The Forest Resources of St. Vincent, West Indies Richard A. Birdsey, Peter L. Weaver, and Calvin F. Nicholls. SUMMARY Forest vegetation covers 13,000 ha or 38 percent of the land surface of St. Vincent Island. More than half of the forest area is successional, and there are substantial areas of palm, dwarf, and dry scrub forest. Nearly 6 percent of the land area is composed of mature, mostly undisturbed primary forest. Inga vera, Licania ternatensis, Dacryodes excelsa, and Cecropia peltata are common tree species in natural forests. Hibiscus elatus, Pinus caribaea, and Swietenia macrophylla are tree species that have been planted in St. Vincent. Pinus caribaea has attained the best growth rates. ACKNOWLEDGEMENTS This project was partially funded by the U.S. Agency for International Development as part of the U.S. Government's contribution to the Caribbean Environmental Action Plan. The authors wish to acknowledge John T. Valonta, Peace Corps volunteer, for providing valuable assistance during inventory planning and fieldwork. St. Vincent Forestry department personnel G. Cardice, L. Quammi, and Connor assisted in sample plot location and measurement. The Forest Resources of St. Vincent, West Indies All land above 300 m was reserved by law years ago to protect the forest, but many parcels are in non-forest use. Few roads penetrate the interior. Despite encroachment problems, the remote areas have retained a high proportion of forest cover. An exception is in the Southeast, where only 32 percent of the land above 300 m is forest land. Here a dense road network penetrates well into the inland. This region would likely be the first to lose forest cover. Land Characteristics Three major timberland classes include primary rainforest located at the highest elevations and farthest distance from roads (table 6). Young secondary forests are more accessible and tend to be associated with agricultural activity. The average distance to a road for all timberland is less than 100 m, meaning secondary and young secondary forests have smaller areas, but the young...

Secondary forests have nearly twice the number of stems (Table 7) or forests have smaller average diameters and heights. These statistics suggest that, in the successional process, the disturbed site is quickly colonized by a large number of small stems that compete intensely until a secondary stand is well established. The secondary forest then matures over a long period, accumulating biomass to reach a potential of more than 30 m^3/ha. At some point during the maturation process, the number of small stems again begins to increase as tolerant understory species and saplings of shade-tolerant species become established. The primary forest develops the appearance of two distinct strata, with the upper canopy height averaging more than 25 m above the ground. The basal area of saplings is significantly greater than that of poletimber, with large sawtimber-size trees clearly dominating the available growing space (Fig. 7). Wood volume steadily accumulates over time. Most of the volume in young secondary forests is found in large residual trees that have outlasted surrounding disturbances. Young secondary forests average two large trees per hectare in the 76 cm dbh and larger classes, and no trees in the 50- to 70-cm dbh classes (Table 8). Secondary forests have 18 and primary forests 43 trees/ha whose dbh is greater than 50 cm. Much of the apparent variability in these statistics is due to the intermingling of the three timberland resource classes. Basal area (square meters/hectare) for basal area (chart reading omitted) varies with young secondary, secondary, and primary forest types. Average distance to roads and water is also considered, with specific ranges provided for each type. Average dbh, sapling population, distance metrics, and other characteristics are detailed in the associated charts and tables.

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13 ---Page Break--- it i i i 1} classes. Steep slopes, unstable soils, high rainfall, periodic storms, and volcanic eruptions create a very dynamic forest. Sample plots established randomly under these conditions reflect a great deal of this natural diversity. Species Composition Species composition varies considerably among the three timberland classes (tables 9, 10, 11), Although the classes represent three stages of the successional process, an orderly succession of species is not immediately apparent. Inventory sample plots were scattered over the island in different forest stands, so the data do not represent a series of observations of a changing forest, but rather a snapshot of current forests in different stages of development. Tropical species are seldom uniformly distributed over an area, and St. Vincent is no exception. Individual species tend to have a clustered distribution that enhances the stand and site variability associated with diverse stand origins, physiography, and disturbance. Many of the species listed in the tables were sampled at only one location. It was not possible to install enough samples to intensively study individual species. Generally, the data on larger trees (poletimber and sawtimber) sampled with a prism are more accurate than the data on saplings. It follows that the species data for young secondary forests are least reliable, and data for the primary forest are most reliable. In the following discussion, only species that seem to have been reasonably well sampled are

mentioned "Young secondary forests are composed of pioneer saplings and poletimber such as I. vera and Cecropia peltata. Several species are common as saplings but absent from larger size classes. Scattered large trees are remnants of previous forest, including Dacryodes excelsa, Chimarrhis cymosa, and Licania ternatensis. Secondary forests contain many of the same species, with pioneers reaching maturity and the longer-lived species beginning to form a canopy (table 10). Inga vera is clearly the dominant species, accounting for 16 percent of the basal area and 29 percent of all sawtimber trees. Prestoea montana and C. peltata have persisted and many have reached maturity. Chimarrhis cymosa and Ficus citrifolia are frequently observed with db.h. between 60 and 70 cm. Again, some species are present only as large residual trees from prior forest stands. Primary forest composition is quite different from the composition of the younger successional forests (table 11). Short-lived pioneers and secondary species have been replaced or outgrown by overstory giants of many different species, and some new understory species adapted to the moist, shady environment beneath the canopy have appeared. Dacryodes excelsa, L. ternatensis, Ormosia monosperma, and Sloanea massoni together account for 20 percent of the basal area and 33 percent of all sawtimber trees. Several species were encountered only as large sawtimber specimens with no evidence of reproduction under the canopy. Absent from the mature forest were several common successional species: Inga vera, P. montana, Cecropia peltata, F. citrifolia, and Chimarrhis cymosa. For all classes of timberland combined, I. vera comprises the most basal area, followed by L. ternatensis, D. excelsa, and Cecropia peltata. The largest dbh recorded was for S.

S. massoni, at 191.7 cm, The tallest tree was another S. massoni, at 48 m. Timber Volume is the volume, inside the bark, of all sound wood, including bole and branch defects such as rot or large knots, of all tree sections with a minimum diameter of 10 cm and a minimum length of 1 m. This represents the wood volume removed from the forest for all forest products other than fuelwood. Growing-stock volume excludes the cull or rough sections and all of the wood in trees classified as rough or rotten due to excessive incidence of these defects. Growing-stock volume is the wood volume that the commercial logger would remove from the forest for 6.

Number of tree species and diameter classes, ranked by volume: primary forest, Vincent, 1984. Total stem volume of these species is determined by pole timber, saplings, and the like.

Saplings are 25 to 125 cm in height; pole timber trees are 125 to 275 cm in height; sawtimber trees are larger than 275 cm in height. Sawtimber volume is the net volume of wood in all trees larger than 27.5 cm in diameter at breast height (dbh) that can be sawn into lumber. These trees must contain a saw log at least 22.5 cm in diameter outside bark and 3.5 m in length. Timber volume in the young secondary forest averages 62.7 cubic meters per hectare. The average rises to 98.6 cubic meters in secondary forests and 251.3 cubic meters in the primary forest. Although the majority of the volume is found in larger trees, all size classes show an increase in volume in the secondary and primary forest classes. Of most interest to the prospective logger is the volume in large sawtimber trees (dbh larger than 47.5 cm). Most of the usable volume in young secondary forests is found in the occasional large residual trees. This is best indicated by the sawtimber volume total, which

Averages 72 m^3/ha, mostly in D. excelsa and L. lernatensa (Table 12). Inga vera and C. peltata account for more timber volume, but this is in smaller sawtimber and poletimber. Inga vera has some utilization potential for utility or construction grade products. Inga vera is also the principal timber species in secondary forest (Table 13). Sawtimber volume for all species averages 13.7 m^3/ha, with four species accounting for 72 percent of the total. Of these four, D. excelsa and Chimarrhis cymosa are present in large sawtimber sizes and would be the preferred harvest species. Secondary forests are reasonably well-stocked with timber; some individual stands carry as much as 44 m^3/ha of sawtimber. Factors that might limit the availability of this timber by making it uneconomical or impractical to harvest include accessibility, terrain roughness and slope, and the ecological values of the forest. Much of the secondary forest is located in very rugged, uninhabited terrain that does not contain roads or even good trails. The forests are probably the result of natural rather than human disturbance. Physical difficulties limit the opportunities for log extraction. Of additional concern is the ecological value of these secondary forests and the role they may play as seed sources and habitats for many plant and animal species. The parcels are often located adjacent to or within mature timber.

stands as a part of a single, dynamic forest ecosystem. The primary forest carries the high volumes usually reported for the tropical moist forest (table 14). Many different species are represented by large mature individuals that contain as much as 20 m^3 of timber. Sawtimber volume averages 65 m^3, with high-quality timber accounting for 44 percent of the total. Dacryodes excelsa, O. monosperma, Actinostemon caribeus, and Talauma dodecacepala together comprise 69 percent of all sawtimber. The dense timber stands are unlikely to be harvested soon due to the extremely rugged terrain and lack of roads or easy access. The primary forest, because of its limited distribution in the Antilles and the uniqueness of the vegetation on each island, may be the most valuable natural resource of St. Vincent. Besides helping to maintain the island ecosystem and sustain water supplies in the water catchments, they provide habitat for interesting and endangered wildlife species. Since the mature tropical forest may take hundreds of years to fully regenerate, this resource should be managed with the greatest care. The majority of the timber in young secondary and secondary forests is contained in rough cull trees (Cable 15). Successional species have a tendency to become crooked and limby because they grow under uncrowded conditions in early years. Some of the large, residual trees on abandoned agricultural land were open-grown as well. In contrast, two-thirds of the timber in the primary forest is found in growing-stock trees. These trees have survived competition by growing tall and straight in early years and shedding lower branches. Because of the size of these trees, 20 percent of the 7

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Table 18—Volume of timber...

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20 26 {cher ecie “ a Al epi ei 160911 tan "Greed by harden lo ride standards vel in Bother US. ‘The minimum stocking standard for Puerto Rico is 250 saplings oF 100 poletimber-ize trees per hectare ‘of desirable species to assure reasonable stocking of ‘timber stand at maturity. Young secondary forests in ‘St Vincent contain 10 times thi standard of

Saplings and twice the standard of pole timber trees, but the vast majority are classed as rough cull trees and would not be good candidates for future crop trees (Cable 17). This proportion is much higher than the 45 plantation species. Improvement could be accomplished easily by clearing the small trees and other inhibiting vegetation. Stocking improves somewhat for secondary forests that average 281 saplings and 45 pole timber growing-stock trees (table 17). There would be some stands with sufficient growing stock that could be improved by girdling or injecting rough cull trees and undesirable species. Species to favor because of wood quality would include I. vera, F. citrifolia, D. excelsa, Chimarrhis cymosa, Tabebuia pallida, Guarea guidonia, Cordia sulcata, Metrosideros herberti, Sterculia caribaea, Andira inermis, and Nectandra coriacea. Eugenia montana would not compete in the long run with the larger species favored for timber production. These could be left untreated. The much better stocking of growing-stock trees in the primary forest indicates that natural selection processes would eventually favor the larger timber species. Growing-stock basal area averages 64 percent of all stocking in the primary forest, compared with 34 percent in secondary and 16 percent in the young secondary classes (table 18). Although more Table 17—Average number of trees by size class and forest class in St. Vincent 1986 Young Secondary Primary Growing-stock Rough and cull Total Pole timber Growing-stock Rough and cull Total Saplings Growing-stock Rough and cull Total Cecropia peltata should be removed or deadened, while some understory species such as P. columnea may not aim to stay at reading ---Page Break--- More than half the saplings in the primary forest are classed as growing stock. Many are suppressed in natural forests, and to improve timber species’ stocking would be in...

Secondary forest stands with adequate stocking of desirable saplings and poletimber. Implementation of natural forest management requires a detailed survey of the species composition of a particular stand and some experience with how the individual species might respond to release. In the absence of additional applied research studies, it is not recommended that natural forest management be attempted in the forests of St. Vincent on the basis of this survey alone.

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Dry Life Zone and certain serpentine and limestone soils, "Dwarf Forest. Also known as cloud forest or elfin woodland, the dwarf forest is found on the summits of the highest mountains and is characterized by densely packed, gnarled trees less than 7 m tall. 'Forest Land.— Land at least 10 percent stocked by forest trees of any size, or formerly having had such tree cover and not currently developed for nonforest use. The minimum area for classification of forest land is 0.5 ha, and the minimum width for forest strips is 35 m. Unimproved roads and trails, streams, land clearings in forest areas are classed as forest if less than 35 m in width. Growing-Stock Trees.—Sawtimber trees, pole timber trees, saplings, and seedlings; that is, all trees except rough

and rotten trees. 'Nonstocked Land.—Commercial forest land less than 10 percent stocked with growing-stock trees. This includes areas covered by inhibiting vegetation (brush, vines, fern, etc.) classed as forest land. 'Other Forest Land.—Forest land incapable of yielding timber crops because of adverse site conditions, forest land withdrawn from timber utilization through statute or administration. Pole Timber Trees.—Growing-stock trees, 12.5 to 22.5 cm in d.b.h. for softwoods and 12.5 to 27.5 cm for hardwoods, of good form and vigor. Primary Forest—Relatively undisturbed, mature, wet forest composed of mixed tree sizes. The canopy is generally higher than 7 m. 'Rough and Rotten Trees.—Live trees that are unmerchantable for saw logs now or in the future because of defect or rot. 'Saplings.—Growing-stock trees, 2.5 to 12.5 cm in d.b.h., and of good form and vigor. 'Sawtimber Trees.—Growing-stock trees, 22.5 cm and larger in d.b.h. for softwoods and 27.5 cm and larger for hardwoods, containing at least one 3.5 m. Timberland.—Forest land that is producing or is capable of producing crops of industrial wood and not withdrawn from timber utilization. Volume of Growing Stock—Volume of sound wood (less cull volume) in the bole and branches of sawtimber trees that can no longer be measured because

of limbs or Enter Volume of Sats Timber—Net volume of the saw log portion of sawtimber trees in cubic meters, calculated according to the International rule, 0.635 cm (4 inch) Enter Volume of Timber—Volume of all sound wood (including sound cull) in the bole and branches of growing stock, rough, rotten, and salvable dead trees 12.5 cm and larger in dbh, from stump to a minimum 10 cm diameter outside bark. The minimum length of any section included is 1 meter. Young Secondary Forest—Secondary forest with most trees less than 10 years old. Tree Species Tallied in St. Vincent, 1984 Scientific name Acanthocaceae (sp. unknown) Actinostemon caribeus Griseb. Andira inermis (W. Wright) H.B.K. Artocarpus altilis (Parkinson) Fosberg, Calophyllum antillanum Britton Guarea winterana (L.) Gaertn. Cassipourea guianensis Aubl. Cecropia peltata L. Chimarrhis cymosa Jacq. Citharexylum fruticosum L. Citharexylum spinosum L. Cocos nucifera L. Conomorpha peruviana A.DC. Cordia alliodora (Ruiz & Pav.) Oken Condia collococa Le Condia subulata DC. Croton populifolius Lam. Cyathea arborea (L.) J.B. Smith Cyrilla racemiflora L. St. Vincent common name Black plum, Jumbie mango Wild cinnamon Trumpet tree Waterwood Fiddlewood Coconut Red manjack White manjack Black sage Tree fern, jumbie joe Bloodwood ---Page Break--- Tree Species Tallied in St. Vincent, 1984—Continued Guapira fragrans (Dum. Cours) Standley Guarea guidonia (L.) Sleumer Guettarda scabra (L.) Vent. Hedyosmum arborescens Sw. Hibiscus elatus Sw. Inga ingoides (Rich.) Willd. Inga vera Willd. Caesalpinia ferrea (Mart. ex Tul.) Benth. Licania ternatensis (Hook. f.) Fritsch Linociera caribaea (Jacq.) Knobl. Lonchocarpus violaceus (Jacq.) Benth. Mangifera indica L. Manihot bidentata (A. DC.) Chev. Meliosma herbertii Rolfe Miconia virescens (Vahl) Triana Miconia elongata Vahl Micropholis chrysophylloides Pierre Morella deflexa (Poir.) DC. Nectandra coriacea (Sw.) Griseb. Ochroma pyramidale (Cav.) Urban Ocotea leucoxylon (Sw.) Mez Ormosia monosperma (Sw.) Urb. Phoebe elongata (Vahl) Nees Pinus caribaea Morelet Pithecellobium

jupunda (Willd) Urb. Pouteria multiflora (A. DC.) Eyma Prestoea montana (R. Grah.) Nichols. Rubiaceae (sp. unknown) Sapium caribaeum Simarouba amara Aubl. Sloanea caribaea Kr. and Urb. Sloanea massoni Sw. Sterculia caribaea R. Br. Swietenia macrophylla King Swietenia mahagoni Jacq. Symplocos martiniensis Jacq. Tabebuia pallida (DC.) Britton Talauma dodecandra (Lam) Urb. St. Vincent common name Gommier Local mahoe Bashi guava Wild coffee Wild fig Fig Gunstock Mapeo, loblolly Black plum Blue mahoe Spanish ash Spanish ash Wild coffee Bois job Mastic Greenheart Mango Bulletwood, balata Wild cocos Torchwood Candlewood Wild star apple Wild plumrose Sweetwood Balea, batang Sweetwood Sarinette Sweetwood Pine Wild tamarind Penny piece Palm Burn lime Board wood Satinay Boxwood Mahoe Mahogany Mahogany Sweet

leaf White cedar Wild breadfruit, wild almond

tem Priam size Grid spacing (Cluster point spacing) Fixed plot size Breast height Stump height Diameter classes Tree size classes Sapling Poletimber (hardwood) Sawtimber (hardwood) Sawtimber (softwood) Minimum top do. Cubic volume Hardwood saw log Softwood saw log Sapling Minimum 4... saw log Hardwood Softwood Minimum length Cubic section Saw log Sawtimber tree 15 m² (r=22 m) 13m 0m 10 cm=25 to 75 cm dbh, 10 cm=75 to 125 cm dbh, 15 cm=125 to 175 cm dbh, 20 cm=175 to 22.5 cm dbh, etc. 25 to 12.5 cm dbh. 125 to 175 cm dbh. 5 cm dbh, 25 cm dbh. 10 cm 25 cm 115 cm 25 cm 200m 15 cm 1m 25m 3.5 m saw log 6

Birdsey, Richard A.; Weaver, Peter L.; Nicholls, Calvin F. "The forest resources of St. Vincent, West Indies." Res. Pap. SO-229, New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station; 1986. 2p. Presents the principal findings of a 1984 forest inventory of St. Vincent, one of the islands of the West Indies. Data covers plantations and natural forests. Plantation species include Pinus caribaea, Swietenia macrophylla, and Hibiscus elatus. Natural forest vegetation covers 38

percent of the land surface and consists of primary rain forest, secondary forest, palm forest, dwarf forest, and dry forest. Forest management, Caribbean forests, island ecosystems.