention of runoff and protection of water resources. Other goals include: creating nature/hiking/bird watching trails, planting native trees, controlling invasive species, establishing orchards, reforestation, and allowing natural succession of the forest to occur.

2.2.3 Original data

The following is a list of total acres of privately owned, (19 individuals, 5 trusts, and 2 corporate entities), forested lands that have forest management plans in place by island in the U. S. Virgin Islands.

St. Croix: 984.361 acres
St. John: 22.929 acres
St. Thomas: 17.04 acres
Total: 1024.33 acres = 415 hectares

Data on forest acreage under the other management and protection categories is not available. However, a large area on St. John is national park that has conservation of biodiversity as one of its goals. We do not have forest area estimates for the national park alone.

2.3 Analysis and processing of national data

2.3.1 Calibration

No calibration was done to the estimates.

2.3.2 Estimation and forecasting

No fore or back-casting was done with this data.

2.3.3 Reclassification into FRA 2010 categories

The national definition of areas with forest management plans corresponds to the FRA 2010 definition of "Forest area with management plans", so no reclassification is necessary.

2.4 Data for Table T3

Table 3a – Primary designated function

FRA 2010 Categories	Forest area (1000 hectares)			
	1990	2000	2005	2010
Production				
Protection of soil and water				
Conservation of biodiversity				
Social services				
Multiple use				
Other (please specify in comments below the table)				
No / unknown				
TOTAL				

Table 3b – Special designation and management categories

FRA 2010 Categories	Forest area (1000 hectares)			
	1990	2000	2005	2010
Area of permanent forest estate	n.a.	n.a.	n.a.	n.a.
Forest area within protected areas	n.a.	n.a.	n.a.	n.a.
Forest area under sustainable forest management	n.a.	n.a.	n.a.	n.a.
Forest area with management plan	n.a.	n.a.	n.a.	0.415

2.5 Comments to Table T3

Variable / category	Comments related to data, definitions, etc.	Comments on the reported trend
Production		
Protection of soil and water		
Conservation of biodiversity		
Social services		
Multiple use		
Other		
No / unknown designation		
Area of permanent forest estate		
Forest area within protected areas		
Forest area under sustainable forest management		
Forest area with management plan		

Other general comments to the table

3 Table T4 – Forest characteristics

3.1 FRA 2010 Categories and definitions

Term / category	Definition
Naturally regenerated forest	Forest predominantly composed of trees established through natural regeneration.
Introduced species	A species, subspecies or lower taxon, occurring outside its natural range (past or present) and dispersal potential (i.e. outside the range it occupies naturally or could occupy without direct or indirect introduction or care by humans).
Characteristics categories	
Primary forest	Naturally regenerated forest of native species, where there are no clearly visible indications of human activities and the ecological processes are not significantly disturbed.
Other naturally regenerated forest	Naturally regenerated forest where there are clearly visible indications of human activities.
Other naturally regenerated forest of introduced species *(sub-category)*	Other naturally regenerated forest where the trees are predominantly of introduced species.
Planted forest	Forest predominantly composed of trees established through planting and/or deliberate seeding.
Planted forest of introduced species *(sub-category)*	Planted forest, where the planted/seeded trees are predominantly of introduced species.
Special categories	
Rubber plantations	Forest area with rubber tree plantations.
Mangroves	Area of forest and other wooded land with mangrove vegetation.
Bamboo	Area of forest and other wooded land with predominant bamboo vegetation.

3.2 National data

3.2.1 Data sources

References to sources of information	Quality (H/M/L)	Variable(s)	Year(s)	Additional comments
Conservation Data Center, UVI-ECC. 2001. Virgin Islands Rapid Ecological Assessment. Published by the University of the Virgin Islands, No. 2 John Brewers Bay, St. Thomas, VI 00802	High	Vegetation cover, land cover	1994-2000	Forest coverage estimates were extracted from a GIS vegetation map.
Brandeis, T. J., and S. N. Oswalt. 2007. The Status of U.S. Virgin Islands' Forests, 2004. Resource Bulletin SRS-122, USDA Forest Service Southern Research Station, Asheville, NC. pp. 61	High	Forest cover Volume Biomass	1994 and 2004	USDA Forest Service forest inventory

3.2.2 Classification and definitions

National class	Definition
Subtropical dry forest	Found in areas with 600 to 1100 mm of annual precipitation. Some of the native tree species that are common in subtropical dry forest in the U.S. Virgin Islands are turpentine tree [*Bursera simaruba* (L.) Sarg.], torch wood *(Amyris elemifera* L.*),* Jamaican caper *(Capparis cynophallophora* L.*),* orange manjack *(Cordia rickseckeri* Millsp.*),* water mampoo *(Pisonia subcordata* Sw.*),* lignum vitae *(Guaiacum officinale* L.*),* white frangipani *(Plumeria alba* L.*),* and fustic [*Pictetia aculeata* (Vahl) Urban]. The more heavily-disturbed dry forest areas have numerous, smaller stemmed tan tan [*Leucaena leucocephala* (Lam.) deWit], *Prosopis juliflora* (Sw.) DC., stink kasha *(Acacia macracantha* Humb. & Bonpl.*)*, and acacia [*Acacia farnesiana* (L.) Willd.] individuals.
Subtropical moist forest	Found in areas with 1000 too 2200 mm of annual precipitation. Some of the many natural indicator species of subtropical moist forest in the U.S. Virgin Islands include the dog almond [*Andira inermis* (W. Wright) Kunth ex DC.], black mampoo [*Guapira fragrans* (Dum.-Cours.) Little], dog plum *(Spondias mombin* L.*),* gre gre *(Bucida buceras* L.*),* sandbox tree *(Hura crepitans* L.*),* kapoktree [Ceiba pentandra (L.) Gaertn.], cigar box cedar *(Cedrela odorata* L.*),* bayrumtree *(Pimenta racemosa* var. *racemosa),* royal palm *(Roystonea borinquena* O.F. Cook) (on St. Croix only), stinkingtoe *(Hymanaea courbaril* L.*),* pumpwood *(Cecropia schreberiana* Miq.*)*, and pink poui [*Tabebuia heterophylla* (DC.) Britt.]. While subtropical moist forests have some of the same introduced species found in subtropical dry forest, tamarind *(Tamarindus indica* L.*)* and genip *(Melicoccus bijugatus* Jacq.*)* are also commonly found.
Mangrove forest	Mangrove forests comprised of *Rhizophora mangle* L., *Avicennia nitidia* Jacq., *Laguncularia racemosa* (L.) Gaertn. f., and *Conocarpus erectus* L. are found along the coastlines and estuaries.

3.2.3 Original data

See data for table T1 for original data on forest area.

3.3 Analysis and processing of national data

3.3.1 Calibration

The national data shows a total land area of 34,637 ha in the U.S. Virgin Islands while FAO-STAT has the total at 35,000 ha. The differences are probably due to rounding so no calibration was done to the estimates.

Calibration was done on the mangrove forest estimate that comes from the Conservation Data Center's vegetation maps. The CDC had a total land area of 36,445 ha, so a conversion factor of 0.96 was applied to the mangrove forest area estimates, giving a mangrove forest area of 110.52 ha.

3.3.2 Estimation and forecasting

There was no trend data available for estimation and forecasting for mangrove forest, so the same values were used for all points in time.

3.3.3 Reclassification into FRA 2010 categories

All forests are considered to be "Other naturally regenerated forests". So the total forest area for all four reporting years were taken directly from table T1.

3.4 Data for Table T4

Table 4a

FRA 2010 Categories	Forest area (1000 hectares)			
	1990	2000	2005	2010
Primary forest	0	0	0	0
Other naturally regenerated forest	23.58	21.91	21.07	20.23
...of which of introduced species	0	0	0	0
Planted forest	0	0	0	0
...of which of introduced species	0	0	0	0
TOTAL	**23.58**	**21.91**	**21.07**	**20.23**

Table 4b

FRA 2010 Categories	Area (1000 hectares)			
	1990	2000	2005	2010
Rubber plantations (Forest)	0	0	0	0
Mangroves (Forest and OWL)	0.1	0.1	0.1	0.1
Bamboo (Forest and OWL)	0	0	0	0

3.5 Comments to Table T4

Variable / category	Comments related to data, definitions, etc.	Comments on the reported trend
Primary forest		
Other naturally regenerating forest	All forests on the U.S. Virgin Islands are secondary forests with varying degrees of modification caused by human activity.	
Planted forest	While there are some plantations, particularly mahogany, they are of limited extent and we do not have separate estimates for them.	
Rubber plantations	There are no rubber plantations in the U.S. Virgin Islands.	
Mangroves	The FIA-derived national data lacks an estimate for mangroves, an important forest type, so the CDC-derived national data was used to fill this information gap.	There is no trend information for mangrove forests, so the assumption of no change has been made.
Bamboo	There is bamboo on the islands, but not in sufficient quantities to be considered bamboo forests.	

Other general comments to the table
The FIA-derived national data does not separate out mangrove forest from the other forest types, so the assumption is that those forested hectares are included in the subtropical dry forest type (the lower elevation forest that borders the coast and estuarine areas where mangroves are found). The Conservation Data Center made a mangrove forest estimate in their 2000 vegetation map, so that number is presented in Table 4b. Unfortunately, there is no trend information for mangrove forests, so the assumption of no change had to be made.

4 Table T6 – Growing stock

4.1 FRA 2010 Categories and definitions

Category	Definition
Growing stock	Volume over bark of all growing stock trees more than X cm in diameter at breast height (or above buttress if these are higher). Includes the stem from ground level or stump height up to a top diameter of Y cm, and may also include branches to a minimum diameter of W cm.
Growing stock of commercial species	Growing stock (see def. above) of commercial species.

4.2 National data

4.2.1 Data sources

References to sources of information	Quality (H/M/L)	Variable(s)	Year(s)	Additional comments
Brandeis, T. J., and S. N. Oswalt. 2007. The Status of U.S. Virgin Islands' Forests, 2004. Resource Bulletin SRS-122, USDA Forest Service Southern Research Station, Asheville, NC. pp. 61	High	Forest cover Volume Biomass	1994 and 2004	USDA Forest Service forest inventory

4.2.2 Classification and definitions

Note that all live trees were used to estimate volume instead of the USDA Forest Service's FIA program's definition for growing stock growing stock volume.

National class	Definition
All live trees used	All living trees, regardless of whether they are of commercial species classified as sawtimber, poletimber, saplings, and seedlings.
All live tree volume	The m^3 volume of sound wood in all living trees at least 12.5 cm d.b.h. from a 30-cm stump to a minimum 10-cm top d.o.b. of the central stem, measured outside of bark.

4.2.3 Original data

Data from the 2004 forest inventory for mean merchantable all live tree volume, outside bark, per hectare by survey unit (island) and forest type is presented below.

Survey unit	All groups	Subtropical dry	Subtropical moist
St. Croix	7.940	5.549	15.807
St. John	29.493	15.211	50.917
St. Thomas	14.412	10.029	16.515
Total	**16.407**	**9.020**	**29.080**

The per hectare all live tree volumes were then multiplied by the number of hectares for that survey unit and forest type, resulting in the estimates below.

	Measured GS volume	
Survey unit	**1994**	**2004**
St. Croix		
Subtropical dry	47,948	60,781
Subtropical moist	45,762	46,851
Total	*93,710*	*107,633*
St. John		
Subtropical dry	45,227	43,021
Subtropical moist	92,878	92,878
Total	*138,104*	*135,898*
St. Thomas		
Subtropical dry	23,634	20,552
Subtropical moist	69,651	64,676
Total	*93,285*	*85,228*
All islands		
Subtropical dry	116,809	124,353
Subtropical moist	208,291	204,405
Grand total	**375,857**	**348,438**

The following table has information on all live tree by species composition.

Species	Common name	Spp. Vol.	% of total	Sp. Vol/ha
Guapira fragrans	black mampoo	11.488	0.194	3.184
Swietenia mahagoni	West Indian mahogany	6.712	0.113	1.860
Bursera simaruba	gumbo limbo	6.580	0.111	1.824
Melicoccus bijugatus	Spanish lime	6.216	0.105	1.723
Acacia muricata	spineless wattle	3.710	0.063	1.028
Bourreria succulenta	bodywood	3.566	0.060	0.988
Pisonia subcordata	water mampoo	3.406	0.058	0.944
Andira inermis	cabbagebark tree	2.109	0.036	0.584
Manilkara bidentata	bulletwood	1.800	0.030	0.499
Maytenus laevigata	white cinnamon	1.756	0.030	0.487

Others	-	11.861	0.200	3.287
Total		**59.205**	**1.000**	**16.407**

4.3 Analysis and processing of national data

4.3.1 Calibration

The FIA-derived national data shows a total land area of 34,637 ha in the U.S. Virgin Islands while FAO-STAT has the total at 35,000 ha. The differences are probably due to rounding so no calibration was done to the estimates.

4.3.2 Estimation and forecasting

Forest area for each forest type was estimated and forecast as described in the documentation for table T1.

	Change		Projected GS volume			
Survey unit	**10 yr. change**	**Annual change**	**1990**	**2000**	**2005**	**2010**
St. Croix						
Subtropical dry	12832.96	1283.30	42,815	55,648	62,065	68,481
Subtropical moist	1089.57	108.96	45,326	46,416	46,960	47,505
All life zones	*13922.52*	*1392.25*	*88,141*	*102,064*	*109,025*	*115,986*
St. John						
Subtropical dry	-2206.19	-220.62	46,109	43,903	42,800	41,697
Subtropical moist	0.00	0.00	92,878	92,878	92,878	92,878
All life zones	*-2206.19*	*-220.62*	*138,987*	*136,781*	*135,678*	*134,575*
St. Thomas						
Subtropical dry	-3082.73	-308.27	24,867	21,785	20,243	18,702
Subtropical moist	-4975.08	-497.51	71,641	66,666	64,179	61,691
All life zones	*-8057.80*	*-805.78*	*96,508*	*88,451*	*84,422*	*80,393*
All islands						
Subtropical dry	7544.04	754.40	113,792	121,336	125,108	128,880
Subtropical moist	-3885.51	-388.55	209,845	205,959	204,016	202,074
All life zones	**-27419.47**	**-2741.95**	**386,825**	**359,406**	**345,696**	**331,986**

4.3.3 Reclassification into FRA 2010 categories

The total volume figures above were not reclassified to make them the equivalent to total growing stock as defined in the FRA 2010 categories. All live tree volume has been used in place of growing stock in all instances.

4.4 Data for Table T6

Table 6a – Growing stock

FRA 2010 category	Volume (million cubic meters over bark)							
	Forest				Other wooded land			
	1990	2000	2005	2010	1990	2000	2005	2010
Total growing stock	0.387	0.359	0.346	0.332	n.a.	n.a.	n.a.	n.a.
... of which coniferous	0.000	0.000	0.000	0.000	n.a.	n.a.	n.a.	n.a.
... of which broadleaved	0.387	0.359	0.346	0.332	n.a.	n.a.	n.a.	n.a.
Growing stock of commercial species	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.

Table 6b – Growing stock of the 10 most common species

FRA 2010 category / Species name			Growing stock in forest (million cubic meters)			
Rank	Scientific name	Common name	1990	2000	2005	2010
1st	*Guapira fragrans*	black mampoo	0.075	0.070	0.067	0.064
2nd	*Swietenia mahagoni*	West Indian mahogany	0.044	0.041	0.039	0.038
3rd	*Bursera simaruba*	gumbo limbo	0.043	0.040	0.038	0.037
4th	*Melicoccus bijugatus*	Spanish lime	0.041	0.038	0.036	0.035
5th	*Acacia muricata*	spineless wattle	0.024	0.023	0.022	0.021
6th	*Bourreria succulenta*	bodywood	0.023	0.022	0.021	0.020
7th	*Pisonia subcordata*	water mampoo	0.022	0.021	0.020	0.019
8th	*Andira inermis*	cabbagebark tree	0.014	0.013	0.012	0.012
9th	*Manilkara bidentata*	bulletwood	0.012	0.011	0.011	0.010
10th	*Maytenus laevigata*	white cinnamon	0.011	0.011	0.010	0.010
Remaining			0.077	0.072	0.069	0.067
TOTAL			0.387	0.359	0.346	0.332

Table 6c – Specification of threshold values

Item	Value	Complementary information
Minimum diameter (cm) at breast height of trees included in growing stock	12.5 cm	DBH measured at 1.37 cm.
Minimum diameter (cm) at the top end of stem for calculation of growing stock	10.0 cm	
Minimum diameter (cm) of branches included in growing stock	n.a.	Estimate does not include branches, only main stem
Volume refers to "above ground" or "above stump"	AS	Stump height = 30 cm

4.5 Comments to Table T6

Variable / category	Comments related to data, definitions, etc.	Comments on the reported trend
Total growing stock	Growing stock is a relatively small portion of the total volume available in all live trees. Few trees are considered growing stock due to poor form. Therefore, all live tree volume is presented here.	This trend information is based on forest area data from two points in time, 1994 and 2004, and plot data from one point in time, 2004.
Growing stock of broadleaved / coniferous	There are few conifers growing in the U.S. Virgin Islands. Growing stock and all live tree volume is entirely in broadleaved trees.	
Growing stock of commercial species	We do not have a list of commercial species, so they are not presented separately.	
Growing stock composition		This trend information is based on forest area data from two points in time, 1994 and 2004, and plot data from one point in time, 2004. It assumes the relative proportions of each species remained the same as in 2004 and constant from 1990-2005.

Other general comments to the table

5 Table T7 – Biomass stock

5.1 FRA 2010 Categories and definitions

Category	Definition
Above-ground biomass	All living biomass above the soil including stem, stump, branches, bark, seeds, and foliage.
Below-ground biomass	All biomass of live roots. Fine roots of less than 2mm diameter are excluded because these often cannot be distinguished empirically from soil organic matter or litter.
Dead wood	All non-living woody biomass not contained in the litter, either standing, lying on the ground, or in the soil. Dead wood includes wood lying on the surface, dead roots, and stumps larger than or equal to 10 cm in diameter or any other diameter used by the country.

5.2 National data

5.2.1 Data sources

References to sources of information	Quality (H/M/L)	Variable(s)	Year(s)	Additional comments
Brandeis, T. J., and S. N. Oswalt. 2007. The Status of U.S. Virgin Islands' Forests, 2004. Resource Bulletin SRS-122, USDA Forest Service Southern Research Station, Asheville, NC. pp. 61	High	Forest cover Volume Biomass	1994 and 2004	USDA Forest Service forest inventory

5.2.2 Classification and definitions

National class	Definition
Aboveground biomass and carbon, live	Total oven-dry biomass in kilograms of all live aboveground tree parts, including stem, stump, branches, bark, seeds, and foliage, as estimated from regression equations that predict aboveground biomass from individual tree d.b.h. and total height measurements.
Aboveground biomass and carbon, standing dead	Total oven-dry biomass in kilograms of all standing dead aboveground tree parts, including stem, stump, branches, bark, seeds, and foliage, as estimated from regression equations that predict aboveground biomass from individual tree d.b.h. and total height measurements, only for trees at least 12.5 cm d.b.h.
Belowground biomass and carbon	Total oven-dry biomass in kilograms of all live belowground tree parts, as estimated using a regression equation that models the relationship between aboveground biomass and belowground biomass.
Down woody material	Woody pieces of trees and shrubs that have been uprooted (roots no longer support growth) or severed from their root system, are not self-supporting, and are lying on the ground.
Coarse woody debris	Down pieces of wood with a minimum small-end diameter of at least 8 cm and a length of at least 0.9 m (excluding decay class 5). Coarse woody material pieces must be detached from a bole and/or not be self-supported by a root system, and must have a lean angle of more than 45 degrees from vertical.
Fine woody debris	Down pieces of wood with a diameter ≤8 cm, not including foliage or bark fragments.

5.2.3 Original data

The original data for above and below ground live tree biomass per hectare as measured by the 2004 forest inventory appears below.

Per hectare above-ground biomass of live trees by survey unit and forest-type group

	Forest-type group	
Survey unit	**Subtropical dry**	**Subtropical moist**
St. Croix	26.59	44.91
St. John	66.08	93.80
St. Thomas	12.73	45.77
All units	38.24	64.46

Per hectare below-ground biomass of live trees by survey unit and forest-type group

	Forest-type group	
Survey unit	**Subtropical dry**	**Subtropical moist**
St. Croix	**6.84**	**10.87**
St. John	15.85	21.74
St. Thomas	2.63	11.28
All units	9.41	15.27

For dead wood, which includes standing dead trees and down woody material on the forest floor, the original data from the 2004 forest inventory appears below. Note that the down woody material original data was a carbon estimate that was multiplied by 2 to convert to a biomass estimate.

	Forest-type group	
Survey unit	**Subtropical dry**	**Subtropical moist**
St. Croix	2.60	5.26
St. John	4.72	8.54
St. Thomas	4.36	6.28
All units	11.68	20.08

5.3 Analysis and processing of national data

5.3.1 Calibration

The FIA-derived national data shows a total land area of 34,637 ha in the U.S. Virgin Islands while FAO-STAT has the total at 35,000 ha. The differences are probably due to rounding so no calibration was done to the estimates.

5.3.2 Estimation and forecasting

The per hectare values from the original data (2004 forest inventory) were multiplied by the forest area for each of the projected years for aboveground live, belowground live and dead woody biomass.

Aboveground live tree biomass								
	Projected forest areas				Estimated population values			
Survey unit	**1990**	**2000**	**2005**	**2010**	**1990**	**2000**	**2005**	**2010**
St. Croix								
Subtropical dry	9,036	8,050	7,556	7,063	240,270	214,040	200,925	187,811
Subtropical moist	2,868	2,936	2,971	3,005	128,781	131,877	133,425	134,973
Total	*11,904*	*10,986*	*10,527*	*10,069*	*369,051*	*345,917*	*334,350*	*322,783*
St. John								
Subtropical dry	3,031	2,886	2,814	2,741	200,313	190,729	185,937	181,145
Subtropical moist	1,824	1,824	1,824	1,824	171,100	171,100	171,100	171,100
Total	*4,855*	*4,710*	*4,638*	*4,565*	*371,414*	*361,829*	*357,037*	*352,245*
St. Thomas								
Subtropical dry	2,480	2,172	2,019	1,865	31,566	27,653	25,696	23,740
Subtropical moist	4,338	4,037	3,886	3,736	198,554	184,765	177,871	170,977
Total	*6,818*	*6,209*	*5,905*	*5,600*	*230,120*	*212,418*	*203,567*	*194,717*
Grand total	**23,577**	**21,906**	**21,070**	**20,234**	**970,584**	**920,164**	**894,955**	**869,745**

Belowground live tree biomass								
	Projected forest areas				Estimated population values			
Survey unit	**1990**	**2000**	**2005**	**2010**	**1990**	**2000**	**2005**	**2010**
St. Croix								
Subtropical dry	9,036	8,050	7,556	7,063	61,807	55,060	51,686	48,312
Subtropical moist	2,868	2,936	2,971	3,005	31,170	31,919	32,294	32,669
Total	*11,904*	*10,986*	*10,527*	*10,069*	*92,977*	*86,979*	*83,980*	*80,981*
St. John								
Subtropical dry	3,031	2,886	2,814	2,741	48,047	45,748	44,599	43,449
Subtropical moist	1,824	1,824	1,824	1,824	39,656	39,656	39,656	39,656
Total	*4,855*	*4,710*	*4,638*	*4,565*	*87,703*	*85,404*	*84,255*	*83,105*
St. Thomas								
Subtropical dry	2,480	2,172	2,019	1,865	6,522	5,713	5,309	4,905
Subtropical moist	4,338	4,037	3,886	3,736	48,933	45,535	43,836	42,137
Total	*6,818*	*6,209*	*5,905*	*5,600*	*55,455*	*51,248*	*49,145*	*47,042*
Grand total	**23,577**	**21,906**	**21,070**	**20,234**	**236,135**	**223,632**	**217,380**	**211,128**

Standing and down woody dead material biomass								
	Projected forest areas				Estimated population values			
Survey unit	1990	2000	2005	2010	1990	2000	2005	2010
St. Croix								
Subtropical dry	9,036	8,050	7,556	7,063	23,494	20,929	19,647	18,364
Subtropical moist	2,868	2,936	2,971	3,005	15,083	15,446	15,627	15,808
Total	*11,904*	*10,986*	*10,527*	*10,069*	*38,577*	*36,375*	*35,274*	*34,173*
St. John								
Subtropical dry	3,031	2,886	2,814	2,741	14,308	13,624	13,281	12,939
Subtropical moist	1,824	1,824	1,824	1,824	15,578	15,578	15,578	15,578
Total	*4,855*	*4,710*	*4,638*	*4,565*	*29,886*	*29,201*	*28,859*	*28,517*
St. Thomas								
Subtropical dry	2,480	2,172	2,019	1,865	10,811	9,471	8,801	8,131
Subtropical moist	4,338	4,037	3,886	3,736	27,243	25,351	24,405	23,459
Total	*6,818*	*6,209*	*5,905*	*5,600*	*38,054*	*34,822*	*33,206*	*31,590*
Grand total	**23,577**	**21,906**	**21,070**	**20,234**	**106,517**	**100,399**	**97,339**	**94,280**

The totals are as follows.

Totals, aboveground live biomass			
1990	2000	2005	2010
970,584	920,164	894,955	869,745

Totals, belowground live biomass			
1990	2000	2005	2010
236,135	223,632	217,380	211,128

Totals, dead woody biomass			
1990	2000	2005	2010
106,517	100,399	97,339	94,280

5.3.3 Reclassification into FRA 2010 categories

National and FRA categories for above-ground and below-ground biomass are the same. The national down woody materials, (consisting of coarse and fine woody debris) and standing dead trees, fall within the FRA dead wood category.

5.4 Data for Table T7

FRA 2010 category	Biomass (million metric tonnes oven-dry weight)							
	Forest				Other wooded land			
	1990	2000	2005	2010	1990	2000	2005	2010
Above-ground biomass	0.971	0.920	0.895	0.870	n.a.	n.a.	n.a.	n.a.
Below-ground biomass	0.236	0.223	0.217	0.211	n.a.	n.a.	n.a.	n.a.
Dead wood	0.107	0.100	0.097	0.094	n.a.	n.a.	n.a.	n.a.
TOTAL	**1.314**	**1.243**	**1.209**	**1.175**	n.a.	n.a.	n.a.	n.a.

5.5 Comments to Table T7

Variable / category	Comments related to data, definitions, etc.	Comments on the reported trend
Above-ground biomass	Aboveground live tree biomass was estimated using several regression equations that can be found in Brandeis, T. J., and S. N. Oswalt. 2007. The Status of U.S. Virgin Islands' Forests, 2004. Resource Bulletin SRS-122, USDA Forest Service Southern Research Station, Asheville, NC. pp. 61	
Below-ground biomass	Total oven-dry biomass in kilograms of all live belowground tree parts was estimated using a regression equation that models the relationship between aboveground biomass and belowground biomass from Cairns, M. A., S. Brown, E. H. Helmer, and G. A. Baumgardner. 1997. Root biomass allocation in the world's upland forests. Oecologia 111:1-11.	
Dead wood	Standing dead tree biomass was estimated using the same allometric equations used for live trees. Down woody biomass estimates were calculated by multiplying the carbon estimates by 2. Carbon estimates were derived from methods that appear in Woodall, C., and M. S. Williams. 2005. Sampling protocol, estimation and analysis procedures for down woody materials indicator of the FIA program. General Technical Report NC-256, USDA Forest Service, North Central Research Station, St. Paul, MN. These methods adjust carbon content for degree of decay.	

Other general comments to the table

6 Table T8 – Carbon stock

6.1 FRA 2010 Categories and definitions

Category	Definition
Carbon in above-ground biomass	Carbon in all living biomass above the soil, including stem, stump, branches, bark, seeds, and foliage.
Carbon in below-ground biomass	Carbon in all biomass of live roots. Fine roots of less than 2 mm diameter are excluded, because these often cannot be distinguished empirically from soil organic matter or litter.
Carbon in dead wood	Carbon in all non-living woody biomass not contained in the litter, either standing, lying on the ground, or in the soil. Dead wood includes wood lying on the surface, dead roots, and stumps larger than or equal to 10 cm in diameter or any other diameter used by the country.
Carbon in litter	Carbon in all non-living biomass with a diameter less than the minimum diameter for dead wood (e.g. 10 cm), lying dead in various states of decomposition above the mineral or organic soil.
Soil carbon	Organic carbon in mineral and organic soils (including peat) to a specified depth chosen by the country and applied consistently through the time series.

6.2 National data

6.2.1 Data sources

References to sources of information	Quality (H/M/L)	Variable(s)	Year(s)	Additional comments
Brandeis, T. J., and S. N. Oswalt. 2007. The Status of U.S. Virgin Islands' Forests, 2004. Resource Bulletin SRS-122, USDA Forest Service Southern Research Station, Asheville, NC. pp. 61	High	Forest cover Volume Biomass	1994 and 2004	USDA Forest Service forest inventory

6.2.2 Classification and definitions

National class	Definition
Aboveground biomass and carbon	Total oven-dry biomass in kilograms of all live aboveground tree parts, including stem, stump, branches, bark, seeds, and foliage, as estimated from regression equations that predict aboveground biomass from individual tree d.b.h. and total height measurements. Carbon is calculated by multiplying estimated total biomass of all trees with d.b.h. ≥2.5 cm by a factor of 0.5.
Belowground biomass and carbon	Total oven-dry biomass in kilograms of all live belowground tree parts, as estimated using a regression equation that models the relationship between aboveground biomass and belowground biomass (Cairns, M. A., S. Brown, E. H. Helmer, and G. A. Baumgardner. 1997. Root biomass allocation in the world's upland forests. Oecologia 111:1-11). Carbon is calculated by multiplying biomass by a factor of 0.5. Estimated for all trees with d.b.h. ≥ 2.5 cm.

Down woody material	Woody pieces of trees and shrubs that have been uprooted (roots no longer support growth) or severed from their root system, are not self-supporting, and are lying on the ground.
Coarse woody debris	Down pieces of wood with a minimum small-end diameter of at least 8 cm and a length of at least 0.9 m (excluding decay class 5). Coarse woody material pieces must be detached from a bole and/or not be self-supported by a root system, and must have a lean angle of more than 45 degrees from vertical. These pieces of down wood comprise the 1,000+ fuel-hour class, also.
Fine woody debris	Down pieces of wood with a diameter ≤8 cm, not including foliage or bark fragments. These pieces of down wood comprise the medium (0.7-8 cm diameter) and small fuel-hour classes (0-0.6 cm diameter), also.

6.2.3 Original data

Original data on forest carbon in live and dead standing trees on a per hectare basis as measured by the 2004 forest inventory is as follows.

Per hectare carbon in live and dead standing trees by survey unit and forest-type group measured in 2004.

		Forest-type group	
Survey unit	**Type**	**Subtropical dry**	**Subtropical moist**
St. Croix	Live	13.29	27.89
	Dead	0.05	0.00
	Total	*13.34*	*27.89*
St. John	Live	40.96	57.77
	Dead	0.18	0.81
	Total	*41.14*	*58.58*
St. Thomas	Live	7.68	28.53
	Dead	0.00	0.24
	Total	*7.68*	*28.77*
All units	Live	23.83	39.87
	Dead	0.09	0.38
	Grand total	**23.92**	**40.25**

Original data on per hectare carbon in down woody materials and the forest floor from the 2004 forest inventory appears below. Carbon content in fine and coarse woody debris is corrected for degree of decay and forest floor carbon estimates come from laboratory analysis of samples collected in the 2004 forest inventory.

Per hectare mean carbon (Mg/ha) in down woody materials and forest floor by forest life zone for St. Croix, St. John, and St. Thomas, by forest life zone measured in 2004.

Survey Unit	Forest life zone	Fine woody debris	Coarse woody debris	Forest Floor	Total Carbon
St. Croix	Subtropical dry	1.18	0.07	3.03	4.28
	Subtropical moist	1.45	1.18	2.25	4.88
	All groups	*1.22*	*0.23*	*2.92*	*4.37*
St. John	Subtropical dry	1.93	0.25	5.90	8.99
	Subtropical moist	2.33	1.13	5.53	8.08
	All groups	*2.09*	*0.60*	*5.75*	*8.44*
St. Thomas	Subtropical dry	0	0	0	0
	Subtropical moist	2.50	0.40	3.72	6.62
	All groups	*2.50*	*0.40*	*3.72*	*6.62*

6.3 Analysis and processing of national data

6.3.1 Calibration

The FIA-derived national data shows a total land area of 34,637 ha in the U.S. Virgin Islands while FAO-STAT has the total at 35,000 ha. The differences are probably due to rounding so no calibration was done to the estimates.

6.3.2 Estimation and forecasting

Forest biomass values from table 7.4 were multiplied by 0.5 to estimate forest carbon in aboveground live tree, belowground live tree, standing dead tree, and down woody materials. The remaining forest carbon in the forest floor was estimated by multiplying the original data per hectare carbon values by the forest area from each projection year.

Forest floor carbon								
	Projected forest areas				Estimated population values			
Survey unit	**1990**	**2000**	**2005**	**2010**	**1990**	**2000**	**2005**	**2010**
St. Croix								
Subtropical dry	9,036	8,050	7,556	7,063	27,379	24,390	22,896	21,402
Subtropical moist	2,868	2,936	2,971	3,005	6,452	6,607	6,685	6,762
Total	*11,904*	*10,986*	*10,527*	*10,069*	*33,831*	*30,997*	*29,581*	*28,164*
St. John								
Subtropical dry	3,031	2,886	2,814	2,741	17,885	17,029	16,602	16,174
Subtropical moist	1,824	1,824	1,824	1,824	10,087	10,087	10,087	10,087
Total	*4,855*	*4,710*	*4,638*	*4,565*	*27,972*	*27,117*	*26,689*	*26,261*
St. Thomas								
Subtropical dry	2,480	2,172	2,019	1,865	0	0	0	0
Subtropical moist	4,338	4,037	3,886	3,736	16,138	15,017	14,457	13,896
Total	*6,818*	*6,209*	*5,905*	*5,600*	*16,138*	*15,017*	*14,457*	*13,896*
Grand total	**23,577**	**21,906**	**21,070**	**20,234**	**77,941**	**73,131**	**70,726**	**68,321**

The forest floor carbon estimates were then summed with the biomass carbon estimates to complete table 8.4.

6.3.3 Reclassification into FRA 2010 categories

National and FRA categories for above-ground and below-ground biomass are the same. The national down woody materials, (consisting of coarse and fine woody debris) and standing dead trees, fall within the FRA dead wood category.

6.4 Data for Table T8

FRA 2010 Category	Carbon (Million metric tonnes)							
	Forest				Other wooded land			
	1990	2000	2005	2010	1990	2000	2005	2010
Carbon in above-ground biomass	0.485	0.460	0.447	0.435	n.a.	n.a.	n.a.	n.a.
Carbon in below-ground biomass	0.118	0.112	0.109	0.106	n.a.	n.a.	n.a.	n.a.
Sub-total: Living biomass	***0.603***	***0.572***	***0.556***	***0.540***	n.a.	n.a.	n.a.	n.a.
Carbon in dead wood	0.053	0.050	0.049	0.047	n.a.	n.a.	n.a.	n.a.
Carbon in litter	0.039	0.037	0.035	0.034	n.a.	n.a.	n.a.	n.a.
Sub-total: Dead wood and litter	***0.092***	***0.087***	***0.084***	***0.081***	n.a.	n.a.	n.a.	n.a.
Soil carbon	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
TOTAL	**0.696**	**0.659**	**0.640**	**0.622**	n.a.	n.a.	n.a.	n.a.

Soil depth (cm) used for soil carbon estimates	n.a.

6.5 Comments to Table T8

Variable / category	Comments related to data, definitions, etc.	Comments on the reported trend
Carbon in above-ground biomass	Carbon estimates were derived from aboveground live tree biomass estimates by multiplying by 0.5.	
Carbon in below-ground biomass	Carbon estimates were derived from belowground live tree biomass estimates by multiplying by 0.5.	
Carbon in dead wood	Carbon estimates were derived from methods that appear in Woodall, C., and M. S. Williams. 2005. Sampling protocol, estimation and analysis procedures for down woody materials indicator of the FIA program. General Technical Report NC-256, USDA Forest Service, North Central Research Station, St. Paul, MN. These methods adjust carbon content for degree of decay.	
Carbon in litter	These values were calculated in a laboratory from samples collected in the field. Methodology is described in O'Neill, Katherine P; Amacher, Michael C.; Perry, Charles H. 2005. Soils as an indicator of forest health: a guide to the collection, analysis, and interpretation of soil indicator data in the Forest Inventory and Analysis program Gen. Tech. Rep. NC-258. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Research Station. 53 p.	
Soil carbon	We do not have estimates of soil carbon at this time.	

Other general comments to the table

Appendix 1

Differences between the forest area estimates presented in FAO Forest Resources Assessments of 2005 and 2010 for the U. S. Virgin Islands

Thomas J. Brandeis

USDA Forest Service, Southern Research Station, Forest Inventory and Analysis, 4700 Old Kingston Pike, Knoxville, TN 37919, Tel: (865) 862-2030, Fax: (865) 862-0262, tjbrandeis@fs.fed.us

The forest area figures presented in the Forest Resource Assessment (FRA) 2005 report for the U.S. Virgin Islands were based on a vegetation map produced by the Virgin Islands Conservation Data Center (VICDC) (2001). These 2005 forest area estimates were derived from the GIS version of that map by summing the areas of polygons classified as forest according to their vegetation classifications as documented in Thomas and Devine (2005).

The FRA 2010 figures come from a U. S. Forest Service forest inventory that was underway, but not complete, at the time of writing FRA 2005 (Brandeis and Oswalt, 2007). The forest areas estimates, in particular, had not yet been made at the time of FRA 2005. The differences between these 2 estimates are immediately evident and striking (table 1), but have a relatively simple explanation.

Table 1. Forest area estimates for the U. S. Virgin Islands presented in the Forest Resource Assessments of 2005 and 2010.

	Area (1000 hectares)			
FRA Year	**1990**	**2000**	**2005**	**2010**
2005	11.9	10.4	9.5	-
2010	23.58	21.91	21.07	20.23

The VICDC and Thomas and Devine (2005) documentation defined forest using minimum canopy coverage requirements (25% for forest and 10% for open-canopy forest types) that the vegetation had to meet at the time of measurement/classification. The U.S. Forest Service's Forest Inventory and Analysis (FIA) program, however, defines forest as being "at least 10% stocked with trees of any size or has been at least 10% stocked in the past". Additionally, the definition states that "the condition is not subject to nonforest use(s) that prevent normal tree regeneration and succession". This definition allows areas that have not yet achieved any minimum required canopy coverage, such as newly planted plantations or old fields being colonized by trees, to be classified as forest because there are no impediments to the vegetation reaching that minimum requirement in the future.

Using the VIDC forest definition, approximately 30% of the U.S. Virgin Islands land area was covered in forest, while according to the U.S. Forest Service's definition there was approximately 60% forest cover (Brandeis and Cochran, 2006; Brandeis and Oswalt, 2007). Brandeis and Cochran (2006) showed that by including the VICDC shrubland classes (10-25% canopy cover) into their total forest area increased forest cover estimate to 60%, which is comparable to U.S. Forest Service's estimates.

The consequences for forest area estimation of different forest definition become especially apparent in the U.S. Virgin Islands, and similar islands in the Caribbean, due to the combination of land use history and ecological conditions. Extensive areas of secondary forests are now growing on abandoned agricultural land on many islands with subtropical dry climates in the Caribbean. The woody vegetation communities prevalent have many early-successional species, short statured with shrub-like growth forms and less-dense forest canopies. Defining these areas as shrubland, other wooded land or forest has important implications in the assessment forest area.

Literature cited

Anderson, R.L., Birdsey, R.A., Barry, P.J., 1982. Incidence of damage and cull in Puerto Rico's timber resource, 1980. In. USDA Forest Service, Southern Forest Experiment Station, New Orleans, LA., p. 13.

Brandeis, T.J., Cochran, J.K., 2006. Defining forest and its implications for estimating forest area in the Virgin Islands. In: Zimmerman, T.W. (Ed.), 11th Annual Caribbean Urban and Community Forestry Conference, June 19-22, 2006. University of the Virgin Islands Cooperative Extension Service. In press, St. Croix, U.S. Virgin Islands.

Brandeis, T.J., Oswalt, S.N., 2007. The Status of U.S. Virgin Islands' Forests, 2004. In. USDA Forest Service Southern Research Station, Asheville, NC., p. 61.

Thomas, T., Devine, B., 2005. Island peak to coral reef. A field guide to the plant and marine communities of the Virgin Islands. The University of the Virgin Islands, U.S. Virgin Islands.

Virgin Islands Conservation Data Center, 2001. U.S. Virgin Islands Rapid Ecological Assessment: Vegetation Community Classification GIS Maps for St. Croix, St. John and St. Thomas. University of the Virgin Islands, Eastern Caribbean Center, and The Nature Conservancy, St. Thomas, U.S. Virgin Islands.